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Digital tracking, provider decision support systems, and targeted client communication via mobile devices to improve primary health care (Review)

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[Intervention Review]

Digital tracking, provider decision support systems, and targeted client communication via mobile devices to improve primary health care

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ABSTRACT

Background

Digital tracking on mobile devices, combined with clinical decision support systems and targeted client communication, can facilitate service delivery and potentially improve outcomes.

Objectives

To assess the effects of using a mobile device to track service use when combined with clinical decision support (**Tracking + CDSS**), with targeted client communications (**Tracking + TCC**), or both (**Tracking + CDSS + TCC**).

Search methods

Cochrane CENTRAL, MEDLINE, Embase, Ovid Population Information Online (POPLINE), K4Health and WHO Global Health Library (2000 to November 2022).

Selection criteria

Randomised and non-randomised trials in community/primary care settings.

Participants: primary care providers and clients

Interventions:

1. Tracking + CDSS
2. Tracking + TCC
3. Tracking + CDSS + TCC

Comparators: usual care (without digital tracking)

Data collection and analysis

Two authors independently screened trials, extracted data and assessed risk of bias using the RoB 1 tool. We used a random-effects model to meta-analyse data producing risk differences (RD), risk ratios (RR), or odds ratios (OR) for dichotomous outcomes and mean differences (MD) for continuous outcomes. Evidence certainty was assessed using GRADE.

Main results

We identified 18 eligible studies (11 randomised, seven non-randomised) conducted in Bangladesh, China, Ethiopia, India, Kenya, Palestine, Uganda, and the USA. All non-randomised studies had a high risk of bias.

These results are from randomised studies.

'Probably/may/uncertain' indicates 'moderate/low/very low' certainty evidence.

Tracking + CDSS

Relating to antenatal/ postnatal care:

Providers' adherence to recommendations

May slightly increase home visits in the week following delivery (2 studies, 4531 participants; RD 0.10 [0.07, 0.14])

May slightly increase counselling for initiating complementary feeding (2 studies, 4397 participants; RD 0.12 [0.08, 0.15])

May slightly increase the mean number of home visits in the month following delivery (1 study, 3023 participants; MD 0.75 [0.47, 1.03])

Uncertain effect on home visits within 24 hours of delivery

Clients' health behaviours

May slightly increase skin-to-skin care (1 study, 1544 participants; RD 0.05 [0.00, 0.10])

May slightly increase early breastfeeding (2 studies, 4540 participants; RD 0.08 [0.05, 0.12])

Uncertain effects on applying nothing to the umbilical cord, taking ≥ 90 iron-folate tablets during pregnancy, exclusively breastfeeding for six months, delaying the newborn's bath at least two days and Kangaroo Mother Care.

Clients' health status

May reduce low birthweight babies (1 study, 3023 participants; RR 0.53 [0.38, 0.73])

May increase infants with pneumonia or fever seeking care (1 study, 3470 participants; RR 1.13 [1.03, 1.24])

Uncertain effects on stillbirths, neonatal and infant deaths, or testing positive for HIV during antenatal testing

Tracking + TCC

Clients' health status

In stroke patients over 12 months:

May slightly increase blood pressure (BP) medication adherence (1 study, 1226 participants; RR 1.10 [1.00, 1.21])

May reduce deaths (1 study, 1226 participants; RR 0.52 [0.28, 0.96])

May slightly reduce systolic BP (1 study, 1226 participants; MD -2.80 mmHg [-4.90, -0.70])

May slightly improve EQ-5D scores (1 study, 1226 participants; MD 0.04 [0.02, 0.06])

May reduce stroke hospitalisations (1 study, 1226 participants; RR 0.45 [0.32, 0.64]).

Tracking + CDSS + TCC

Providers' adherence to recommendations

Probably increases guideline adherence for antenatal screening and management of anaemia (1 study, 10,502 participants; OR 1.88 [1.52, 2.32]), diabetes (1 study, 8669 participants; OR 1.45 [1.14, 1.84}), hypertension (1 study, 15,555 participants; OR 1.62 [1.29, 2.04]) and probably leads to lower adherence for abnormal foetal growth (1 study, 1165 participants; OR 0.59 [0.37, 0.95]).

May slightly increase nevirapine prophylaxis in infants of HIV+ve mothers (1 study, 609 participants; OR 1.75 [0.73, 4.19])

Data quality

In pregnant women (1 study, 6367 participants), tracking + CDSS + TCC:

Probably slightly reduces missing data for haemoglobin (RR 0.77 [0.71, 0.84]) but slightly more for BP at delivery (RR 1.16 [1.08, 1.24])

May have little or no effect on missing data on gestational age (RR 0.96 [0.81, 1.14]) or birthweight (RR 0.90 [0.77, 1.04])

Clients' health behaviour

May have little or no effect on being on anti-retroviral therapy at delivery (1 study, 438 participants; OR 1.41 [0.81, 2.45]) or exclusive breastfeeding for six months (1 study, 695 participants; OR 1.74 [0.95, 3.17]) in HIV+ve mothers

Uncertain effects on physical activity in high cardiovascular-risk adults

Clients' health status

May reduce the number of deaths in patients with hypertension and diabetes (1 study, 3698 participants; OR 0.61 [0.35, 1.06])

May reduce new cardiovascular events in high-cardiovascular risk adults over 6-18 months (1 study, 8642 participants; OR 0.58 [0.42, 0.80})

May slightly decrease in antenatal women severe hypertension, but the confidence interval includes both a decrease and increase (1 study, 6367 participants; OR 0.61 [0.27, 1.37])

In women receiving antenatal care (1 study, 6367 participants), tracking + CDSS + TCC maymake little or no difference to adverse pregnancy outcomes (OR 0.99 [0.87, 1.12]), moderate or severe anaemia (OR 0.82 [0.51, 1.31]), or large-for-gestational-age babies (OR 1.06 [0.90, 1.25]).

In adults with hypertension or diabetes (1 study, 3324 participants), tracking + CDSS + TCC maymake little or no difference to HbA1c (MD 0.08 [-0.27, 0.43]), total cholesterol (MD -2.50 [-7.10, 2.10]), 10-year cardiovascular risk (MD -0.40 [-2.30, 1.50]), tobacco use (MD-0.05 [-0.47, 0.37]), alcohol use (MD 0.70 [-3.70, 5.10]), or PHQ-9 (MD -1.60 [-4.40, 1.20]).

Uncertain effects on maternal or infant mortality before the baby reaches 18 months in HIV-positive mothers, patients who achieve optimal BP, BP controlled at five years, diastolic or systolic BP, body mass index, fasting glucose and quality of life in adults with hypertension or diabetes

Client service utilisation

May have little or no effect on missed early infant diagnosis visits (1 study, 1183 participants; OR 0.92 [0.63, 1.35]).

Uncertain effects on linkage to care

Client satisfaction

Probably increases slightly the number of adults with hypertension or diabetes reporting "slightly/much better" change in the quality of care (1 study, 3324 participants; RR 1.02 [1.00, 1.03]).

No studies evaluated time between presentation and appropriate management, timeliness of receiving/accessing care, provider acceptability/satisfaction, resource use, or unintended consequences.

Authors' conclusions

Digital tracking may improve primary care workers' ability to follow recommended antenatal and chronic disease practices, quality of patient records, patient health outcomes and service use. However, these interventions led to small or no outcome differences in most studies.

PLAIN LANGUAGE SUMMARY

Digital tracking, provider decision support systems, and targeted client communication via mobile devices to improve primary healthcare

Key messages

Using digital tools to help healthcare workers track patient information and make decisions has mixed results. These approaches may lead to benefits in some situations but may make little or no difference in others. We often do not know the full impact because there are not enough studies, or the studies do not provide clear answers.

What did we want to find out?

This review examined whether digital tools can help healthcare workers collect better patient information and provide better care compared to traditional methods, like paper records or no tools at all. The focus was on primary healthcare settings, such as clinics and community health programmes.

What are digital tracking systems?

Digital tracking systems help healthcare workers collect and store patient information over time. This can help them provide better care and allow governments to design better health services.

Patient information is often stored in electronic medical records in wealthier countries. However, healthcare workers in many low- and middle-income countries still use paper records or have limited access to digital tools. Mobile devices like tablets and smartphones can make it easier for healthcare workers in these settings to use digital systems to track patient information more accurately and securely.

What other tools are included?

Decision support tools: Digital tracking systems are sometimes combined with decision support tools. These tools guide healthcare workers in analysing patient data and deciding on the best treatment.

Targeted client communication: Digital tracking systems can also be combined with systems for communicating with patients and clients. These tools allow healthcare workers to send patient messages, such as appointment reminders, medication schedules, or health advice.

What did we find?

The review included 18 studies. Seventeen were from low- and middle-income settings where electronic medical record systems are rare or just being rolled out. Most studies focused on healthcare workers using mobile devices, particularly for maternal and child health or managing chronic diseases.

When primary healthcare workers use digital tracking systems combined with decision support tools, targeted client communication, or both, compared to usual care, the results are mixed.

Positive effects: These tools may have some benefits. For example, they may help healthcare workers follow guidelines better, keep more accurate records and provide better quality of care. They may also improve patient outcomes. For example, some mothers may have fewer low-birthweight babies or may start breastfeeding earlier. Some patients may also have improved quality of life or be more consistent with taking medications for chronic conditions such as stroke. However, these positive effects may be small.

***Little to no impact*:** In other cases, the tools may make little or no difference to healthcare worker behaviour or patient health.

***Uncertainty*:** In many cases, the results are unclear because there are not enough studies or the studies do not provide strong evidence.

What are the limitations of these findings?

We have little confidence in the findings because there were not many studies; some studies were small, and others had design problems that made their findings less certain.

How up-to-date is this review?

The review examined studies conducted between 2000 and November 2022.

SUMMARY OF FINDINGS

Summary of findings 1. Comparison 1 (Summary) : Tracking with clinical decision-support system (tracking + CDSS) compared to usual care in primary care

Comparison 1 (summary): Tracking with clinical decision support system (Tracking + CDSS) compared to usual care in primary care

Patient or population: healthcare providers using clinical decision support system tools and patients receiving care from such providers

Setting: primary healthcare settings (China, India, Ghana, Tanzania, USA)

Intervention: digital tracking with mobile clinical decision support system (Tracking + CDSS)

Comparison: standard care or no intervention (standard care could be providers using decision support tools on paper or usual care that did not involve any additional follow-up)

Outcomes Effects of Tracking + CDSS compared to usual care (number of studies, participants)	Certainty of the evidence (GRADE)
A. Providers' adherence to recommended practices, guidelines, or protocol	
• **May slightly increase** the number of women who received a home visit in the first week after delivery (2 randomised studies, 4531 participants)[a,b] , the number of mothers counselled to initiate complementary feeding for their infant at six months (2 randomised studies, 4397 participants)[a,b], and the number of community health worker (CHW) home visits in the first month after delivery (1 randomised study, 3023 women/ 578 CHWs)[b]	⊕⊕⊖⊖ **Low**
• **Uncertain** of the effect on the number of women who received a home visit 24 hours after delivery (2 randomised studies, 4572 participants)[a,b], the number of women counselled to initiate complementary foods at six months (1 observational study, 1761 participants)[c]; the number of children receiving an immediate referral to a hospital following an office visit for asthma (1 observational study, 152 participants)[d] ; the effect on the proportion of antenatal care visits with recorded blood pressure measurements, blood tests, weight measurements and urine tests (1 observational study, 1068 participants)[e]	⊕⊖⊖⊖ **Very low**
B. Time between presentation and appropriate management	
No studies evaluated this outcome.	No evidence
C. Quality of data about services provided	
No studies evaluated this outcome.	No evidence
D. Clients' health behaviour	
• **May slightly increase** the number of mothers reporting that they provided skin-to-skin care after delivery (1 randomised study, 1544 participants)[f], and the number of mothers who initiate breastfeeding early with their newborns (2 randomised studies, 4540 participants)[b, f]	⊕⊕⊖⊖ **Low**
• **Uncertain** of the effect on the number of maternal respondents who reported that nothing was applied to the umbilical cord following delivery (1 randomised study, 1480 participants)[f], the number of women who consumed at least 90 iron-folate tablets during pregnancy (2 randomised studies, 4576 participants[b,f] and 1 observational study, 1068 participants[e]), the number of women who exclusively breastfeed for six months (2 randomised studies, 4309 participants)[b,f], the number of newborns who have their first bath delayed at least two days (1 randomised study, 1500 partici-	⊕⊖⊖⊖ **Very low**

pants)[f], the number of newborns who receive Kangaroo Mother Care (1 randomised study, 3023 participants)[b]	
E. Clients' health status and well-being	
• **May reduce** the number of low birthweight babies born ≤ 2 kg (1 randomised study, 3023 participants)[b] and **increase** the number of infants with pneumonia or fever in the past two weeks seeking care from a community health worker (1 randomised study, 3470 participants)[b]	⊕⊕⊖⊖ **Low**
• **Uncertain** of the effect on the number of stillbirths, neonatal deaths and infant deaths (1 randomised study, 8230 participants)[b], the number of women testing positive for HIV during antenatal HIV testing (1 randomised study, 658 participants)[g], improving asthma severity in children as assessed during a doctor's office visit (1 observational study, 152 participants)[d]	⊕⊖⊖⊖ **Very low**
F. Clients' utilisation of primary health care and/or services	
• **May** result in **little or no difference** in the number of fully immunised children under five years (3 randomised studies, 4602 participants)[a,b], and an **increase** in the number of women giving birth in a health facility (1 randomised study, 571 participants)[h]	⊕⊕⊖⊖ **Low**
• **Uncertain** of the effect on the number of women giving birth in a health facility (2 randomised studies, 4834 participants)[a,b]; women currently using modern contraceptive methods (1 randomised study, 1413 participants)[a]; women who had HIV tests performed during an antenatal visit (1 randomised study, 1698 participants)[f]; women who have at least two tetanus injections during pregnancy (1 randomised study, 298 participants)[a]; children under five years who are fully immunised (1 observational study, 2038 participants)[e]; women with at least two tetanus injections during pregnancy (1 observational study, 1068 participants)[e]; children who had an Emergency Department visit or who were hospitalised within one week of a doctor's visit for asthma (1 observational study, 152 participants)[d]; women receiving at least three antenatal visits during pregnancy (2 observational studies, 2535 participants)[e]; women giving birth in a health facility (2 observational studies, 2536 participants)[e,i]	⊕⊖⊖⊖ **Very low**
G. Provider acceptability of/satisfaction with the intervention	
No studies evaluated this outcome.	No evidence
H. Client acceptability of/satisfaction with the intervention	
No studies evaluated this outcome.	No evidence
I. Resource use	
No studies evaluated this outcome.	No evidence
J. Unintended consequences	
No studies evaluated this outcome.	No evidence

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Carmichael 2019
[b]Modi 2019
[c]Patil 2022
[d]Shiffman 2000
[e]Prinja 2017
[f]Bull 2018
[g]Chen 2016
[h]Hackett 2018
[i]Ilozumba 2018
Please refer to Table 1 for more detailed results, including the absolute and relative effects and explanations for downgrading the certainty of the evidence.
Abbreviations:
CDSS: clinical decision support system

Summary of findings 2. Comparison 2 (summary): Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary care

Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary care	
Patient or population: healthcare providers using digital tracking with targeted client communication and clients receiving care from such providers **Setting:** primary healthcare settings (China, Uganda) **Intervention:** digital tracking with mobile targeted client communication(Tracking + TCC) **Comparison:** standard care or no intervention (standard care without digital interventions or usual care that did not involve any additional follow-up)	
Outcome Effects of tracking + TCC (number of studies, participants)	**Certainty of the evidence (GRADE)**
A. Clients' timeliness of receiving and accessing healthcare services and information	
No studies assessed this outcome.	No evidence
B. Quality of data about services provided	
No studies assessed this outcome.	No evidence
C. Patients'/clients' health behaviour	
• **may slightly** increase medication adherence to antihypertensives in stroke patients (1 randomised study, 1226 participants)[a]	⊕⊕⊖⊖ **Low**
D. Patients'/clients' health status and well-being	
• **may reduce** the number of deaths over 12 months amongst stroke survivors (1 randomised study, 1226 participants)[a]; **slightly reduce** systolic blood pressure at 12 months in patients who have had a stroke (1 randomised study, 1226 participants)[a]; and **slightly improve** the health-related quality of life at 12 months (1 randomised study, 1226 participants)[a] in stroke survivors	⊕⊕⊖⊖ **Low**
• **uncertain** of the effect on the number of women who gave birth at home (1 observational study, 525 participants)[b] and the number of neonatal deaths (1 observational study, 379 participants)[b]	⊕⊖⊖⊖ **Very low**
E. Client utilisation of primary healthcare services	

• **may reduce** the number of hospitalisations for stroke over 12 months in stroke survivors (1 study, 1226 participants)[a]	⊕⊕⊖⊖ **Low**
F. Provider acceptability of/satisfaction with the intervention	
No studies assessed these outcomes.	No evidence
G. Client acceptability of/ satisfaction with the intervention	
No studies assessed these outcomes.	No evidence
H. Resource use	
No studies assessed these outcomes.	No evidence
I. Unintended consequences	
No studies assessed these outcomes.	No evidence

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a]Yan 2021
[b]Asiki 2018
Please refer to Table 2 for more detailed results, including the absolute and relative effects and explanations for downgrading the certainty of the evidence.
Abbreviations:
TCC: targeted client communication

Summary of findings 3. Comparison 3 (summary): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary care

Effect of tracking clients' health service use and status combined with decision support conducted via a mobile device and targeted client communication accessible via a mobile device (Tracking + CDSS + TCC) compared to usual care

Patient or population: healthcare providers using clinical decision support and targeted client communication tools and patients receiving care from such providers in primary care

Setting: Bangladesh, Ethiopia, India, Kenya, and Palestine

Intervention: Tracking + CSS + TCC

Comparison: standard care or no intervention (standard care with providers using decision support tools on paper, paper-based information booklet on management, or usual care that does not involve any additional follow-up

Outcome Effect of Tracking + CDSS + TCC (Number of studies, participants)	**Certainty of the evidence (GRADE)**
A. Providers' adherence to recommended practice	

• **probably** results in **increased** guideline adherence for antenatal screening and the management of anaemia (1 randomised study, 10,502 participants)[b]; diabetes (1 randomised study, 8669 participants)[b]; hypertension (1 randomised study, 15,555 participants)[b]; and **probably** results in **lowered** guideline adherence for screening and management of abnormal foetal growth (1 randomised study, 1165 participants)[b]	⊕⊕⊕⊖ **Moderate**
• **may** have **little to no effect** on the number of infants of HIV+ve mothers receiving Nevirapine prophylaxis (1 randomised study, 609 participants)[a]	⊕⊕⊖⊖ **Low**
B. Time between presentation and appropriate management	
No study assessed this outcome.	No evidence
C. Clients' timeliness of receiving and accessing healthcare services and information	
No study assessed this outcome.	No evidence
D. Quality of data about services provided	
• **probably** results in **slightly less** missing data for haemoglobin at delivery but **slightly more** missing data for blood pressure at delivery in women who have just given birth (1 randomised study, 6367 participants)[b]	⊕⊕⊕⊖ **Moderate**
• **may** make **little or no difference** to the amount of missing data on gestational age or on birthweight at delivery in women who have just given birth (1 randomised study, 6367 participants)[b]	⊕⊕⊖⊖ **Low**
E. Clients' health behaviour	
• **may** make **little or no difference** to the number of HIV-positive pregnant women/mothers on anti-retroviral therapy (ART) at delivery (1 randomised study, 438 participants)[a] • **may increase** the number of HIV+ve women who are exclusively breastfeeding at six months, but the confidence interval also includes a small decrease (1 randomised study, 695 participants)[a]	⊕⊕⊖⊖ **Low**
• **uncertain** of the effect on the physical activity levels of adults at high risk of cardiovascular disease (1 randomised study, 8642 participants)[c]	⊕⊖⊖⊖ **Very low**
F. Clients' health status and well-being	
• **may reduce** the number of deaths in patients with hypertension and diabetes, but the confidence interval includes no difference in deaths (1 randomised study, 3698 participants)[d] • **may reduce** new cardiovascular events in high-cardiovascular risk adults over a 6-18-month follow-up period (1 randomised study, 8642 participants)[c] • **may lead to a very small decrease** in the number of antenatal women with severe hypertension, but the confidence interval includes both an increase and a decrease (1 randomised study, 6367 participants)[b] • **maymake little or no difference** to the number of women with adverse pregnancy outcomes, moderate or severe anaemia, or a large-for-gestational-age baby in women receiving antenatal care (1 randomised study, 6367 participants)[b] • **maymake little or no difference** to HbA1c, total cholesterol, Framingham predicted 10-year cardiovascular risk, tobacco use, alcohol use, or PHQ-9 depression score in adults with hypertension or diabetes (1 randomised study, 3324 participants)[d]	⊕⊕⊖⊖ **Low**

• **uncertain** of the effects on
  ◦ maternal mortality (1 randomised study, 1156 participants)[a] or infant mortality (1 randomised study, 1191 participants)[a] before the baby reaches 18 months old in HIV-positive mothers
  ◦ high cardiovascular-risk patients who achieve optimal systolic blood pressure (< 140 mm/hg) (1 randomised study, 8642 participants)[c]
	⊕⊖⊖⊖ **Very low**

○ adults with hypertension whose blood pressure is controlled < 140/90 at five years (1 randomised study, 933 participants)[e] ○ systolic blood pressure in adults with an increased risk of cardiovascular disease (2 randomised studies, 11,966 participants)[c,d], or body mass index in adults with hypertension or diabetes (2 randomised studies, 11,966 participants)[c,d] ○ fasting plasma glucose in adults with hypertension or diabetes (1 randomised study, 3324 participants)[d] ○ diastolic blood pressure and quality of life in adults with hypertension and diabetes (1 randomised study, 8642 participants)[c]	
G. Client utilisation of primary healthcare services	
• **may** make **little or no difference** to the number of pregnant women who never missed an early infant diagnosis visit (1 randomised study, 1183 participants)[a]	⊕⊕⊖⊖ **Low**
• **uncertain** of the effects on: ○ improving patient linkage to care (1 randomised study, 933 participants)[e] ○ the number of fully vaccinated children over 298 days old in a hard-to-reach rural (1 observational study, 136 participants)[f] or hard-to-reach urban setting (1 observational study, 210 participants)[f] ○ the number of pregnant women who attended at least four antenatal care visits (1 observational study, 1185 participants)[g] or gave birth or received postnatal care at a health facility (1 observational study, 1224 participants)[g]	⊕⊖⊖⊖ **Very low**
H. Provider acceptability of/satisfaction with the intervention	
No study assessed these outcomes.	No evidence
I. Client acceptability of/satisfaction with the intervention	
• **probably slightly increases** the number of adults with hypertension or diabetes reporting a "slightly/much better" change in the quality of care (1 randomised study, 3324 participants)[d]	⊕⊕⊕⊖ **Moderate**
J. Resource use	
No study assessed these outcomes.	No evidence
K. Unintended consequences	
No study assessed these outcomes.	No evidence

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

[a] Suryavanshi 2020
[b] Venkateswaran 2022
[c] Peiris 2019
[d] Prabhakaran 2019
[e] Vedanthan 2019
[f] Uddin 2016

[g]Shiferaw 2016
Please refer to Table 3 for more detailed results, including the absolute and relative effects and explanations for downgrading the certainty of the evidence.
Abbreviations:
CDSS: clinical decision support system
TCC: targeted client communication

BACKGROUND

The World Bank/World Health Organization (WHO)/US Agency for International Development (USAID) Roadmap for Health Measurement and Accountability Post-2015 (MA4Health) reported that "Public health and clinical care cannot be delivered safely, with high quality, and cost-effectively, without seamless, sustainable, and secure data and information exchanges at all levels of the health system" (Haazen 2015). The report further specified that countries should have comprehensive databases with electronic tracking systems that support delivering quality health services, allowing providers to follow up with clients over time, whether within the facility or in the community. An effective healthcare system should be able to store, share, and use health data so providers can use that information to improve clinical care, treatment co-ordination, and disease management. Better data on health status are critical for addressing various coverage and quality of care bottlenecks to achieve universal healthcare coverage (Atasoy 2019; Frøen 2016).

When available, such functional health information systems can provide additional opportunities for improving the quality and safety of preventative and clinical healthcare services. Too often, providers lack information on the most appropriate treatment for clients due to limited training, insufficient time to keep abreast of current evidence, or the sheer complexity of the disease. In primary care, despite the availability of knowledge and specific diagnostic, treatment, and management protocols, a discrepancy exists between knowledge and its application. This 'know-do' gap in healthcare quality has been cited as a critical barrier to optimal healthcare outcomes (Blank 2013; Das 2018; Mohanan 2015).

Description of the condition

For clients receiving primary care services, interactions with providers during healthcare appointments remain vital opportunities to receive evidence-based clinical information tailored to the individual's specific health needs. Limited interactions with the healthcare system between clinical appointments often result in poor engagement; for example, poor adherence to recommended clinical care plans or medication regimens. In low-resource settings, a shortage of trained healthcare professionals and low provider-to-patient ratios often translate into additional barriers to enabling clients to receive counselling or information to help them manage their health or learn about preventative health measures. The lack of data for clinical decision-making and follow-up exacerbates these gaps.

Description of the intervention

To facilitate continuity of care, particularly for ongoing or chronic health concerns like pregnancy or diabetes, providers must uniquely identify each client and track their healthcare interactions over time. Digital interventions on mobile devices have the potential to facilitate the maintenance of comprehensive client health records, enhance clinical practices, and foster better client engagement. **Digital tracking**, a vital aspect of these interventions, involves the ongoing monitoring of a client's health status by digitally entering and accessing data related to healthcare services. This process may include converting traditional paper health records, such as medical registers and service logbooks, into electronic formats for digital tracking.

Systems designed to track and manage preventative and clinical services allow providers to capture, store, access, and share client information during the clinical encounter. Monitoring health status enables tailoring clinic care to patients' needs and appropriate management (WHO/ITU 2012). Additionally, tracking can facilitate the aggregation, analysis, and synthesis of client data from multiple sources to enable better decision-making for client care and more accurate surveillance of disease and service utilisation trends.

In most high-income countries (HICs), sophisticated computerised health records have been widely implemented over the past decade. In low- and middle-income countries (LMICs), where computerised infrastructure may be limited, mobile devices are widely used instead of stationary computers to leapfrog the lack of infrastructure while digitising client health records.

Digital client health records can be integrated with other tools that provide information to healthcare providers and clients through mobile devices. For example, mobile **clinical decision support systems** (CDSSs) can couple clinical practice guidelines with client information from the electronic health record to identify drug interactions, client risks, and appropriate disease management. A clinical decision support system (CDSS) aims "to improve healthcare delivery by enhancing medical decisions with targeted clinical knowledge, patient information, and other health information". It is typically "comprised of software designed to be a direct aid to clinical decision-making, in which the characteristics of an individual patient are matched to a computerised clinical knowledge base and patient-specific assessments, or recommendations are then presented to the clinician for a decision" (Sutton 2020). Mobile CDSSs may vary in functionality and applications to improve diagnosis, facilitate evidence-based screening, counselling, and treatment, and improve workflow efficiencies (Orton 2018).

On the client side, digital health records may be integrated with systems designed to improve adherence to the clinical care plan via targeted communication with clients on their mobile devices. **Targeted client communication** (TCC) is the transmission of unidirectional targeted health content that is individually tailored based on static and dynamic information about the recipients from a health registry system (Argawal 2018). This shared information can fall along a continuum of tailored to untailored communication, including transmission of individualised notifications according to a specific individual clinical care plan, as well as transmission of predetermined content developed for the identified population group. Examples of targeted client communication (TCC) may include appointment reminders, medication reminders, notification of test results, or patient education on specific health conditions that pertain to the client. To define appropriate populations for TCC, providers need to identify and subscribe eligible individuals to a system that allows the transmission of health information. Additionally, the health system must determine the timing and content of transmitted information rather than have clients seeking information on demand.

How the intervention might work

Longitudinal tracking of client health information varies widely depending on the availability of health infrastructure. In HICs, providers may track client health information using sophisticated electronic medical records. Such records are expected to

conform to nationally recognised interoperability standards, draw from multiple sources, support various disease groups and comorbidities, and be shared and controlled by healthcare providers and clients (Kahn 2009). These records may be integrated with CDSSs relevant to a medical speciality or a high-priority hospital condition (Moja 2014). They often contain additional features that support education and automated client follow-up according to their specific health issues (Sutton 2020).

In most LMICs, such systems tend to vary widely according to available infrastructure and human resources and the presence of a nationally accepted unique patient identification system. For example, in computerised peri-urban and urban centres, digital health records customised to the workflows of individual clinics and hospitals may be available. In some primary healthcare settings, particularly in remote areas, the transition from paper to digital records is still in its infancy. Interoperability standards are not well-defined or used in practice, precluding the establishment and sharing of digital health records. Longitudinal digital records used to support reproductive, maternal, newborn, and child health while following care provided to women and infants from prenatal to postpartum are often called electronic registries or eRegistries (Frøen 2016). Like electronic medical records, eRegistries provide an organised system for collecting, managing, and analysing data by using reproductive, maternal, newborn, and child health data, chronic disease monitoring and other health data to improve health and serve as an entry point for accessing a range of preventative and curative services and promoting health.

Digital health records may drive multiple mobile applications that can draw on stored client data to guide a provider through treatment protocols (e.g. CDSSs) or offer additional client support in the form of information and reminders (e.g. TCC). Providers may load electronic databases onto a handheld mobile device to manage clinical diaries, input new client data that can later be synchronised with an external source (Divall 2013; Orton 2018), access summary dashboards, and retrieve information and decision support aids based on client-specific information.

Broadly, CDSSs may serve the following functions.

- Guide the healthcare provider through process algorithms using 'if-then' rules based on evidence-based clinical protocols;
- Provide the healthcare provider with a checklist based on clinical evidence-based protocols;
- Present step-by-step guidance for screening clients by health status or risk status, including using models based on machine learning models for risk prediction.

Providers may use the data stored in digital health records to generate TCC messages delivered to the client's mobile device that reach clients near-instantaneously with information tailored to their needs. Various communication modalities such as text messages, phone calls, interactive voice response systems, unstructured supplementary service data (USSD) messages, multimedia messages, pictures, and in-app alerts might be used in communicating with clients. Such targeted communication with clients may serve several functions.

- Targeted health event alerts to alert clients about diagnostics results or the availability of results. Efficient delivery of diagnostic results may expedite follow-up, appropriate treatment, and ongoing engagement with care;
- Targeted health education messages based on the client's care plan or demographic health status may enhance knowledge about their health condition and positively influence behaviour and healthcare practices;
- Targeted alerts and reminders may be sent to improve client adherence to medication regimens and attendance at clinic appointments.

Interventions integrating digital health records with CDSSs or TCCs are multi-faceted and may vary widely. For example, the mTika immunisation registry system supports vaccinators in registering and tracking children for receipt of recommended childhood vaccinations during the first year of life (De Cock 2020). Caregivers of children receive appointment reminders via short message service (SMS) to their registered phone number one week before and one day before the scheduled vaccination appointment. In addition to tracking and sending targeted messages to caregivers, mTika offers CDSS components such as vaccination schedules calculated based on the child's date of birth (Uddin 2016). Another example is the Safer Deliveries programme in Zanzibar (Lund 2012). This programme helps community health workers (CHWs) register pregnant women via mobile phones. CHWs then visit these women in their homes and offer antenatal care via mobile-based CDSSs throughout pregnancy while preparing women to deliver at a health facility (Dtree International 2017).

Why it is important to do this review

Digital, mobile, and wireless technologies provide an innovative and accessible platform for accelerating health services and enhancing quality of care. Health records available on mobile devices can facilitate the delivery of critical care outside formal healthcare settings within the community and in areas where healthcare facilities may lack essential infrastructure (Agarwal 2021). Evidence suggests that the use of digital health records, combined with additional tools such as CDSSs, may improve the quality of health services and healthcare outcomes (Agarwal 2021).

A systematic review of 148 randomised trials on the effects of CDSS reported significant improvements in healthcare process measures related to preventative services, diagnostic testing, and treatment (Bright 2012). Another systematic review assessed the effectiveness of CDSSs integrated with electronic health records. This review of 25 randomised trials concluded that integrated CDSSs did not affect mortality but significantly prevented disease morbidity (Moja 2014). A systematic review of 17 randomised trials for childhood obesity interventions utilising CDSS and machine learning found that those integrated with electronic health records or mobile apps were effective amongst children and caregivers (Triantafyllidis 2020). Although this evidence is promising, it does not speak to the effectiveness of interventions provided via mobile devices, especially in low-income settings, where such interventions are in the early stages of development.

Several systematic reviews have examined using TCCs to improve health knowledge, behaviour, and outcomes (Free 2013; Gurol-Urganci 2013; Vodopivec-Jamsek 2012; Whittaker 2016). Much of the available evidence is of low or moderate quality and includes limited studies from low-resource settings that are not conducted in primary healthcare settings. A systematic review of eight randomised trials assessed the effects of mobile phone messaging reminders on improving attendance at healthcare appointments. This review concluded that mobile phone text

messaging reminders, similar to phone call reminders, were associated with increased attendance at healthcare appointments (Gurol-Urganci 2013). Whittaker 2016 included 12 moderate to high-quality studies and found a beneficial impact of mobile phone-based smoking cessation interventions on six-month cessation outcomes. Another systematic review of 75 controlled trials on the effectiveness of mobile technology-based health behaviour change interventions and disease management interventions delivered to healthcare consumers suggested the benefits of text messaging for improving antiretroviral treatment adherence and smoking cessation (Free 2013). However, this review found limited evidence from LMICs and noted an overall lack of high-quality trials. Two systematic reviews - one focused on the use of TCC via mobile devices for the improvement of sexual and reproductive health, and the other for the improvement of maternal, neonatal, and child health - documented uncertainty regarding the effects of TCC on improving related health outcomes, given low certainty and availability of such evidence (Palmer 2020a; Palmer 2020b). None of these reviews focused on interventions integrating TCCs with longitudinal digital health records.

This review assesses evidence on tracking systems accessible via mobile devices integrated with CDSSs and TCCs. Given the recent emergence of digital technologies for health, Ministries of Health, donors, and decision-makers need evidence-based guidance on the value of digital tools in strengthening health system gaps. In response to this global need, the World Health Organization is developing guidelines to inform investments in digital health approaches. This review on digital interventions that use combinations of CDSSs, TCCs, and electronic health records constitutes one of a suite of such reviews. The preliminary results of this review were used to directly inform WHO guidelines on the effectiveness of these strategies in addressing health system shortfalls (WHO 2019).

OBJECTIVES

To assess the effects of using a mobile device to track service use when combined with clinical decision support (**Tracking + CDSS**), with targeted client communications (**Tracking + TCC**), or both (**Tracking + CDSS + TCC**).

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised trials and the following non-randomised study design types.

- Non-randomised trials;
- Controlled before-after studies, provided they had at least two intervention sites and two control sites;
- Interrupted time-series studies, if the intervention occurred at a clearly defined time and investigators documented at least three data points before and at least three after the intervention.

We included published studies, conference abstracts, and unpublished data regardless of their publication status and language of publication.

Types of participants

- All cadres of healthcare providers (including professionals, paraprofessionals, and lay health workers) who provide primary care services;
- Other individuals or groups involved in client registration or tracking could include administrative staff and managerial and supervisory staff. Participants may be based in a primary healthcare facility or the community but must be involved in supporting the delivery of primary healthcare services;
- Patients/clients receiving primary healthcare services.

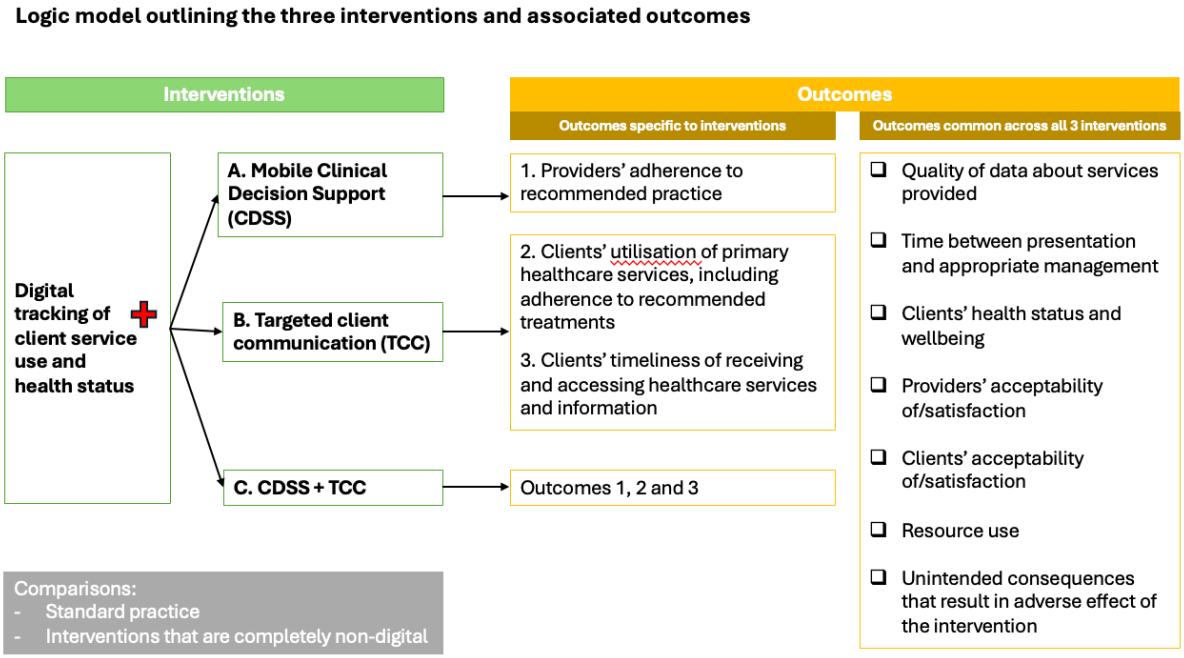
By 'primary care services', we mean a combination of the following.

- First contact point for health care (Awofeso 2004), including care delivered at an individual or community level, or both (Muldoon 2006), by non-specialist healthcare providers, and intended to bring care to where people work and live (Muldoon 2006), as well as to co-ordinate or provide continuity of care (WHO 2008);
- Any rehabilitative, therapeutic, preventative, and promotive health care (Global Health Watch 2011).

Types of interventions

For this systematic review, we included multi-faceted interventions for improving the quality and efficiency of delivering healthcare services. These multi-faceted interventions comprise a digital system that allows providers to longitudinally follow up on clients by entering and accessing data on healthcare services utilised by the client (i.e. 'digital tracking' of clients), combined with other interventions aimed at improving either client adherence to treatment or quality of services received by the client. We present a logic model to clarify the relationship between interventions and outcomes (Figure 1).

Figure 1. Logic model outlining the three interventions and associated outcomes (Copyright © 2018 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd: reproduced with permission)



We included studies in which the intervention involved digital tracking of clients combined with a digital clinical decision support system (CDSS) via mobile device, digital tracking of clients combined with targeted client communications (TCC) via mobile device, or digital tracking of clients combined with both interventions (CDSS and TCC) in the context of a primary healthcare setting.

In each case, the provider must be able to enter client data using a mobile interface and/or access individual client data using a mobile device. Providers may prefer entering data on desktop computers in contexts with more developed infrastructure. We included studies that tested interventions using client information as entered via desktops, so long as the record was accessible on a mobile interface. Interventions may consist of systems by which CDSS tools are available on mobile devices and are used to enter relevant client data via these mobile devices. Similarly, the system may be set up to send targeted messages to clients' mobile devices. For studies where investigators used digital devices to provide maternity care from the prenatal to the postpartum period and had the function of birth notification, we included only prenatal outcomes.

By 'mobile devices', we mean mobile phones (but not analogue landline telephones), tablets, personal digital assistants, and smartphones.

As shown in Figure 1, comparisons for this review included standard practice and interventions that used non-digital systems.

We excluded the following.

- Studies that performed digital tracking of client healthcare services on a laptop alone or in which the client health record was not accessible via a mobile device;
- Studies that provided decision support on stationary computers or laptops alone;
- Pilot and feasibility studies (a pilot study is defined as "a version of the main study that is run in miniature to test whether the components of the main study can all work together", and a feasibility study is defined as "pieces of research done before a main study" (Arain 2010));
- Studies in which the CDSS or TCC was provided as a standalone intervention or was not linked to client health records (digital tracking);
- Studies in which untargeted client communication was provided;
- Studies that included interventions targeted at the notification of new births measuring only postnatal outcomes attributable to timely birth notification;
- Studies that did not include a direct face-to-face provider-client service delivery interaction. Studies of remote patient monitoring (telemonitoring) on its own or with telemedicine. Studies using mHealth tools mainly to support patient self-management rather than primary care;
- Studies in which digital tracking was used only to support audit and management in a health facility and not in relation to CDSS tools or TCC;
- Design or usability studies of eligible interventions;
- Studies that provided digital tacking + telemonitoring (e.g. Castillo 2019);

- Studies that provided CHW screening (using a mobile device) and electronic appointment scheduling without any ongoing digital tracking (e.g. Beratarrechea 2019).

Types of outcome measures

This review contributed to the guidelines process for the WHO Guideline Development Group's Recommendations on Digital Interventions for Health System Strengthening (WHO 2019). The outcomes of importance were initially identified through an expert panel discussion during an in-person Guideline Development Group scoping meeting. This was followed by a series of stakeholder surveys where respondents were asked to rank outcomes and interventions along a nine-point scale (from 1 = not important to 9 = critical). Over 300 respondents from all WHO regions participated in two surveys, which helped to narrow down the final list of priority questions, including interventions and outcomes.

In a second stage, as part of an initial full-text review, we abstracted data and identified an extensive number of outcomes based on our data abstraction sheet. All the relevant outcomes within the outcomes categories prioritised earlier were abstracted. We then further prioritised the reporting of outcomes based on whether the outcomes were validated, included in standardised surveys, globally monitored as part of initiatives such as the Countdown to 2030, or of high clinical and public health relevance. We consulted with primary care clinicians and public health experts, focusing on specific health areas to ascertain relevance.

Finally, we performed a third round of prioritisation with individual experts in the fields of child and maternal health and chronic disease to confirm the final list of outcomes for these areas before proceeding to data extraction and analysis.

The final list of outcomes selected is reported in Appendix 1; Appendix 2; Appendix 3.

Primary outcomes

Following the WHO Guideline Development Group's prioritisation process, we searched and extracted study outcomes from the following agreed domains for each comparison.

Intervention	Outcomes specific to interventions	Outcomes common across all three interventions
Tracking + CDSS	• Providers' adherence to recommended practice (e.g. providing service at the recommended time, referral as recommended; screening and prioritising as recommended); • The time between presentation and appropriate management.	• Quality of data about services provided (accuracy, timeliness, completeness of data); • Clients' health behaviour; • Clients' health status and well-being; • Clients' utilisation of primary health care and/or services; • Provider acceptability of/satisfaction with the intervention; • Client acceptability of/satisfaction with the intervention; • Resource use (e.g. human resources/time, including additional time spent by providers when managing/transitioning dual paper and digital reporting systems; training, supplies, and equipment); • Unintended consequences that result in adverse effects of the intervention (these could include providers' time spent on administrative tasks; misinterpretation of data; transmission of inaccurate data, for instance, through incorrect data entries; loss of verbal or non-verbal communication cues; issues of privacy and disclosure; failure of, or delay in, message delivery; loss or misuse of devices; interrupted workflow due to infrastructural constraints for battery recharge and network coverage; impact on equity).
Tracking + TCC	• Clients' timeliness of receiving and accessing healthcare services and information (e.g. partner notification, receipt of test results).	
Tracking + CDSS + TCC	• Providers' adherence to recommended practice, guidelines, or protocols (e.g. providing service at the recommended time; referral as recommended; screening and prioritising as recommended); • Time between presentation and appropriate management; • Clients' timeliness of receiving and accessing healthcare services and information (e.g. partner notification, receipt of test results).	

CDSS: clinical decision support system

TCC: targeted client communication

Secondary outcomes

This review had no secondary outcomes.

Search methods for identification of studies

We restricted the search from 2000 to November 2022. This was based on the increased availability and penetration of mobile devices in low- and middle-income countries starting in 2000 (International Telecommunications Union 2015).

Electronic searches

An independent Information Specialist (JE) developed search strategies in consultation with the review authors.

We searched the following databases for primary studies from 2000 to 9 November 2022:

- Cochrane Central Register of Controlled Trials, Issue 10 of 12, October 2022, part of the Cochrane Library, Wiley
- MEDLINE(R) ALL (Ovid) 1946 to November 08, 2022;
- Embase <1974 to 2022 Week 44>, Ovid;
- Global Index Medicus, WHO (https://www.globalindexmedicus.net/);
- International Clinical Trials Registry Platform (ICTRP), WHO (www.who.int/clinical-trials-registry-platform);
- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (clinicaltrials.gov/);
- POPLINE (searched 7 August 2019).

Appendix 4 lists the search strategies for each database. Search strategies comprise keywords and controlled vocabulary terms. We did not apply any language limits.

In February 2024, we conducted simple searches in PubMed to check for any new randomised trials that might have been published since the date of the last search in November 2022.

Searching other resources

We searched for ongoing trials in the following trial registries and contacted study authors to request further information and data, if available.

- WHO ICTRP (World Health Organization International Clinical Trials Registry Platform;www.who.int/ictrp);
- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov).

We searched Epistemonikos (www.epistemonikos.org) for relevant systematic reviews and potentially eligible primary studies. Additionally, the WHO called for papers through popular digital health communities of practice, such as the Global Digital Health Network and grey literature, to identify additional primary studies.

Grey literature

In addition to the above databases, we searched mhealthevidence.org for grey literature. However, mHealthevidence.org lost funding support and was discontinued in 2021, so our successive searches did not include this database.

We reviewed reference lists of all included studies and relevant systematic reviews for additional potentially eligible primary studies. We contacted authors of included studies/reviews to clarify reported published information and to seek unpublished results/data.

Data collection and analysis

Selection of studies

A key team of authors examined all the records retrieved from the searches using the Covidence systematic review software (Covidence). Two review authors independently assessed all titles and abstracts to eliminate ineligible ones, seeking the input of a third review author in case of disagreements. Full-text copies of articles deemed potentially relevant by at least two review authors were obtained. Two review authors independently applied the inclusion criteria to each full paper, and any disagreements were resolved through team discussion. We recorded all reasons for the exclusion of ineligible studies.

In the Characteristics of excluded studies table, we listed studies that initially appeared to meet the inclusion criteria during the title and abstract screening but were later excluded following full-text review. We collated multiple reports of the same study so that each study, rather than each report, was the unit of interest in the review. In the Characteristics of ongoing studies table, we described descriptive details about the studies, including the study design, participants, intervention, primary outcomes, and start dates.

We documented the selection procedure to be able to generate a PRISMA flow diagram (Page 2021).

Data extraction and management

We modified the EPOC standard data extraction form and adapted it for study characteristics and outcome data relevant to this review (EPOC 2017a). We identified key characteristics of the intervention for abstraction based on mHealth Evidence Review and Assessment (mERA) guidelines (Agarwal 2016). We piloted the form on at least one study in the review. Two review authors (NH, HB, WYC) independently extracted the following study characteristics from the included studies.

- General information: title, reference details, study author contact details, publication type, funding source, conflicts of interest of study authors;
- Population and setting: country, geographical location (rural, urban, peri-urban), healthcare setting (e.g. facility-based, community-based);
- Methods: intervention function, study design, unit of allocation, and study duration;
- Participant characteristics: type of healthcare worker (function, age, length of training), description of clients serviced by the healthcare worker, description of any other participants in the intervention, withdrawals;
- Interventions:
  - For tracking + CDSS interventions: intervention purpose; components of tracking interventions and CDSS interventions; type of technology and mode of delivery; content of the intervention; type of mobile device/s used (smartphone, tablet, feature phone, basic phone, laptops); healthcare provider training; interoperability; compliance with national guidelines; data security; comparison; fidelity assessment; duration of the intervention;
  - For tracking + TCC interventions: intervention purpose; intervention components' mode, timing, frequency, and duration of intervention delivery; content of the intervention; type of mobile device/s used (smartphone, tablet, feature phone, basic phone, laptops); interoperability; compliance with national guidelines; data security; comparison; fidelity assessment;
  - For tracking + CDSS + TCC interventions: we extracted all characteristics listed in the sub-bullets above;

- Outcomes: primary and other outcomes (continuous and dichotomous) for each intervention group, time points reported, adverse events, and results of any subgroup analyses.

We noted in the Included studies whether outcome data were reported in an unusable way. We resolved disagreements by reaching a team consensus or involving a third review author (SA).

Assessment of risk of bias in included studies

Two review authors (WYC, NH) independently assessed the risk of bias for each study by using Cochrane RoB 1 as outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* Section 8.5 (Higgins 2024) and guidance from the EPOC group (EPOC 2017b). Any disagreements were resolved through team discussion. We assessed the risk of bias for randomised/non-randomised trials and controlled before-after studies using the following criteria: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting, baseline outcomes measurement, similarity of baseline characteristics, and other bias. For interrupted time-series studies, we assessed the risk of bias using these seven standard criteria (EPOC 2017b): independence of the intervention from other changes, prespecified shape of the intervention effect, independence of intervention and data collection procedures, objectivity of the outcomes, bias resulting from missing outcome measures, selective outcome reporting, and other biases such as seasonality. The risk of bias criteria of baseline outcomes measurement and similarity of baseline characteristics were considered within the 'other' risk of bias domain.

We judged the risk of each potential source of bias as high, low, or unclear and provided a quote from the study report and a justification for our judgement in the risk of bias table. We summarised risk of bias judgements across different studies for each domain listed. We made assessments separately for different key outcomes when necessary (e.g. for unblinded outcome assessment, the risk of bias for all-cause mortality may be very different than for a patient-reported pain scale). If the information on the risk of bias was related to unpublished data or correspondence with a trialist, we noted this in the risk of bias table. We did not exclude studies on the grounds of their risk of bias and reported risk of bias when presenting the results of studies. When considering treatment effects, we considered the risk of bias for studies contributing to that outcome. We assessed evidence quality using the GRADE approach (Guyatt 2008). Findings are summarised in Summary of findings 1; Summary of findings 2; Summary of findings 3) with more detailed explanations for the evidence assessments in Table 1; Table 2; Table 3.

We conducted the review according to the published protocol and reported deviations in Differences between protocol and review.

Measures of treatment effect

We reported pre-intervention and post-intervention means and proportions for intervention and comparison groups. When possible, we used a random-effects model to meta-analyse data producing risk differences (RD), risk ratios (RR), or odds ratios (OR) for dichotomous outcomes, together with appropriate associated 95% confidence intervals, and mean differences or standardised mean differences for continuous data, together with 95% appropriate associated confidence intervals. We ensured that an increase in scores for continuous outcomes could be interpreted the same way for each outcome, explained the direction to the reader, and reported when directions were reversed, if necessary. For interrupted time series, we reported pre- and post-intervention slopes of analysis, differences between slopes, and differences between intercepts at the first intervention point and predicted intercept by intervention. If interrupted time-series data had been analysed incorrectly, we reanalysed the data, when possible (EPOC 2017c).

Unit of analysis issues

If cluster-randomised trials or controlled before-after studies were included in the review, we reported cluster-adjusted risk ratios or differences and their 95% confidence intervals. If the analysis was not adjusted for clustering, we used the intra-cluster correlation coefficient (ICC), if available, to adjust the confidence interval. If the ICC was unavailable, we presented results without a measure of variance or precision of effect for outcomes for which we found a unit of analysis error (EPOC 2017d).

Dealing with missing data

We contacted investigators to verify key study characteristics and to obtain missing outcome data when possible (e.g. when a study was identified as abstract only). If this was not possible, we reported the data as missing, noted this in the risk of bias tables, and did not attempt to impute missing values. For all outcomes, we carried out analyses, to the extent possible, on an intention-to-treat basis using available cases. However, in assessing adverse events, we related results to actual treatment received (i.e. analyses were based on participants who actually received the intervention and adverse events reported in the studies).

Assessment of heterogeneity

We conducted a meta-analysis if we found sufficient studies that evaluated similar interventions and reported comparable outcomes. We examined heterogeneity by visually inspecting forest plots and using the I^2 statistic to measure heterogeneity amongst the trials in each analysis. We noted the presence of substantial heterogeneity (I^2 = 50% to 90%) or considerable heterogeneity (I^2 = 75% to 100%) (Higgins 2024). If we identified substantial heterogeneity, we explored this by performing a prespecified subgroup analysis.

Assessment of reporting biases

We attempted to contact the study authors to ask them to provide missing outcome data. When this was not possible, and missing data were thought to introduce serious bias, we explored the impact of including such studies in the overall assessment of results. In cases where adjusted analyses for dichotomous outcomes were reported using odds ratios and not risk ratios, we used Cochrane statistical software (RevMan 2025) to convert odds ratios to risk ratios before including results in a meta-analysis. If we could pool more than 10 trials, we created funnel plots to explore possible publication bias or other causes of asymmetry (Sterne 2011). We interpreted the results of the funnel plots with caution, as funnel plot calculations for dichotomous outcomes measured as risk ratios are not well-developed, and statistical funnel plot results may not be representative in cases of small-study effects.

Data synthesis

When studies evaluated similar interventions, we grouped them together and summarised key characteristics of each study in tables to facilitate comparison across studies. We undertook meta-analyses using a random-effects model only when this was meaningful (i.e. when intervention, context, and outcomes were similar enough for pooling to make sense). Trialists commonly indicate when they have skewed data by reporting medians and interquartile ranges. When we encountered this, we noted that the data were likely to be skewed and considered the implications of this. When a single trial reported multiple trial arms, we included only the relevant arms. When we entered two comparisons (e.g. intervention A vs usual care and intervention B vs usual care) into the same meta-analysis, we halved the control group to avoid double-counting.

Subgroup analysis and investigation of heterogeneity

We performed subgroup analysis to assess variation in the delivery of the intervention across different population groups, interventions, or setting characteristics, if possible. We only conducted subgroup analysis if sufficient trials were available for statistically significant group comparisons. We assessed heterogeneity within each subgroup using forest plots and the I^2 measure. We summarised the results of subgroup analysis within the text of the review, if meta-analysis was not possible or meaningful. We carried out subgroup analyses in each of the following categories, depending on the availability of data.

Tracking + CDSS	Tracking + TCC	Tracking + CDSS + TCC
• Intervention characteristics (e.g. smartphones vs tablets); • Functional characteristics, such as the use of decision support as checklists, as screening tools, and for risk stratification and treatment, as effects of decision support tools may be different depending on the purpose for which they are used.	• Intervention characteristics (e.g. communication modalities including SMS, IVR, voice, or multimedia); • Intervention purpose (e.g. appointment reminders, medication reminders, health information); • Intervention timing or frequency.	• Intervention characteristics (e.g. smartphones vs tablets); • Functional characteristics, such as the use of decision support as checklists, as screening tools, and for risk stratification and treatment, as effects of decision support tools may be different depending on the purpose for which they are used; • Intervention characteristics (e.g. communication modalities including SMS, IVR, voice, or multimedia); • Intervention purpose (e.g. appointment reminders, medication reminders, health information); • Intervention timing or frequency.

- Type of geographic setting (e.g. urban, rural, peri-urban; low- and middle-income countries), as we anticipate that the intervention may have different effects owing to social and economic differences between settings;
- Type of healthcare setting (e.g. community-based, clinic-based), which may influence the way the intervention is delivered and its effects;
- Provider type (e.g. lay provider vs professional healthcare provider), as we anticipate that different types of providers may vary in their use of decision support tools provided via a mobile device;
- Health area (e.g. chronic disease, infectious disease, maternal health, child health), as the effects of using decision support tools may vary by types of services used to address needs in different health areas.

CDSS: clinical decision support system

IVR: interactive voice response

SMS: short message service

TCC: targeted client communication

Sensitivity analysis

We performed sensitivity analyses, as defined a priori, to assess the robustness of our conclusions and explore their impact on effect sizes. This involved restricting our analysis to published studies and removing from meta-analysis studies that had high risk of bias, as determined by the risk of bias assessment.

Summary of findings and assessment of the certainty of the evidence

We created three summary of findings (SoF) tables to summarise the findings for the three main intervention comparisons. We included the most important outcomes to permit conclusions about the certainty of evidence provided within the text of the review.

Summary of findings 1: Tracking with clinical decision support system (Tracking + CDSS) compared to usual care in primary care

A. Providers' adherence to recommended practices, guidelines, or protocol;
B. Time between presentation and appropriate management;
C. Quality of data about services provided;
D. Clients' health behaviour;
E. Clients' health status and well-being;
F. Clients' utilisation of primary health care and/or services;
G. Provider acceptability of/satisfaction with the intervention;
H. Client acceptability of/ satisfaction with the intervention;
I. Resource use;
J. Unintended consequences.

Summary of findings 2: Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary care

A. Clients' timeliness of receiving and accessing healthcare services and information;
B. Quality of data about services provided;
C. Patients'/clients' health behaviour;
D. Patients'/clients' health status and well-being;
E. Client utilisation of primary healthcare services;
F. Provider acceptability of/satisfaction with the intervention;
G. Client acceptability of/satisfaction with the intervention;
H. Resource use;
I. Unintended consequences.

Summary of findings 3: Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary care

A. Providers' adherence to recommended practice;
B. Time between presentation and appropriate management;
C. Clients' timeliness of receiving and accessing healthcare services and information;
D. Quality of data about services provided;
E. Clients' health behaviour;
F. Clients' health status and well-being;
G. Client utilisation of primary healthcare services;
H. Provider acceptability of/satisfaction with the intervention;
I. Client acceptability of/satisfaction with the intervention;
J. Resource use;
K. Unintended consequences.

During the review process, we included additional relevant outcomes when we became aware of an important outcome we had failed to list in our planned summary of findings table. We highlighted these in the Differences between protocol and review section.

Two review authors independently assessed the certainty of evidence (high, moderate, low, and very low) using the five GRADE considerations (risk of bias, consistency of effect, imprecision, indirectness, and publication bias) (Guyatt 2008). We used methods and recommendations as described in Section 8.5 and Chapter 12 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2024), as well as EPOC worksheets (EPOC 2017e), along with GRADEpro software (GRADEpro GDT 2024). We resolved disagreements on certainty ratings by discussion, justified decisions to downgrade or upgrade the ratings using footnotes in the table, and made comments to aid readers' understanding of the review when necessary. We used plain language statements to report these findings in the review (EPOC 2017f).

We noted in the comments if we could not incorporate any additional outcome information into meta-analyses and stated whether this supported or contradicted information from the meta-analyses. When it was impossible to meta-analyse the data, we summarised the findings narratively in the results section.

This was a large review with many outcomes. Using the same format as an earlier review on decision support tools (Agarwal 2021), we decided to present a high-level narrative summary of the key findings with the GRADE assessments in Summary of findings 1; Summary of findings 2; Summary of findings 3). More detailed results tables, including the effect sizes and explanations for the evidence assessments, are found in Table 1; Table 2; Table 3.

RESULTS

Description of studies

We imported 28,685 records into Covidence for screening. After removing 10,354 duplicates, we screened the titles and abstracts of 18,331 records. The study selection process is summarised in a PRISMA flow diagram (Figure 2). We shortlisted 156 studies for full-text review. After excluding 122 studies due to ineligibility, we included 18 studies for data extraction and analysis, and identified 16 ongoing studies.

Figure 2. PRISMA flow diagram

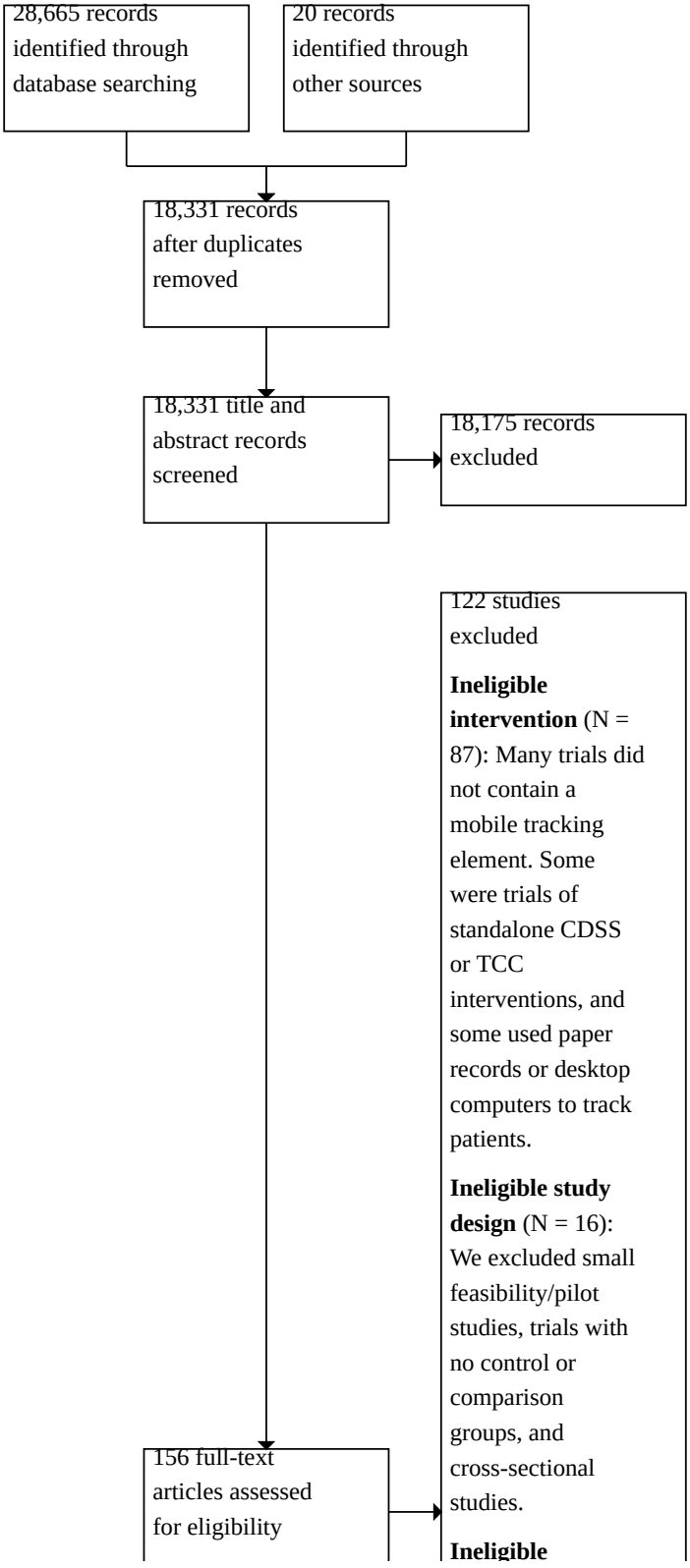
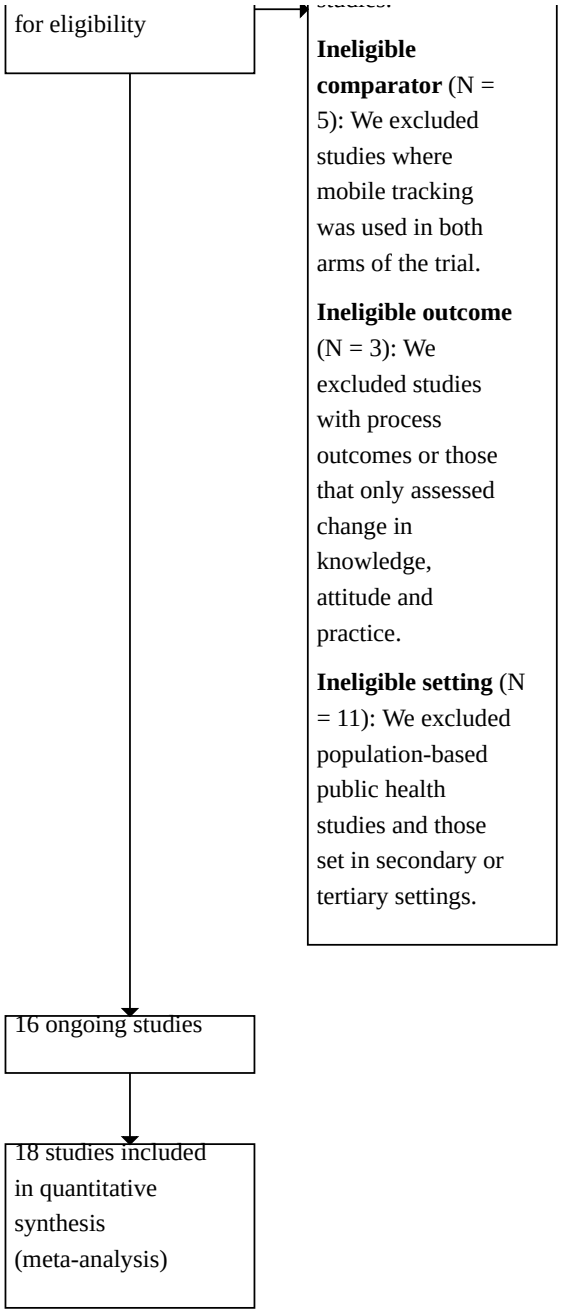


Figure 2. (Continued)



Results of the search

We included 18 studies published between 2000 and 2022 (see Included studies). Eleven were cluster-randomised controlled trials (cRCT), two were before-and-after studies, and five were non-randomised studies.

A further 16 studies met the review's eligibility criteria but, as of February 2024, had no published results. These are found in Ongoing studies.

There were no unclassified studies and a simple search in PubMed in February 2024 for any new randomised trials published since the date of the last search did not identify any eligible studies.

Included studies

Population

Studies were conducted in urban and rural settings in Bangladesh (N = 1), China (N = 2), Ethiopia (N = 1), India (N = 8), Kenya (N = 1), Palestine (N = 1), Tanzania (N = 2), Uganda (N = 1) and the USA (N = 1). The participants in the trials were women receiving pre-or

postnatal care (N = 11), mothers of young children (N = 2), children (N = 2), and adults with chronic disease (N = 4).

Interventions

The maternal and child health interventions sought to link pregnant women to their nearest health facility for childbirth (Asiki 2018) to improve the continuity and quality of care for child and maternal health services (Ilozumba 2018; Modi 2019; Patil 2022; Shiferaw 2016), to promote better reproductive, maternal, newborn, child health and nutrition behaviours (Carmichael 2019; Hackett 2018; Prinja 2017), to improve vaccine coverage (Chen 2016; Prinja 2017; Uddin 2016), for monitoring childhood asthma (Shiffman 2000), and to promote the prevention of mother-to-child transmission for HIV (Bull 2018; Suryavanshi 2020).

Chronic disease interventions sought to enhance the quality of care for cardiovascular disease (Peiris 2019), hypertension (Prabhakaran 2019; Vedanthan 2019), diabetes (Prabhakaran 2019), and secondary stroke prevention (Yan 2021).

Comparison 1. Effects of digitally tracking clients' health service use and status combined with decision support using a mobile device (tracking + CDSS).

Nine studies evaluated the effects of digital tracking + CDSS. These were conducted in India (Carmichael 2019; Ilozumba 2018; Modi 2019; Patil 2022; Peiris 2019), Tanzania (Bull 2018; Hackett 2018), China (Chen 2016) and the USA (Shiffman 2000). Study settings included rural (Bull 2018; Carmichael 2019; Chen 2016; Hackett 2018; Ilozumba 2018; Patil 2022; Prinja 2017; Shiffman 2000), tribal (Modi 2019), peri-urban (Shiffman 2000) and urban (Shiffman 2000) locations. The study designs included cluster-randomised controlled trials (Bull 2018; Carmichael 2019; Chen 2016; Hackett 2018; Modi 2019), a controlled before-and-after study (Prinja 2017), non-randomised cluster trials (Ilozumba 2018, Patil 2022), and a non-randomised cluster study nested in a before-an- after study (Shiffman 2000).

The included studies examined the use of digital health interventions to support the continuum of care services during pregnancy, delivery and postnatal periods (Bull 2018; Carmichael 2019; Ilozumba 2018; Modi 2019; Patil 2022; Prinja 2017) for promoting facility-based delivery (Hackett 2018; Ilozumba 2018), neonatal care (Modi 2019; Prinja 2017), childhood immunisation (Chen 2016; Modi 2019; Prinja 2017), and paediatric asthma management (Shiffman 2000). Bull 2018 delivered services to women with HIV to prevent mother-to-child transmission.

Users of the tracking and decision support components of the digital health interventions included cadres of lay health workers such as Accredited Social Health Activists (ASHAs) and Anganwadi workers (Carmichael 2019; Ilozumba 2018; Modi 2019; Patil 2022; Peiris 2019; Prinja 2017), community health workers (Hackett 2018; Shiferaw 2016; Suryavanshi 2020), paediatricians (Shiffman 2000) and village doctors (Chen 2016).

Users used basic phones (Ilozumba 2018), Java-based mobile phones (Prinja 2017), smartphones (Chen 2016; Hackett 2018; Modi 2019; Patil 2022), and tablets (Shiffman 2000). In Chen 2016, text messages were used to inform caregivers about upcoming appointments in the intervention and control arms. Hence, the effect of the text messages was not considered for the review of this objective.

Tracking systems were used to register and manage patient records and improve adherence to clinical protocols using decision support algorithms.

Decision support systems were used for a range of functions. In Carmichael 2019, the CDSS facilitated the computation of estimated due dates and body mass index. In Bull 2018, the CDSS helped reinforce health workers' clinical decisions with integrated alerts and reminders about specific protocols related to the prevention of mother-to-child transmission (PMTCT) of HIV. According to Chen 2016, the CDSS was used to train village doctors by providing tailored health information related to immunisation, such as abnormal reactions and key knowledge and skills of intradermal and subcutaneous injections. In Hackett 2018, the CDSS included electronic decision-tree protocols pertaining to specific health counselling topics and messages, particular lessons in the photo book, danger sign identification, and flagged clients who required immediate health facility referral. In Ilozumba 2018, the CDSS included checklists, danger sign monitoring, and educational prompts. In Modi 2019, the CDSS came in the form of a digital checklist and inbuilt algorithms to screen and risk-stratify complex child and maternal health cases with customisable management guidelines tailored to the risk profile. In Peiris 2019, doctors were provided with decision support recommendations for blood pressure and cardiovascular risk factor management, including prompts for medication prescribing. In Prabhakaran 2019, the CDSS component was used to support nurses and physicians in managing patients' chronic conditions by generating recommendations for treatment plans based on patient data and clinical algorithms. In Prinja 2017, the CDSS function used algorithms to assist in the early identification, treatment, and rapid referral to appropriate care of any danger signs amongst pregnant women or neonates. In Shiferaw 2016, the CDSS consisted of a screening tool to assist the health worker in risk-stratifying which pregnant women were eligible to receive 'Routine ANC/Basic care' versus 'Specialised Care' per the Ministry of Health's protocol. In Shiffman 2000, the CDSS contained asthma management guidelines with dynamically generated treatment recommendations based on the American Association for Pediatrics practice parameters. It also assisted in calculating predicted peak expiratory flow rates and medication dosages for children with asthma. In Suryavanshi 2020, the CDSS used programmed algorithms based on pregnancy/breastfeeding status questions to assist outreach workers with patient communication during home visits, risk assessment and educational support for pregnant women.

In Patil 2022, the CDSS component of the application was not enabled during their evaluation. Still, it was supposed to assist community health workers in their home visits to provide health and nutrition education to pregnant and lactating women on pregnancy care and infant and young child feeding practices by providing checklists and a library of instructional videos serving as a job-aid during client counselling.

Comparison 2. Effects of digitally tracking clients' health service use and status combined with targeted client communication using a mobile device (tracking + TCC)

Two studies evaluated the impact of a digital tracking + TCC study. Asiki 2018 was a non-randomised trial conducted in rural Uganda to examine the use of a smartphone application for registering and tracking pregnant women to link them to the

nearest primary healthcare facility during childbirth. The targeted client communication component consisted of SMS messages on antenatal care, safe delivery, nutrition and motivation for mothers to get the proper care at the right time. These SMS messages were sent to the village health workers and a lay health worker, who delivered the messages to the pregnant women. The study design was a non-randomised, controlled cluster trial, and village health workers in the control group used a paper-based system for registering pregnant women with no follow-up targeted client communications via SMS. Yan 2021 was a cluster-randomised trial evaluating a mobile health intervention (SINEMA App) to improve stroke management by village doctors in rural China. Village doctors collect, record and retrieve patient records on the app, which hospital doctors can review. The targeted client communication component consisted of a bank of SMS messages about health education, physical activity and medication adherence. Village doctors in the control clusters delivered their usual care without specific interventions to enhance stroke management.

Comparison 3. Effects of digitally tracking clients' health service use and status combined with decision support and targeted client communication using a mobile device (digital tracking + CDSS + TCC)

Seven studies evaluated the impact of digital tracking + CDSS + TCC. These were conducted in Bangladesh (Uddin 2016), Ethiopia (Shiferaw 2016), India (Peiris 2019; Prabhakaran 2019; Suryavanshi 2020), Kenya (Vedanthan 2019), and Palestine (Venkateswaran 2022). Study settings included rural (Prabhakaran 2019; Prinja 2017; Shiferaw 2016; Uddin 2016, Vedanthan 2019), rural and urban (Suryavanshi 2020) and urban locations (Shiferaw 2016; Uddin 2016, Venkateswaran 2022). The urban setting in the study by Uddin and colleagues comprised zones with street dwellers (Uddin 2016). The study designs included cluster-randomised controlled trials (Peiris 2019; Prabhakaran 2019; Suryavanshi 2020; Vedanthan 2019; Venkateswaran 2022), a non-randomised controlled cluster trial (Shiferaw 2016), and a controlled before-and-after study (Uddin 2016).

The included studies examined the use of digital health interventions to support cardiovascular disease risk management (Peiris 2019; Vedanthan 2019), management of hypertension and diabetes (Prabhakaran 2019), antenatal care (Venkateswaran 2022), delivery and postnatal care utilisation (Shiferaw 2016), improving routine childhood vaccination coverage (Uddin 2016), and enhance uptake of HIV mother-to-child prevention services (Suryavanshi 2020). Users of the tracking and decision support components of the digital health interventions included Accredited Social Health Activists (ASHAs - a type of lay health worker) (Peiris 2019), outreach workers (Suryavanshi 2020), community health workers (Vedanthan 2019), nurses, physicians or medical officers (Prabhakaran 2019; Shiferaw 2016; Venkateswaran 2022) and Health Assistants responsible for routine childhood immunisations (Uddin 2016). Health workers in three studies used tablet devices (Peiris 2019; Prabhakaran 2019; Suryavanshi 2020) to access the digital health intervention's tracking and decision support features, whereas healthcare workers in four studies used smartphone devices (Shiferaw 2016; Uddin 2016; Vedanthan 2019). One study used the DHIS2 Tracker software on desktop computers (Venkateswaran 2022). We included this study as the software can also be used on tablets. Three studies described the use of open-source systems such as Sana Mobile (Peiris 2019), CommCare (Prabhakaran 2019), and Open Data Kit (Shiferaw 2016) to create their digital health interventions.

Tracking systems in the included studies were used to register and manage patient records and collect data needed for decision support algorithms (Peiris 2019; Prabhakaran 2019; Shiferaw 2016; Uddin 2016). Decision support was used for risk assessment (Peiris 2019; Prabhakaran 2019; Shiferaw 2016), lifestyle recommendations (Peiris 2019; Prabhakaran 2019), treatment (e.g. medication) recommendations (Peiris 2019; Prabhakaran 2019), as well as scheduling of and reminders for follow-up appointments (Peiris 2019; Prabhakaran 2019; Shiferaw 2016; Suryavanshi 2020; Uddin 2016; Venkateswaran 2022).

Targeted client communication was sent to adults (≥ 40 years) diagnosed with cardiovascular disease (Peiris 2019), adults (≥ 30 years) diagnosed with hypertension or diabetes (Prabhakaran 2019), pregnant women (Shiferaw 2016; Uddin 2016) and parents of infants (Uddin 2016). Targeted client communication included reminders for medication adherence (Peiris 2019; Prabhakaran 2019), reminders for upcoming appointments (Peiris 2019; Prabhakaran 2019; Shiferaw 2016; Uddin 2016), and health education messages (Shiferaw 2016; Vedanthan 2019) and, in all studies, they were delivered via SMS to the client's phone. Control groups implemented usual care and relied on extant paper-based systems for data collection and patient management. In Prabhakaran 2019, nurses were provided with a tablet device without the digital health intervention to collect baseline study data.

Comparisons

All studies compared the intervention group to standard or usual care without digital tracking, targeted client communication or decision support using a mobile device.

Excluded studies

We excluded a total of 122 studies from the review following full-text screening.

The reasons for exclusion were:

- Ineligible intervention (N = 87): many trials did not contain a mobile tracking element. Some were trials of standalone CDSS or TCC interventions, and some used paper records or desktop computers to track patients;
- Ineligible study design (N = 16): we excluded small feasibility/pilot studies, trials with no control or comparison groups, and cross-sectional studies;
- Ineligible comparator (N = 5): we excluded studies where mobile tracking was used in both arms of the trial;
- Ineligible outcome (N = 3): we excluded studies with process outcomes or those that only assessed change in knowledge, attitude and practice;
- Ineligible setting (N = 11): we excluded population-based public health studies and those set in secondary or tertiary settings.

A selection of excluded studies are reported in Excluded studies.

The full list of excluded studies with the reasons for exclusion can be found in Appendix 5.

Risk of bias in included studies

Figure 3 shows the graph of the risk of bias assessment, and Figure 4 the risk of bias traffic light assessments.

Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies

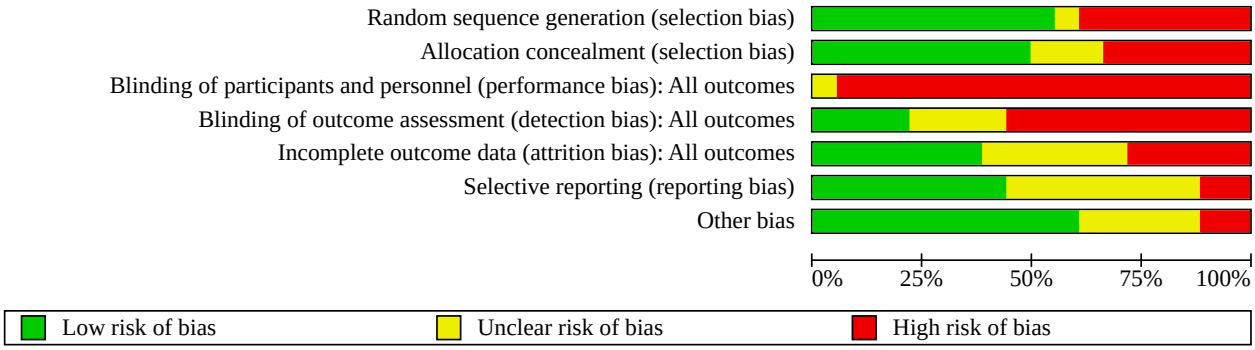


Figure 4. Risk of bias summary: review authors' judgements about each risk of bias item for each included study

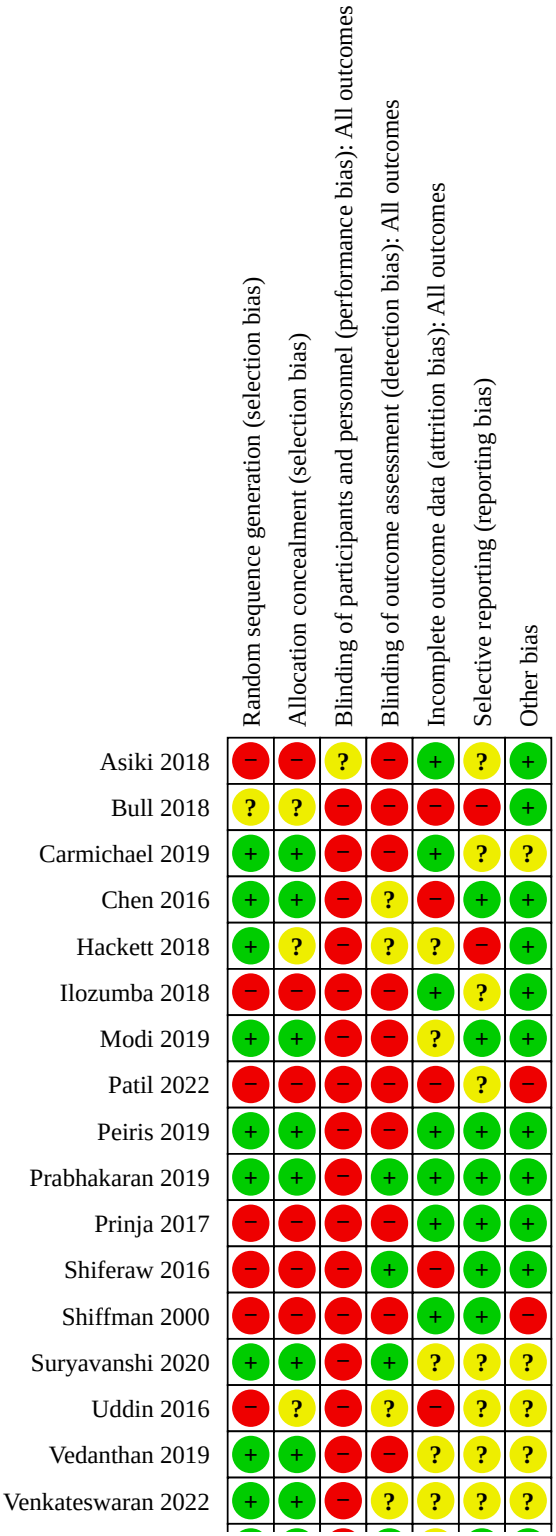
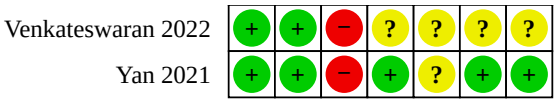


Figure 4. (Continued)



Risk of bias assessments for individual studies are described in Characteristics of included studies.

Allocation

Random sequence generation and allocation concealment (selection bias)

We identified a high risk of selection bias in seven studies due to a lack of randomisation and concealment (Asiki 2018; Ilozumba 2018; Patil 2022; Prinja 2017; Shiferaw 2016; Shiffman 2000; Uddin 2016) or because participants were assigned to the intervention and control groups in different phases of the study (Shiffman 2000). One study (Bull 2018) had an unclear risk of selection bias as it mentioned that matched types of health facilities were randomly assigned to either intervention or control, but did not describe the randomisation or allocation concealment processes. One study (Hackett 2018) described the randomisation process, but no details were provided regarding allocation concealment.

Blinding

Blinding of participants and personnel (performance bias)

Due to the nature of the interventions, performance bias was present in all studies as it was not feasible to blind the participant or personnel. The digital nature of the interventions (e.g. personnel using digital devices or participants receiving SMS messages) precluded blinding. In 11 studies (Bull 2018; Carmichael 2019; Chen 2016; Hackett 2018; Modi 2019; Peiris 2019; Prabhakaran 2019; Suryavanshi 2020; Vedanthan 2019; Venkateswaran 2022; Yan 2021), a cluster-randomised controlled design was used, so there was no attempt to blind participants or personnel. One study (Asiki 2018) had an unclear risk of performance bias because the researchers attempted to incorporate measures to blind participants and personnel; however, the extent to which the measures were successful is unclear.

Blinding of outcome assessment (detection bias)

We identified a high risk of detection bias in 10 studies because the outcome assessor was not blinded (Bull 2018; Carmichael 2019; Shiffman 2000); because the participants were unblinded (Modi 2019; Peiris 2019; Prinja 2017; Vedanthan 2019), or because participants self-reported their outcome data (Asiki 2018; Ilozumba 2018; Patil 2022). We identified unclear risk of detection bias in three studies because the full details of outcome assessment (Chen 2016; Hackett 2018) or measures for blinding (Uddin 2016) were not described. In one study (Venkateswaran 2022), the risk of detection bias was unclear as healthcare providers and data collectors were masked to the outcome measures, and to minimise any bias in data collection, the data collectors were trained to digitise the entire paper record, with multiple data points beyond trial outcomes.

Incomplete outcome data

We identified a high risk of attrition bias in five studies. In four studies (Bull 2018; Chen 2016; Patil 2022; Uddin 2016), this was because participants differed at baseline and endline measurements and, in one study (Shiferaw 2016), the analysis was limited to participants with follow-up data. We identified an unclear risk of attrition bias in six studies due to a lack of reporting of the extent of attrition (Hackett 2018; Modi 2019; Suryavanshi 2020; Vedanthan 2019; Venkateswaran 2022; Yan 2021). The remaining studies (Asiki 2018; Carmichael 2019; Ilozumba 2018; Peiris 2019; Prabhakaran 2019; Prinja 2017; Shiffman 2000) had a low risk of attrition bias.

Selective reporting

We identified a high risk of selective reporting in two studies (Bull 2018; Hackett 2018) because of a lack of trial protocol registration (Bull 2018), reporting of outcomes only in the intervention group (Bull 2018), inconsistency of data reported in tables and text (Bull 2018), and missed reporting of several secondary outcomes (Hackett 2018). We identified an unclear risk of selective reporting in eight studies (Asiki 2018; Carmichael 2019; Ilozumba 2018; Patil 2022; Suryavanshi 2020; Uddin 2016; Vedanthan 2019; Venkateswaran 2022) either because of a lack of trial registration or published protocol, or not all outcomes listed on the protocol were reported. The remaining eight studies had a low risk of selective reporting as all outcomes on the published protocol or trial registry were reported (Chen 2016; Modi 2019; Peiris 2019; Prabhakaran 2019; Prinja 2017; Shiferaw 2016; Shiffman 2000; Yan 2021).

Other potential sources of bias

We identified a high risk of other sources of bias in two studies (Patil 2022; Shiffman 2000). In Shiffman 2000, there were differences between the characteristics of participants in the intervention and control groups at baseline. In Patil 2022, the observational design, using 1:1 nearest neighbour propensity score matching using interview recalls in the outcome assessment, introduced concerns regarding purposive sampling, confounding, and measurement biases.

We identified an unclear risk of other sources of bias in five studies due to the repeated cross-sectional study design (Carmichael 2019), a potential Hawthorne effect and underpowered sample size (Suryavanshi 2020), significant differences in demographics and mobile phone ownership between baseline and endline (Uddin 2016), the sequential study rollout design (Vedanthan 2019) and potential documentation bias for foetal growth (Venkateswaran 2022).

Effects of interventions

See: **Summary of findings 1** Comparison 1 (Summary) : Tracking with clinical decision-support system (tracking + CDSS) compared to usual care in primary care; **Summary of findings 2** Comparison 2 (summary): Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary care; **Summary of findings 3** Comparison 3 (summary): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary care

We report findings from randomised and non-randomised trials separately, as findings from observational trials are graded as very low-certainty evidence.

A high-level narrative summary of the findings describing the effects, number of studies, number of participants and the GRADE certainty of the evidence for each outcome category is provided in Summary of findings 1; Summary of findings 2; Summary of findings 3. For more detailed results, including the absolute and relative effects and explanations for downgrading the certainty of the evidence, please refer to Table 1; Table 2; Table 3.

Comparison 1. Effects of digitally tracking clients' health service use and health status combined with decision support conducted via a mobile device (tracking + CDSS) compared to usual care

(See Summary of findings 1 and Table 1)

A. Providers' adherence to recommended practices, guidelines, or protocol

The following effects were found from randomised trials:

- It is uncertain whether tracking + CDSS compared with usual care affects the number of women who receive a home visit 24 hours after delivery because the certainty of this evidence is very low (Carmichael 2019; Modi 2019) [Analysis 1.1];
- Tracking + CDSS compared to usual care may slightly increase the number of women who receive a home visit in the first week after delivery (risk difference (RD) 0.10, 95% confidence interval (CI) 0.07 to 0.14; 2 studies, 4531 participants; low-certainty evidence) (Carmichael 2019; Modi 2019) [Analysis 1.1];
- Tracking + CDSS compared to usual care may result in a small increase in the number of mothers counselled to initiate complementary feeding for their infant at six months (RD 0.12, 95% CI 0.08 to 0.15; 2 studies, 4397 participants; low-certainty evidence) (Carmichael 2019; Modi 2019) [Analysis 1.1];
- Tracking + CDSS compared to usual care may slightly increase the number of community health worker (CHW) home visits in the first month after delivery (mean difference (MD) 0.75, 95% CI 0.47 to 1.03; 1 study, 3023 women/578 CHWs; low-certainty evidence) (Modi 2019) [Analysis 1.2].

The following effects were found from non-randomised (observational) trials:

- It is uncertain if tracking + CDSS affects the number of women who were counselled to initiate complementary foods at six months because the certainty of the evidence is very low (Patil 2022) [Analysis 1.1];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of children receiving an immediate referral to a hospital following an office visit for asthma because the certainty of the evidence is very low (Shiffman 2000) [Analysis 1.1];
- It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded blood pressure measurements because the certainty of the evidence is very low (Prinja 2017) [Analysis 1.1];
- It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded blood tests because the certainty of the evidence is very low (Prinja 2017) [Analysis 1.1];
- It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded weight measurements because the certainty of the evidence is very low (Prinja 2017) [Analysis 1.1];
- It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded urine tests because the certainty of the evidence is very low (Prinja 2017) [Analysis 1.1].

B. Time between presentation and appropriate management

No studies evaluated this outcome.

C. Quality of data about services provided

No studies evaluated this outcome.

D. Clients' health behaviour

The following effects were found from randomised trials:

- Tracking + CDSS compared to usual care may slightly increase maternal respondents reporting they provided skin-to-skin care to their newborn (RD 0.05, 95% CI 0.00 to 0.10; 1 study, 1544 participants; low-certainty evidence) (Carmichael 2019) [Analysis 1.3];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of mothers who report that nothing was applied to their newborn's umbilical cord because the certainty of the evidence is very low (Carmichael 2019) [Analysis 1.3];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women who consume at least 90 iron-folate tablets during pregnancy because the certainty of the evidence is very low (Carmichael 2019; Modi 2019) [Analysis 1.3];
- Tracking + CDSS compared to usual care may slightly increase the number of mothers who initiate breastfeeding early with their newborns (RD 0.08, 95% CI 0.05 to 0.12; 2 studies, 4540 participants; low-certainty evidence), but it is uncertain whether tracking + CDSS compared with usual care affects the number of women who exclusively breastfeed for six months because the certainty of the evidence is very low (Carmichael 2019; Modi 2019) [Analysis 1.3];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of newborns who have their first bath delayed at least two days (this is beneficial to protect the baby from infection) because the certainty of the evidence is very low (Carmichael 2019) [Analysis 1.3];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of newborns who receive Kangaroo Mother Care because the certainty of the evidence is very low (Modi 2019) [Analysis 1.3].

The following effects were found from non-randomised (observational) trials:

- It is uncertain whether tracking + CDSS compared with usual care affects the number of women who consume at least 90 iron-folate tablets during pregnancy because the certainty of the evidence is very low (Prinja 2017)[Analysis 1.3].

E. Clients' health status and well-being

The following effects were found from randomised trials:

- It is uncertain whether tracking + CDSS compared with usual care affects the number of stillbirths, the number of neonatal deaths and the number of infant deaths because the certainty of the evidence is very low (Modi 2019) [Analysis 1.5];
- Tracking + CDSS compared to usual care may reduce the number of low birth weight babies ≤ 2 kg (risk ratio (RR) 0.53, 95% CI 0.38 to 0.73; 1 study, 3023 participants; low-certainty evidence) and may increase the number of infants with pneumonia or fever in the past two weeks seeking care from a community health worker (RR 1.13, 95% CI 1.03 to 1.24; 1 study, 3470 participants; low-certainty evidence) (Modi 2019) [Analysis 1.5];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women testing positive for HIV during antenatal HIV testing because the certainty of the evidence is very low (Bull 2018) [Analysis 1.5].

The following effects were found from non-randomised (observational) trials:

- It is uncertain whether tracking + CDSS, compared with usual care, improves asthma severity in children assessed during a doctor's office visit because the certainty of the evidence is very low (Shiffman 2000) [Analysis 1.4].

F. Clients' utilisation of primary health care and/or services

The following effects were found from randomised trials:

- Tracking + CDSS compared to usual care may result in little or no difference in the number of fully immunised children under five years (RD 0.01, 95% CI -0.02 to 0.05; 3 studies, 4602 participants; low-certainty evidence) (Carmichael 2019; Chen 2016; Modi 2019) [Analysis 1.7];
- It is uncertain if tracking + CDSS affects the number of women giving birth in a health facility because the certainty of the evidence is very low (Carmichael 2019; Modi 2019) [Analysis 1.7];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women currently using modern contraceptive methods because the certainty of the evidence is very low (Carmichael 2019) [Analysis 1.7];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women who have HIV tests performed during an antenatal visit because the certainty of the evidence is very low (Bull 2018) [Analysis 1.6];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women who have at least two tetanus injections during pregnancy because the certainty of the evidence is very low (Carmichael 2019) [Analysis 1.6];
- Tracking + CDSS compared to usual care may increase the number of women giving birth in a health facility (odds ratio (OR) 1.96, 95% CI 1.21 to 3.17; 1 study, 571 participants; low-certainty evidence) (Hackett 2018) [Analysis 1.8].

The following effects were found from non-randomised (observational) trials:

- It is uncertain whether tracking + CDSS compared with usual care affects the number of children under five years who are fully immunised because the certainty of the evidence is very low (Prinja 2017) [Analysis 1.7];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women who have at least two tetanus injections during pregnancy because the certainty of the evidence is very low (Prinja 2017) [Analysis 1.6];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of children who had an Emergency Department visit within one week of a doctor's visit for asthma or the number of children who were hospitalised within one week of a doctor's office visit for asthma because the certainty of the evidence is very low (Shiffman 2000) [Analysis 1.6];
- It is uncertain whether tracking + CDSS compared with usual care affects the number of women receiving at least three antenatal visits during pregnancy or the number of women giving birth in a health facility because the certainty of the evidence is very low (Ilozumba 2018; Prinja 2017) [Analysis 1.8].

G. Provider acceptability or satisfaction with the intervention

No studies assessed these outcomes.

H. Client acceptability of/satisfaction with the intervention

No studies assessed these outcomes.

I. Resource use

No studies assessed these outcomes.

J. Unintended consequences

No studies assessed these outcomes.

Comparison 2. Effects of digitally tracking clients' health service use and status combined with TCCs accessible via a mobile device (tracking + TCC) compared to usual care

(See Summary of findings 2 and Table 2).

A. Clients' timeliness of receiving and accessing healthcare services and information

No studies assessed this outcome.

B. Quality of data about services provided

No studies assessed this outcome.

C. Clients' health behaviour

The following effects were found from randomised trials:

- Tracking + TCC may slightly increase adherence to antihypertensive medications at 12 months in stroke survivors (RR 1.10, 95% CI 1.00 to 1.21; 1 study, 1226 participants; low-certainty evidence) (Yan 2021) [Analysis 2.1].

D. Clients' health status and well-being

The following effects were found from randomised trials:

- Tracking + TCC compared to usual care may reduce the number of deaths over 12 months in stroke survivors (RR 0.52, 95% CI 0.28 to 0.96; 1 study, 1226 participants; low-certainty evidence) (Yan 2021) [Analysis 2.4];
- Tracking + TCC compared to usual care may slightly reduce systolic blood pressure at 12 months in stroke survivors (MD

-2.80, 95% CI -4.90 to -0.70; 1 study, 1226 participants; low-certainty evidence) (Yan 2021) [Analysis 2.4]:

- Tracking + TCC compared to usual care may slightly improve the EQ-5D health-related quality of life at 12 months in stroke survivors (MD 0.04, 95% CI 0.02 to 0.06; 1 study, 1226 participants; low-certainty evidence) (Yan 2021) [Analysis 2.4].

The following effects were found from non-randomised (observational) trials:

- It is uncertain whether tracking + TCC compared with usual care affects the number of women who give birth at home or the number of neonatal deaths because the certainty of the evidence is very low (Asiki 2018) [Analysis 2.2].

E. Client's utilisation of primary healthcare services

- Tracking + TCC compared to usual care may reduce the number of hospitalisations for stroke over 12 months in stroke survivors (RR 0.45, 95% CI 0.32 to 0.64; 1 study, 1226 participants; low-certainty evidence) (Yan 2021) [Analysis 2.5].

F. Provider acceptability or satisfaction with the intervention

No studies assessed these outcomes.

G. Client acceptability of/ satisfaction with the intervention

No studies assessed these outcomes.

H. Resource use

No studies assessed these outcomes.

I. Unintended consequences

No studies assessed these outcomes.

Comparison 3. Effects of digitally tracking clients' health service use and status combined with decision support conducted via a mobile device and TCCs accessible via a mobile device (Tracking + TCC + CDSS) compared to usual care

(See Summary of findings 3 and Table 3).

A. Providers' adherence to recommended practice

The following effects were found from randomised trials:

- Tracking + TCC + CDSS compared with usual care may have little or no effect on the number of infants of HIV+ve mothers receiving Nevirapine prophylaxis (OR 1.75, 95% CI 0.73 to 4.19; 1 study, 609 participants; low-certainty evidence) (Suryavanshi 2020) [Analysis 3.1];
- Tracking + TCC + CDSS compared with usual care probably leads to higher guideline adherence for antenatal screening and management of anaemia (OR 1.88, 95% CI 1.52 to 2.32; 1 study, 10,502 participants; moderate-certainty evidence) (Venkateswaran 2022) [Analysis 3.1];
- Tracking + TCC + CDSS compared with usual care probably leads to higher guideline adherence for antenatal screening and management of diabetes (OR 1.45, 95% CI 1.14 to 1.84; 1 study, 8669 participants; moderate-certainty evidence) (Venkateswaran 2022) [Analysis 3.1];
- Tracking + TCC + CDSS compared with usual care probably leads to higher guideline adherence for antenatal screening and management of hypertension (OR 1.62, 95% CI 1.19 to 2.04; 1 study, 15,555 participants; moderate-certainty evidence) (Venkateswaran 2022) [Analysis 3.1];
- Tracking + TCC + CDSS compared with usual care probably leads to lower guideline adherence for abnormal foetal growth screening and management (OR 0.59, 95% CI 0.37 to 0.95; 1 study, 1165 participants; moderate-certainty evidence) (Venkateswaran 2022) [Analysis 3.1].

B. Time between presentation and appropriate management

No study assessed this outcome.

C. Clients' timeliness of receiving and accessing healthcare services and information

No study assessed this outcome.

D. Quality of data about services provided

The following effects were found from randomised trials:

- Tracking + TCC + CDSS compared with usual care may make little or no difference to the amount of missing data on gestational age (RR 0.96, 95% CI 0.81 to 1.14; 1 study, 6367 participants; low-certainty evidence) (Venkateswaran 2022) [Analysis 3.2];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to the birthweight in women who have just given birth (RR 0.90, 95% CI 0.77 to 1.04; 1 study, 6367 participants; low-certainty evidence) (Venkateswaran 2022) [Analysis 3.2];
- Tracking + TCC + CDSS compared with usual care probably leads to slightly less missing data for haemoglobin at delivery in women who have just given birth (RR 0.77, 95% CI 0.71 to 0.84; 1 study, 6367 participants; moderate-certainty evidence) (Venkateswaran 2022) [Analysis 3.2];
- Tracking + TCC + CDSS compared with usual care probably leads to slightly more missing data for blood pressure at delivery in women who have just given birth (RR 1.16, 95% CI 1.08 to 1.24; 1 study, 6367 participants; moderate-certainty evidence) (Venkateswaran 2022) [Analysis 3.2].

E. Clients' health behaviour

The following effects were found from randomised trials:

- It is uncertain whether tracking + TCC + CDSS compared to usual care affects the physical activity levels of adults at high risk of cardiovascular disease because the certainty of this evidence is very low (Peiris 2019) [Analysis 3.3];
- Tracking + TCC + CDSS compared to usual care may make little or no difference to the number of pregnant women on anti-retroviral therapy (ART) at delivery (OR 1.41, 95% CI 0.81 to 2.45; 1 study, 438 participants; low-certainty evidence) (Suryavanshi 2020) [Analysis 3.3];
- Tracking + TCC + CDSS compared to usual care may increase the number of HIV-positive women who are exclusively breastfeeding at 6 months, but the confidence interval also includes a small decrease (OR 1.74, 95% CI 0.95 to 3.17; 1 study, 695 participants; low-certainty evidence) (Suryavanshi 2020) [Analysis 3.3].

F. Clients' health status and well-being

The following effects were found from randomised trials:

- Tracking + TCC + CDSS may reduce the number of deaths in patients with hypertension and diabetes, but the confidence interval includes no difference in deaths (OR 0.61, 95% CI 0.35 to 1.06; 1 study, 3698 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.4];
- It is uncertain whether tracking + TCC + CDSS compared with usual care improves the number of high cardiovascular-risk patients who achieve optimal systolic blood pressure (< 140 mm/hg) because the certainty of this evidence is very low (Peiris 2019) [Analysis 3.4];
- Tracking + TCC + CDSS compared with usual care may reduce new cardiovascular events in high cardiovascular-risk adults over a 6-to-18-month follow-up period (OR 0.58, 95% CI 0.42 to 0.80; 1 study, 8642 participants; low-certainty evidence) (Peiris 2019) [Analysis 3.4];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects maternal mortality before the baby reaches 18 months old in HIV-positive mothers because the certainty of this evidence is very low (Suryavanshi 2020) [Analysis 3.4];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects infant mortality before the baby reaches 18 months old in HIV-positive mothers because the certainty of this evidence is very low (Suryavanshi 2020) [Analysis 3.4];
- It is uncertain whether tracking + TCC + CDSS compared to usual care affects the number of adults with hypertension whose blood pressure is controlled (< 140/90 at five years) because the certainty of this evidence is very low (Vedanthan 2019) [Analysis 3.4];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to the number of adverse pregnancy outcomes in women receiving antenatal care (OR 0.99, 95% CI 0.87 to 1.12; 1 study, 6367 participants; low-certainty evidence) (Venkateswaran 2022) [Analysis 3.4];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to the number of antenatal women with moderate or severe anaemia (OR 0.82, 95% CI 0.51 to 1.31; 1 study, 6367 participants; low-certainty evidence) (Venkateswaran 2022) [Analysis 3.4];
- Tracking + TCC + CDSS compared to usual care may lead to a very small decrease in the number of antenatal women with severe hypertension, but the confidence interval includes both a decrease and an increase in hypertension (OR 0.61, 95% CI 0.27 to 1.37; 1 study, 6367 participants; low-certainty evidence) (Venkateswaran 2022) [Analysis 3.4];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to the number of antenatal women with a large-for-gestational-age baby (OR 1.06, 95% CI 0.90 to 1.25; 1 study, 6367 participants; low-certainty evidence) (Venkateswaran 2022) [Analysis 3.4];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects the mean change in systolic blood pressure in adults with an increased risk of cardiovascular disease because the certainty of this evidence is very low (Peiris 2019; Prabhakaran 2019) [Analysis 3.5];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects body mass index in adults with hypertension or diabetes because the certainty of this evidence is very low (Peiris 2019; Prabhakaran 2019) [Analysis 3.5];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to HbA1c levels in adults with hypertension or diabetes (MD 0.08, 95% CI -0.27 to 0.43; 1 study, 3324 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.5];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects fasting plasma glucose in adults with an increased risk of cardiovascular disease because the certainty of this evidence is very low (Prabhakaran 2019) [Analysis 3.5];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to total cholesterol levels in adults with hypertension or diabetes (MD -2.50, 95% CI -7.10 to 2.10; 1 study, 3324 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.5];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to Framingham's predicted 10-year risk of cardiovascular disease in adults with hypertension or diabetes (MD -0.40, 95% CI -2.30 to 1.50; 1 study, 3324 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.5];
- Tracking + TCC + CDSS compared to usual care may make little or no difference to tobacco use (modified CARRS questionnaire) in adults with hypertension or diabetes (MD -0.05, 95% CI -0.47 to 0.37; 1 study, 3324 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.5];
- Tracking + TCC + CDSS compared to usual care may make little or no difference to alcohol use (AUDIT score) in adults with hypertension or diabetes (MD 0.70, 95% CI -3.70 to 5.10; 1 study, 3325 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.5];
- Tracking + TCC + CDSS compared to usual care may make little or no difference to the PHQ-9 depression score in adults with hypertension or diabetes (MD -1.60, 95% CI -4.40 to 1.20; 1 study, 3324 participants; low-certainty evidence) (Prabhakaran 2019) [Analysis 3.5];
- It is uncertain whether tracking + TCC + CDSS compared to usual care affects diastolic blood pressure in adults with hypertension and diabetes because the certainty of this evidence is very low (Peiris 2019) [Analysis 3.5];
- It is uncertain whether tracking + TCC + CDSS compared to usual care affects the EQ-5D quality of life score in adults with hypertension or diabetes, as the certainty of the evidence is very low (Peiris 2019) [Analysis 3.5].

G. Client utilisation of primary healthcare services

The following effects were found from randomised trials:

- It is uncertain whether tracking + TCC + CDSS, compared with usual care, improves patient linkage to care because the certainty of this evidence is very low (Vedanthan 2019) [Analysis 3.6];
- Tracking + TCC + CDSS compared with usual care may make little or no difference to the number of pregnant women who never missed an early infant diagnosis visit (OR 0.92, 95% CI 0.63 to 2.35; 1 study, 1183 participants; low-certainty evidence) (Suryavanshi 2020) [Analysis 3.7].

The following effects were found from non-randomised (observational) trials:

- It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of children over 298 days old in a hard-to-reach rural setting who are fully vaccinated because the certainty of this evidence is very low (Uddin 2016) [Analysis 3.8];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of children over 298 days old in a hard-to-reach urban setting who are fully vaccinated because the certainty of this evidence is very low (Uddin 2016) [Analysis 3.8];
- It is uncertain whether tracking + TCC + CDSS compared with usual care increases the number of pregnant women who attended at least four antenatal care visits because the certainty of this evidence is very low (Shiferaw 2016) [Analysis 3.6];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of women who give birth at a health facility because the certainty of this evidence is very low (Shiferaw 2016) [Analysis 3.6];
- It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of women who receive postnatal care in a health facility because the certainty of this evidence is very low (Shiferaw 2016) [Analysis 3.6].

H. Provider acceptability of/satisfaction with the intervention

No study assessed these outcomes.

I. Client acceptability of/satisfaction with the intervention

The following effects were found from randomised trials:

- Tracking + TCC + CDSS compared to usual care probably slightly increases the number of adults with hypertension or diabetes reporting a "slightly/much better" change in the quality of care (RR 1.02, 95% CI 1.00 to 1.03; 1 study, 3324 participants; moderate-certainty evidence) (Prabhakaran 2019) [Analysis 3.9].

J. Resource use

No study assessed these outcomes.

K. Unintended consequences

No study assessed these outcomes.

DISCUSSION

We assessed whether healthcare workers in primary care and community-based settings using mobile devices that can track patients by accessing their electronic health records result in a better quality of care. We searched for trials examining the impact of health workers using digital tracking on mobile devices with electronic clinical decision support tools, with targeted client communication (such as SMS messages), or with both. All studies compared the intervention to health workers without mobile devices and patients receiving routine care without the help of mobile technologies. We searched for studies conducted from 1 January 2000 to 9 November 2022.

Summary of main results

We found 18 studies conducted in urban and rural settings in Bangladesh (1 study), China (2 studies), Ethiopia (1 study), India (8 studies), Kenya (1 study), Palestine (1 study), Tanzania (2 studies), Uganda (1 study) and the USA (1 study). All (aside from 1) were conducted in low- and middle-income settings where electronic medical records are still being rolled out. Fourteen studies examined the impact of digital tracking on maternal and child health outcomes such as antenatal or post-natal care, vaccine uptake, maternal and child nutrition and childhood asthma. Four studies assessed the impact of digital tracking, targeted client communication, and clinical decision support tools on chronic disease care, including hypertension, diabetes, cardiovascular disease, and stroke.

For child and maternal health services, the studies included in this review found that primary healthcare workers using digital tracking with targeted client communication and/or clinical-decision tools (see Summary of findings 1; Summary of findings 3):

- probably improves health worker performance in child and maternal health services (including post-natal home visits, counselling on commencing complementary feeding in infants, and antenatal health checks for blood pressure, urine, weight and blood tests), and slightly better antenatal patient record keeping; however, the improvements were very small;
- may have a positive effect on child and maternal health behaviours (including vaccine uptake in children and pregnant women, giving birth in a health facility, using modern contraception methods, antenatal HIV testing, attending antenatal care visits, initiating early breastfeeding, delaying the newborn's first bath, providing Kangaroo Mother Care, and adhering to HIV medications); however, these improvements were either very small or made little or no difference;
- may slightly improve the health of women and children (including reductions in stillbirths, neonatal and infant deaths, low birthweight babies, mothers testing HIV positive, and adverse events in pregnancy); however, these improvements were either very small or made little or no difference and the effects on other aspects of health status was uncertain due to very low certainty evidence.

For patients with chronic diseases, primary healthcare workers using digital tracking with targeted client communication and/or clinical-decision tools (see Summary of findings 2; Summary of findings 3):

- probably slightly increases the number of adults with hypertension or diabetes reporting a "slightly/ much better" change in the quality of care;
- may have a positive effect on blood pressure medication adherence;
- may improve health (including reductions in death or re-hospitalisation following a stroke, tobacco use, smoking, blood pressure, diabetes control, weight, 10-year cardiovascular risk, quality of life and depression symptoms; however, these improvements were small, and the effects on other measures of health status were uncertain due to the low certainty of the evidence.

No studies evaluated the time between presentation and appropriate management, clients' timeliness of receiving and accessing healthcare services and information, provider acceptability of/satisfaction with the intervention, resource use, or unintended consequences.

Overall completeness and applicability of evidence

We found several limitations in the completeness and applicability of the evidence synthesised in this review.

Populations

All but one study was conducted in low- and middle-income countries. Consequently, the generalisability of the outcomes and the interpretation of the results become more nuanced and require careful consideration, as our findings may not be relevant to high-income settings. All studies focused on two key populations: pregnant or post-natal women and their children or adults with chronic disease. No studies were conducted on other health areas, such as primary mental health care or treatment of non-paediatric communicable diseases. The health workers using the mobile devices were more representative of primary care providers, including doctors, nurses, and various community health workers. Studies had variable lengths of participant follow-up, ranging from two weeks to two years.

Interventions

Most studies using digital tracking interventions included a clinical decision support tool. Only two studies examined interventions with tracking and targeted client communication (without a clinical decision support component), and no studies investigated the impact of digital tracking alone. While tracking patient data allows for continuity of care for patients, the primary intention of these interventions was to improve the quality of services (using CDSS) and/or support behaviour change amongst clients (using TCC) while facilitating continuity of care across health encounters.

Comparators

Although all interventions were compared to usual care, the differences between the services delivered to the intervention group and control groups varied quite widely. In some studies, both arms received similar training and upskilling, the only difference being the digital technology in the intervention arm. In other studies, health workers were provided with more resources and training. As a result, patients in the intervention group may have received far more intensive care, such as better counselling, which may have affected the study outcomes.

Outcomes

No studies assessed the time between presentation and appropriate management, clients' timeliness of receiving and accessing healthcare services and information, provider acceptability of/satisfaction with their intervention, resource use, and unintended consequences affecting the intervention. Evidence from this review does not address the question of the accuracy or completeness of data collected, whether these interventions result in better or more timely access to care, and the administrative or human resource costs and challenges of these interventions.

Quality of the evidence

Many of the studies in this review were cluster-randomised controlled trials with large sample sizes. However, many of the outcomes were from single studies, resulting in downgrading the evidence for imprecision. A few outcomes could be pooled, but these had high levels of heterogeneity; for example, they were measured over different periods of time. As a result, most outcomes were assessed as being either moderate or low-certainty evidence. Five outcomes were based on single non-randomised studies and smaller sample sizes and were downgraded for risk of bias, imprecision and indirectness. As a result, these were assessed to be of very low certainty.

Potential biases in the review process

We tried to minimise bias in the review process in several ways: two or three review authors independently assessed eligibility for inclusion, carried out data extraction, assessed the risk of bias in the trials and assessed the GRADE evidence certainty. During meta-analysis, we adjusted for clustering rather than for confounders, because it was not possible to adjust for both factors based on the available information, and we placed more importance on clustering.

Agreements and disagreements with other studies or reviews

We did not identify any reviews that addressed the same objectives as this review. Studies that have looked at the effects of CDSS without mobile tracking found that CDSS was effective in improving clinical performance, preventive care, and provider performance (Agarwal 2021; Bright 2012; Hunt 1998; Jaspers 2011; Kawamoto 2005; Varghese 2018). Given that most existing reviews focus primarily on computerised stationary CDSS in hospital-based and HIC settings, the interventions' implementation considerations and subsequent effects differ from the studies included in our review. Similar to this review, other reviews included methodological limitations, heterogeneous interventions and comparison groups, and multiple outcomes.

Reviews on the effectiveness of clinical decision support tools have different objectives than this review. Most studies focused primarily on *computerised* CDSS and not on the use of mobile-phone-based CDSS (Bright 2012; Caballero-Ruiz 2017; Hunt 1998; Jaspers 2011; Kaplan 2001; Kawamoto 2005; Kilsdonk 2017; Syrowatka 2016). Other reviews may not have focused explicitly on CDSS and included all digital interventions (Adepoju 2017; Brenner 2016; Carter 2019; Mishra 2019). Several studies were published in the 1990s or 2000s (Hunt 1998; Kaplan 2001; Kawamoto 2005) and were primarily focused on the use of CDSS in hospital-based settings (Bright 2012; Hunt 1998; Jaspers 2011; Kaplan 2001; Martínez-Pérez 2014; Sutton 2020; Varghese 2018) and high-income settings (Dreesens 2019). Other reviews focused only on the use of CDSS amongst community health workers in LMIC settings (Agarwal 2015; Mishra 2019). A few studies have focused primarily on specific outcomes, such as the feasibility and acceptability of the CDSS (Jaspers 2011; Kaplan 2001; Kawamoto 2005; Kilsdonk 2017). Reviews also focused on specific health conditions such as cancer (Baptista 2018; Mazo 2020; Tong 2021), maternal and child health care (Caballero-Ruiz 2017; Carter 2019), non-communicable diseases (Mishra 2019), and cardiovascular disease (Njie 2015). Given the different objectives and inclusion/exclusion criteria of these reviews, their results cannot be directly compared to the results of our review.

AUTHORS' CONCLUSIONS

Implications for practice

The review suggests that digital tracking may improve primary care workers' ability to follow recommended antenatal and chronic

disease care practices and may also improve the quality of patient records and patient behaviours, service use and health outcomes. However, in most studies, the use of digital tracking led to a small difference, or little or no difference, in health outcomes.

People who are considering using digital tracking may find it useful to consult resources for designing digital systems to ensure their platforms are interoperable and aligned with appropriate contexts. These resources include the Digital Implementation Investment Guide (WHO 2020), the Handbook for Digitizing Primary Health Care and Optimizing Person-centred Point of Service Solutions (WHO 2024), and other materials to support human-centred design approaches (CRDM 2024).

In addition to these resources, linked Cochrane Reviews have synthesised qualitative research on health workers' perceptions and experiences of using mHealth technologies to deliver primary health services (Odendaal 2020) and clients' perceptions and experiences of digital communication via mobile devices (Ames 2019). Below is a set of questions initially developed as part of these reviews and based on the review findings. These questions aim to help implementation agencies, Ministries of Health, programme managers, and other stakeholders plan, implement, or manage these types of programmes:

Health systems issues

- How will health workers be engaged in the planning and implementation of the digital tracking system? How will their views be sought and their perspectives taken into account?
- Has a proper assessment been made of whether health workers' use of mobile devices is adding to or alleviating their workload?
- Have considerations around the theory of change or factors leading to behaviour change been taken into account for the targeted client communication component?
- Has there been a structured process for defining the content requirements for the digital tracking and decision support system?
- How will the digital tracking system be used in contexts where paper-based reporting is required? What measures will be in place to mitigate the double burden of using both paper and digital systems for providing and reporting on services?

Technical and infrastructural issues

- Does your setting have the necessary infrastructural and technological capacity to support the implementation of the planned intervention? For example, is there sufficient electricity supply and electricity coverage, network capacity, and technical support for implementation? Have you considered how these might vary by region and put in place provisions to enable offline functionality where needed?
- Is there a strategy to integrate the digital tracking system within the existing electronic health information system/s in your setting?

Health worker training and skills issues

- Has the programme management budgeted for adequate initial training of healthcare workers and other staff, refresher training, and in-service training for new staff members?
- What is the level of digital literacy amongst those healthcare workers who will implement the intervention, as well as managers and supervisors who will support them? What further interventions are needed to ensure an adequate skill level is present at the beginning of the intervention and maintained throughout the intervention?
- Has the programme management identified 'champions' across different settings and healthcare worker cadres to assist those requiring additional support with the devices or application?
- When the digital tracking and decision support system allows the healthcare worker to screen and diagnose clients, are they clinically equipped to respond appropriately to the results of the screening and diagnosing? Are they able to explain the results to the patient?

Implications for research

Digital tracking, clinical decision support system (CDSS) and targeted client communication (TCC) all reflect complex interventions that are challenging to administer with consistency, especially in low-resource settings. One of the challenges of this review was the large heterogeneity in both which outcomes were measured and how these were assessed. This is partly because the intervention is guided by local or national norms for delivering services to achieve its outcomes. For example, the WHO recommends eight antenatal care visits (WHO 2016); however, national protocols may require two to four visits. To generate higher-certainty evidence and facilitate the synthesis of evidence from across settings, it is important that there is greater consistency in which outcomes are measured and how these are assessed. Where feasible and appropriate, standardisation of outcomes and alignment with international norms should be prioritised by research (Kirkham 2017; Williamson 2012).

The evidence for many outcomes was downgraded to low- or very low-certainty because of concerns about the risk of bias. This was the result of the non-randomised design of some trials as well as limitations in the design of the included randomised trials. In addition, evidence for some outcomes was only based on a small number of studies from a restricted range of settings or few events. We need better-designed and larger studies from a broader range of settings.

Future research should also consider health delivery and behavioural factors. For example, it appears that the use of TCC + CDSS slightly improves providers' adherence to protocol; however, there is no evidence on whether these interventions impact clients' longer-term behaviours.

Understanding the cost-effectiveness of these complex interventions is important in addition to evaluating their effects. Future studies should include a cost-effectiveness component.

A primary challenge posed by this review is that the review findings are of low or very low certainty. However, the scarcity of high-quality relevant studies in this field opens an opportunity window for future research endeavours in this area.

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Editorial and peer-reviewer contributions

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The following people conducted the editorial process for this article:

- Sign-off Editor (final editorial decision): Tari Turner, Cochrane Australia, School of Public Health and Preventive Medicine, Monash University;
- Managing Editor (selected peer reviewers, provided editorial guidance to authors, edited the article): Luisa M Fernandez Mauleffinch, Cochrane Central Editorial Service;
- Editorial Assistant (conducted editorial policy checks, collated peer-reviewer comments and supported editorial team): Jacob Hester, Cochrane Central Editorial Service;
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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Asiki 2018

Study characteristics	
Methods	**Aim**: to link pregnant women to their nearest primary healthcare facility during childbirth **Study design**: non-randomised, controlled cluster trial **Cluster features**: 26 villages **Recruitment**: choice of the cohort for the intervention was a pragmatic decision based largely on study resources; the cohort was established in 1989 to investigate HIV trends and population level risk factors and has now been expanded to maternal and child health. **Study dates**: April 2014 to November 2015
Participants	**Inclusion criteria**: pregnant women **Sample size**: 585 clients; 26 HCWs

Asiki 2018 *(Continued)*

	Age: intervention: 15-24 years: 43.3%, 25-34 years: 42.2%, > 35 years: 14.6%; control: 15-24 years: 40.8%, 25-34 years: 43.9%, > 35 years: 15.3% **Sex**: 100% female **Country**: Uganda **Setting**: community-level care in Kalungu District in rural South-West
Interventions	**Intervention**: digital tracking + TCC: smartphone application (n = 13 villages/295 women). **Digital tracking component:** smartphone application registering pregnant women by village health workers using smartphones and tracking pregnant women with automated SMS sent from a centralised database. **TCC component:** SMS with information on antenatal care, safe delivery, nutrition and motivation for mothers to get the right care at the right time, sent to the village health workers, who in turn delivered the messages to the pregnant women **Control**: paper forms (n = 13 villages/290 women): pregnant women were registered on paper forms only and no SMS was sent **Co-interventions**: standard antenatal, delivery and postnatal care
Outcomes	1. Patients'/clients' health status and well-being (home deliveries; neonatal deaths) **Outcome assessment time points**: after birth
Notes	**Funding**: "The authors received no specific funding for this work" **Conflicts of interest**: "The authors have declared that no competing interests exist". **Trial registry ID**: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	This was a non-randomised intervention study nested within a general population cohort.
Allocation concealment (selection bias)	High risk	The study was not randomised; allocation was not concealed.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	There was an attempt at keeping contamination between groups to a minimum: "There was no formal randomization done because we intended to keep adjacent villages together to allow sharing of resources (mobile phones) among village health workers in the intervention arm and minimise contamination of study arms since the study was confined within a defined geographical area where a general population based cohort had been established." But the study authors also reported that: "Information probably leaked through word of mouth from one village health worker to another or between women in adjacent control and intervention village through their social interactions in markets, places of worship (churches and mosques) or even during attendance of antenatal care."
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Data on our primary outcome (place of delivery) was based on a self-report and therefore prone to recall and social desirability bias. If linkage of pregnancy registry with health facility records was possible, health facility birth records would have provided an alternative source of data to verify the self-reports."

Asiki 2018 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	9% in each group were lost to follow-up due to lost pregnancy or migration.
Selective reporting (reporting bias)	Unclear risk	There was no registration number provided (e.g. clinical trials NCT #) and no mention of a protocol. It is unclear if all outcomes were reported.
Other bias	Low risk	No other bias apparent

Bull 2018

Study characteristics	
Methods	**Aim**: to improve the continuity and quality of care for the prevention of mother-to-child transmission (PMTCT) delivery to women in a rural, resource-limited setting **Study design**: cluster-randomised controlled trial **Cluster features**: 14 health facility sites **Recruitment**: no information **Study dates**: February to May 2015
Participants	**Inclusion criteria**: antenatal visits to 14 health facility sites **Sample size**: 2473 antenatal visits; the number of HCWs was not reported **Age**: no information **Sex**: 100% female **Country**: Tanzania **Setting**: health facility sites (hospitals, health centres, and dispensaries) in rural Misungwi district
Interventions	**Intervention**: digital tracking + CDSS (n = 1530 women/1594 antenatal visits/695 HIV tests): mHealth tablet-based application. **Digital tracking component**: client registration and data collection. **CDSS component**: alerts and reminders about specific protocols **Control**: paper registries are the standard of care (n = 879 antenatal visits/486 HIV tests (number of women was not reported)) **Co-interventions**: standard antenatal, delivery and postnatal care
Outcomes	1. Patients'/clients' health status and well-being (HIV status) 2. Clients' utilisation of primary health care and/or services (HIV tests) **Outcome assessment time points**: three months from the start of the intervention
Notes	**Funding**: National Institutes of Health, USA **Conflicts of interest**: “Conflicts of Interest: None declared” **Trial registry ID**: not reported
Risk of bias	

Bull 2018 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Randomized controlled pilot study"; matched types of health facilities were assigned to either intervention or control.
Allocation concealment (selection bias)	Unclear risk	No details were reported on how the random selection was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible to blind participants and personnel; the intervention was compared to standard care.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Health workers were aware of the intervention allocation and study research assistants collected data.
Incomplete outcome data (attrition bias) All outcomes	High risk	All clusters (health facilities) provided data for the study; however, participants at baseline were not necessarily those who provided data at endline. "We utilized the total visits from the T-HIT system, rather than unique patient visits, in the analysis because of an inability to link records in the paper patient logs. Linking patient data in the facility logs would require a manual record-by-record evaluation, looking for the name of each patient in every subsequent record during the pre- and post-intervention phases, which was not feasible."
Selective reporting (reporting bias)	High risk	There was no registration number provided (e.g. clinical trials NCT#) and no mention of a protocol. Some outcomes were only reported for the intervention group (one antenatal visit, more than one antenatal visit) and data were inconsistent between the results text and the results tables.
Other bias	Low risk	No other bias apparent

Carmichael 2019

Study characteristics	
Methods	**Aim**: to evaluate the impact of the use of mobile technology by community-based health workers on health-promoting behaviours amongst women related to reproductive, maternal, newborn and child health and nutrition in Bihar, India **Study design**: cluster-randomised controlled trial **Cluster features**: 70 health sub-centres (the lowest-level public health facility – covering several villages) **Recruitment:** to limit implementation costs and logistical requirements, the intervention focused on four out of 10 blocks (or sub-districts) in Saharsa **Study dates**: January 2012 to August 2014
Participants	**Inclusion criteria:** mothers of infants 0 to 12 months residing in the catchment area of the subcentres **Sample size:** Accredited Social Health Activist (ASHA) n = 285 Anganwadi Worker (AWW) n = 288

Carmichael 2019 *(Continued)*

	Maternal respondents: 3112 participants (1559 baseline survey respondents and 1553 post-implementation survey respondents) **Age:** AWW: mean 35.5 years ASHA: mean 33.3 years Maternal participants: 15 to 65 years **Sex:** 100% female **Country:** India **Setting:** Angawandi centres and community-based
Interventions	**Digital tracking + CDSS** Ananya programme with Information Communication Technology Continuum of Care Service (ICT-CCS) mHealth The Ananya programme is a multi-level intervention to reduce maternal, newborn, and child mortality rates, fertility, and child undernutrition statewide by improving behaviours related to family planning, antenatal care (ANC) and delivery preparation, postnatal care, complementary feeding, and child immunisation. The ICT-CCS tool was a mHealth add-on administered via algorithm-loaded mobile phones (Nokia C2-01) with a keyboard. **Digital tracking component:** registration and tracking of beneficiaries, automated scheduling of home visits, provision of health information through videos, guided protocols for conducting home visits through checklists, a feature to track child immunisations, and supervisory tools **CDSS component:** tools to facilitate the computation of estimated due dates and body mass index **Control:** standard of care for the Ananya programme using paper registries **Co-interventions:** reproductive, maternal, newborn and child health and nutrition interventions
Outcomes	1. Clients utilisation of PHC and/or service health status (antenatal care; home visits after delivery; delivery and newborn care; immunisations; family planning) 2. Clients' health behaviours (exclusive breastfeeding; complementary feeding) **Outcome assessment time points**: baseline (on enrolment) and at the 2-year follow-up
Notes	**Funding:** The Bill and Melinda Gates Foundation funded the Ananya programme and the development and evaluation of the ICT-CCS tool. **Conflicts of interest**: the authors declared no conflicts of interest. **Trial registry ID**: NCT03406221 We reached out to the Borkum/Carmichael study authors for clarification on some numbers, and they shared more detailed tables, but we did not use those data for our analyses.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The evaluation was designed and implemented by Mathematica Policy Research, who conducted extensive pilot testing before launching the survey and

Carmichael 2019 *(Continued)*

		worked with Sambodhi and Population Health Foundation of India to oversee the survey data collection and administration.
Allocation concealment (selection bias)	Low risk	The evaluation was designed and implemented by Mathematica Policy Research, who conducted extensive pilot testing before launching the survey and worked with Sambodhi and Population Health Foundation of India to oversee the survey data collection and administration.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of clients and healthcare providers
Blinding of outcome assessment (detection bias) All outcomes	High risk	No mention of blinding of clients and healthcare providers
Incomplete outcome data (attrition bias) All outcomes	Low risk	Response rates were generally high and similar for intervention and control groups and by time period.
Selective reporting (reporting bias)	Unclear risk	Published outcomes aligned with an earlier report (Borkum) but they differed from the outcomes listed in the trial registration.
Other bias	Unclear risk	Because a different cohort of women gave birth in the 12 months before each survey, the baseline and post-implementation samples were predominately different women (i.e. repeated cross-sections), but they were located in the same villages.

Chen 2016

Study characteristics	
Methods	**Aim**: to improve childhood vaccination coverage and improve knowledge about immunisation amongst healthcare workers **Study design**: cluster-randomised controlled trial **Cluster features**: 36 village doctors **Recruitment**: all village doctors in the catchment area of two townships were screened for inclusion. Caregivers of children aged 12 to 23 months were invited for the baseline and end-line surveys. **Study dates**: December 2013 to January 2015
Participants	**Inclusion criteria**: caregivers of children aged 12 to 23 months receiving immunisation services **Sample size**: 214 clients; 36 HCWs **Age**: 18.1 (14.6-21) months **Sex**: 46% female **Country**: China **Setting**: community-level care in two rural Xuanhan County, Sichuan Province townships
Interventions	**Intervention**: digital tracking + CDSS (n = 18 doctors/101 caregivers at end survey): EPI smartphone application. **Digital tracking component**: making appointments, recording vaccination status, tracking

Chen 2016 *(Continued)*

	overdue children. **CDSS component**: tailored health information related to immunisation such as abnormal reactions and key knowledge and skills of intradermal and subcutaneous injections delivered to village doctors through the application **Control**: usual care (n = 18 doctors/104 caregivers at end survey): village doctors conducted their vaccination work in their usual way and text messages sent through the Child Immunisation Register system were also implemented to alert caregivers about upcoming vaccinations. The text messages included the appointment of vaccination time, date, recommended place and contact number of the local Centre for Disease Control (the administration institution for child vaccination). **Co-interventions**: text messages to parents of both groups with child vaccination appointments and reminders, EPI (Expanded Program on Immunisation) immunisations
Outcomes	1. Clients' utilisation of primary health care and/or services (five-vaccine immunisation coverage) **Outcome assessment time points**: 1 year from start of intervention
Notes	**Funding**: Save the Children, China **Conflicts of interest**: the authors declared that they have no competing interests.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated sequence. From the authors: "We chose the block Tools package in the software programme “R” (https://www.r-project.org/) for matching and randomization."
Allocation concealment (selection bias)	Low risk	Central allocation. From the authors: "a biostatistician generated the random allocation; the random allocation was sent to the program manager at Save the Children, Sichuan Office, who installed the smartphone with EPI app and distributed this to village doctors in the intervention group."
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding was not achievable since the app was used by doctors in one group but not the other.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	A vaccination card was primarily used to assess vaccination status, but if the caregiver did not bring the card, survey answers were included. The proportion of participants with vaccination cards was not reported.
Incomplete outcome data (attrition bias) All outcomes	High risk	Two doctors and two matched doctors were excluded after randomisation because they were too remote to be reached. The caregivers that were questioned at baseline were not the same as the ones questioned at endline. No details on the proportion of participants who did not respond to the survey.
Selective reporting (reporting bias)	Low risk	Outcomes listed in the protocol were all fully reported.
Other bias	Low risk	No other bias apparent

Hackett 2018

Study characteristics

Hackett 2018 *(Continued)*

Methods	**Aim**: to increase women's demand for, and utilisation of, facility delivery within the context of a large maternal, newborn and child health project **Study design**: cluster-randomised controlled trial **Cluster features**: 32 villages **Recruitment**: we recruited community health workers into the study during integrated maternal, newborn and child health training workshops at baseline. **Study dates**: August 2013 to June 2014
Participants	**Inclusion criteria**: women 16 to 49 years that were pregnant during the intervention period and had a live birth and the child was still living **Sample size**: 700 clients; 62 HCWs **Age:** mean (SE) intervention: 28.2 (0.4), control: 29.1 (0.4) years **Sex**: 100% female **Country**: Tanzania **Setting**: community-level care in rural Singida and Iramba districts
Interventions	**Intervention**: digital tracking + CDSS (n = 16 villages/32 healthcare workers/371 women): smartphone application **Digital tracking component**: client registration, home visit scheduling, time-tailored counselling prompts, automated referral and follow-up reminders, and data management and reporting support. **CDSS component**: electronic decision-tree protocols, directing to specific health counselling topics and messages and particular lessons in the photo book, danger sign identification, flagging clients who require immediate referral to health facilities **Control**: community health workers were provided with paper-based registers, and photobooks which are used as counselling tools during household visits to promote healthy behaviours (n = 16 villages/30 healthcare workers/329 women) **Co-interventions**: standard antenatal care
Outcomes	1. Clients' utilisation of primary health care and/or services (facility deliveries) **Outcome assessment time points**: after birth
Notes	**Funding**: Government of Canada through a Contribution Agreement with World Vision Canada and subagreement with University of Toronto; The W Garfield Weston Foundation; the University of Toronto Queen Elizabeth II Graduate Scholarships in Science and Technology (QEII-GSST) Program; the Canadian Institutes of Health Research (CIHR) through a Canada Research Chair in Human Ecology and Public Health and a Canada Research Chair in Biostatistics; Canada Foundation for Infrastructure and Ontario Innovation Trust; University of Toronto Faculties of Arts and Science and Dalla Lana School of Public Health **Conflicts of interest**: “The authors have declared that no competing interests exist.” **Trial registry ID**: NCT03161184

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"We selected intervention villages using a 3-step protocol: (i) a simple randomization procedure was used to select 3 (out of a possible 19) villages to exclude from the study; (ii) the remaining 16 villages were pair-matched on population

Hackett 2018 *(Continued)*

		size; (iii) for each matched pair, one was randomly allocated to the intervention arm and the other to the control arm."
Allocation concealment (selection bias)	Unclear risk	No details were reported on how the random selection was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Group assignment was unmasked.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Outcome assessment was by self-report and the intervention was not masked, but it was verified by clinical records "whenever possible"; unclear how many records were available
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Women with follow-up records were selected for analysis; 128/700 (18%) women were lost to follow-up. A priori sample size calculation had estimated up to 30% dropout rate and reasons for dropping out were travel or relocation, which do not seem to be intervention-related.
Selective reporting (reporting bias)	High risk	Several secondary outcomes have not been reported; see online trial record (NCT03161184).
Other bias	Low risk	No other bias apparent

Ilozumba 2018

Study characteristics	
Methods	**Aim**: to strengthen the role of CHWs in improving maternal health outcomes **Study design**: non-randomised, controlled cluster trial **Cluster features**: no information **Recruitment**: villages were randomly selected from a list of all villages in each block using a power and sample size analysis; a complete house listing was done to identify the eligible respondents. All households having at least one eligible respondent were included in an Eligible Households Form. The required number of households was selected from the sampling frame through systematic random sampling. In each selected household, one eligible respondent was selected and interviewed. **Study dates**: November 2015 to January 2016
Participants	**Inclusion criteria**: females between the ages of 18 and 45 currently living in Deoghar, who had delivered in the last 12 months **Sample size**: 2200 clients; number of HCWs was not reported **Age**: standard care: ≤ 20 years: 20.7%; ≥ 21 years: 79.3%; NGO-programmes: ≤ 20 years: 22.6%; ≥ 21 years: 77.4%; Mobile for Mothers: ≤ 20 years: 24.9%; ≥ 21 years: 75.1% **Sex**: 100% female **Country**: India **Setting**: community-level care in three rural subdistricts in the Deoghar district of Jharkhand state

Ilozumba 2018 *(Continued)*

Interventions	**Intervention**: digital tracking + CDSS (n = 740 women): Mobile for Mothers (basic mobile phone). **Digital tracking component**: registration forms for ASHAs during home visits with pregnant women. **CDSS component**: checklists, danger sign monitoring, and educational prompts **Control**: 1. community health workers were provided with paper-based registers, and photo books which are used as counselling tools during household visits to promote healthy behaviours (n = 740 women); 2. standard care government programmes: recruitment and support of ASHAs, the Mahatma Van scheme, which made ambulances available, and the National Population Stabilization Fund (JSK) scheme, which provided financial incentives for women delivering at the hospital (n = 740 women) **Co-interventions**: standard antenatal, delivery and postnatal care
Outcomes	1. Clients' utilisation of primary health care and/or services (health centre deliveries; ANC visits) **Outcome assessment time points**: after birth (up to 12 months)
Notes	**Funding**: Erasmus Mundus Joint Doctorate Fellowship and a Share-Net Small Grants program **Conflicts of interest**: no information

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Quasi-experimental cross-sectional study with three groups
Allocation concealment (selection bias)	High risk	Quasi-experimental cross-sectional study with three groups
Blinding of participants and personnel (performance bias) All outcomes	High risk	The study was not randomised and there was no description of masking; we assumed a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcomes assessed by self-report at interview; we assumed a high risk of detection bias.
Incomplete outcome data (attrition bias) All outcomes	Low risk	"In each selected household, one eligible respondent was selected and interviewed." "No respondents refused to participate in the survey."
Selective reporting (reporting bias)	Unclear risk	There was no registration number provided (e.g. clinical trials NCT #) and no mention of a protocol. It was unclear if all outcomes were reported.
Other bias	Low risk	No other bias apparent

Modi 2019

Study characteristics

Methods	**Aim**: improve performance of ASHAs and coverage of MNCH services **Study design**: cluster-randomised controlled trial **Cluster features**: 22 primary health centres serving 529 villages

Modi 2019 *(Continued)*

	Recruitment: ASHAs working in the cluster villages were recruited and all eligible women that were not absent on the day of the surveys were included. **Study dates**: February 2016 to January 2017
Participants	**Inclusion criteria**: mothers of a one- to four-month-old infant or a six- to eight-month-old infant at the time of survey **Sample size**: 6493 clients; 561 HCWs **Age**: intervention: mean 24.4 (SD 3.63) years; control: mean 24.3 (SD 3.46) years **Sex**: 100% female **Country**: India **Setting**: community-level care in 22 primary health centres in six rural tribal blocks of Bharuch and Narmada districts in Gujarat state
Interventions	**Intervention**: digital tracking + CDSS (n = 11 clusters/285 ASHAs/3328 mothers at end survey): ImTeCHO smartphone application. **Digital tracking component**: registration of pregnant women and children during home visits, scheduling, schedule reminders, recorded details of the services delivered. **CDSS component**: digital checklist to encourage adherence to protocols during home visits; decision support in the form of digital checklists and inbuilt algorithms to screen and risk-stratify a case with complications; referral coordination to facilitate referral to functional facility and emergency transport; decision support in the form of display of customised management guidelines on mobile phone and web interface to help manage complicated cases; receive training content in form of multimedia files **Control**: the government and other providers continued to provide usual health services in the control area. A refresher training (three days) and one-time supply of commodities were provided to ASHAs from the control and intervention area (n = 11 clusters/293 ASHAs/3165 mothers at end survey) **Co-interventions**: standard antenatal, delivery and postnatal care; EPI (Expanded Program on Immunisation) immunisations
Outcomes	1. Provider's adherence to recommended practice (antenatal home visits; postnatal home visits; complementary feeding counselling; antenatal exams) 2. Patients'/clients' health status and well-being (infant deaths; stillbirths; neonatal deaths; low birthweight; presence of pneumonia/fever post-birth) 3. Clients' utilisation of primary healthcare and/or services (vaccinations; hospital delivery) 4. Clients' health behaviour (immediate and exclusive breastfeeding; post-delivery newborn care; kangaroo mother care) **Outcome assessment time points**: NA
Notes	**Funding**: Indian Council of Medical Research, John D. and Catherine T. MacArthur Foundation, Department of Maternal, Neonatal, Child and Adolescent Health at the World Health Organization **Conflicts of interest**: Argusoft India Ltd. is the owner of the core IT platform which was used to develop ImTeCHO application. RG and SV are co-investigators for this study and employed by Argusoft India Ltd. SQ is a retired medical officer at the WHO. AS is senior scientist at the ICMR; WHO and ICMR funded the trial. **Trial registry ID**: CTRI/2015/06/005847

Risk of bias

Bias	Authors' judgement	Support for judgement

Modi 2019 *(Continued)*

Random sequence generation (selection bias)	Low risk	"The randomization was done using the software nQuery."
Allocation concealment (selection bias)	Low risk	"The stratified randomization was performed by a statistician at All India Institute of Medical Sciences (AIIMS, New Delhi) who was not involved in implementation of the intervention."
Blinding of participants and personnel (performance bias) All outcomes	High risk	"Due to the nature of the community-based intervention, blinding was not possible."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessment at endpoint survey interviews with unblinded subjects
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	All 22 clusters were followed until the end of the trial. 18% (1461/7954) of eligible mothers were absent on the day of the endpoint survey and were excluded from the study.
Selective reporting (reporting bias)	Low risk	Outcomes listed in the protocol were all fully reported.
Other bias	Low risk	No other bias apparent

Patil 2022

Study characteristics	
Methods	**Aim**: to assess whether the Integrated Child Development Services (ICDS) Program and the ICDS-Common Application Software (CAS) intervention improved community health and nutrition workers (CHNW) services related to home visits and counselling of pregnant women and mothers of children < 12 months **Study design**: non-randomised controlled trial (village-matched, quasi-experimental design with repeated cross-sectional pre-intervention and post-intervention measurements) **Recruitment**: 1:1 nearest neighbour propensity score matching (PSM) method was conducted to identify pairs of intervention and comparison villages. Surveys of selected Anganwadi workers were conducted to measure AWC-level outcomes. Mother-child dyads were recruited from Anganwadi Centres (AWC) by child life stages. **Study dates**: September 2016 to August 2019
Participants	**Inclusion criteria**: 1. Pregnant women 2. Mothers of children 3. Children < 60 months of age 4. Anganwadi workers (AWWs) 5. Lady supervisors of the AWWs 6. Other ICDS officials 7. Other government officials and private stakeholders **Sample size**: healthcare workers (N = 845); programme participants (N = 5785) **Age**: AWWs mean age ranged from 37.52 to 40.65 years; mothers mean age ranged from 23.99 to 24.7 years; infants 0 to 12 months

Patil 2022 *(Continued)*

	Sex: 100% female **Country**: India **Setting**: Madhya Pradesh (MP) and Bihar
Interventions	**Intervention**: digital tracking only ICDS-CAS (Integrated Child Development Services with Common Application Software) **Digital tracking component:** data capture and job-aid mobile app for community health and nutrition workers (CHNWs) **Control**: standard ICDS care using paper registries **Co-interventions**: Standard antenatal, delivery and postnatal care
Outcomes	1. Clients' utilisation of PHC and/or service health status (home visits and counselling; growth monitoring and supplementary nutrition services provided by community health workers) 2. Patients'/clients' health behaviour (exclusive breastfeeding to children < 6 months, timely initiation of complementary feeding to children 6 to 8 months, minimum dietary diversity and adequate frequency of meals to children 6 to 11 months) **Outcome assessment time points:** data were collected at two time points: before the launch of the full intervention (May to August 2017), and at follow-up (2019: January to February in MP and July to August in Bihar).
Notes	**Funding**: grant No. OPP1158231 from the Bill & Melinda Gates Foundation **Conflicts of interest**: none declared **Trial registry ID**: ISRCTN83902145 Data from this study were not extracted as it was not clear what the estimates and data meant. Findings are summarised narratively in the text.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	This identification strategy is grounded in the Neyman–Rubin potential outcomes model where a matched cohort design can yield unbiased estimates of the causal effects under a strong assumption that all confounders are measured and balanced between the intervention and comparison groups.
Allocation concealment (selection bias)	High risk	Non-randomised study design
Blinding of participants and personnel (performance bias) All outcomes	High risk	Relied on recall by survey participants in constructing our indicators and not on any objective measurements or data. Researchers did not have access to backend data from the CAS app or ICDS system which could have provided more objective measurements.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Relied on participant recall
Incomplete outcome data (attrition bias)	High risk	No data provided on completion rates or attrition

Patil 2022 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Unclear risk	Some aspects of the intervention could not be performed, and the trial registration was retrospectively altered.
Other bias	High risk	Risk of confounding bias, selection bias and measurement bias due to study design

Peiris 2019

Study characteristics	
Methods	**Aim**: to support doctors and village-based ASHAs in the provision of guidelines-based assessment and management of cardiovascular disease risk **Study design**: cluster-randomised controlled trial **Cluster features**: 18 primary health centres with surrounding villages **Recruitment**: three villages were randomly selected per primary health centre cluster **Study dates**: June 2014 to August 2016
Participants	**Inclusion criteria**: aged ≥ 40 years, classified at high CVD risk and indicated for BP lowering medication based on WHO and NPCDCS guidelines **Sample size**: 8642 clients; 258 HCWs **Age**: mean (SD): intervention: 60.3 (10.71) years; control: 61.0 (10.86) years **Sex**: 56% females **Country**: India **Setting**: community-level care in 18 primary health centre (PHC) clusters in rural West Godavari district in Andhra Pradesh
Interventions	**Intervention**: digital tracking + CDSS + TCC (n = *): SMARThealth India tablet-based application. **Digital tracking component:** cohort creator which facilitated grouping of participants; patient priority module to help prioritise workload for follow-up visits and screening of new participants; alert module to provide feedback on whether patients were achieving recommended targets; responses from the alert/reminder module were used to create prompts in the tablets to alert them to high-risk individuals who required follow-up visits. **CDSS component**: ASHAs conducted household-based assessments using the tablet device. Doctors accessed the data and were provided with decision-support recommendations for BP and other CVD risk factor management. Doctors were prompted to prescribe medications from the drug classes that were available on the essential medicine list in primary healthcare facilities and to enter a reason for not prescribing the medication if they considered it inappropriate. **Control**: during the control periods, participants in these PHCs/villages continued to receive their usual service provided by either a PHC doctor or a private doctor of their choosing. Any individuals identified at baseline to have extreme elevations of their BP were instructed to consult a doctor immediately (n = *). **Co-interventions**: usual care
Outcomes	1. Patients'/clients' health status and well-being (achievement of optimal BP levels; new CVD events) 2. Patients/clients' health behaviour (health-enhancing physical activity) **Outcome assessment time points**: NA

Peiris 2019 *(Continued)*

Notes	* 18 clusters were sequentially allocated to the intervention group in three groups of six clusters each; all served as intervention and all served as control depending on the time point of data collection. **Funding**: Australian National Health and Medical Research Council (NHMRC) Global Alliance for Chronic Disease Grant **Conflicts of interest**: the authors have declared that no competing interests exist. The George Institute for Global Health has a wholly owned social enterprise that is conducting commercial projects that include aspects of the intervention tested in this study. **Trial registry ID**: CTRI/2013/06/003753

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Central computer-based blinded randomisation was conducted with allocation stratified by population size."
Allocation concealment (selection bias)	Low risk	"Central computer-based blinded randomisation was conducted with allocation stratified by population size."
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of clients and healthcare providers
Blinding of outcome assessment (detection bias) All outcomes	High risk	"The data collection team were blinded to the allocation of the village. Outcome analyses were conducted with the statisticians blinded to intervention allocation." Objective outcomes would be at low risk of bias but self-reported outcomes would be at high risk of bias because participants were unblinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	"Independent cross-sectional samples at each time point." No follow-up of individual patients. Of 9610 clients that were approached, 732 refused/were not available and 236 had identity mismatch and were excluded.
Selective reporting (reporting bias)	Low risk	Outcomes listed in the protocol were fully reported.
Other bias	Low risk	No other bias apparent

Prabhakaran 2019

Study characteristics

Methods	**Aim**: to better tackle the growing burden of chronic conditions and their risk factors in primary care through integrated management **Study design**: cluster-randomised controlled trial **Cluster features**: 40 community health centres **Recruitment**: nurses screened participants for enrolment; physicians confirmed eligibility **Study dates**: April 2016 to August 2016
Participants	**Inclusion criteria**: ≥ 30 years of age, diagnosed with hypertension or type 2 diabetes mellitus

Prabhakaran 2019 *(Continued)*

	Sample size: 3698 clients; number of HCWs was not reported **Age:** mean (SD): 55.1 (11) years **Sex**: 45% female **Country**: India **Setting**: community-health centres in four rural districts in Haryana and two rural districts in Karnataka
Interventions	**Intervention**: digital tracking + CDSS + TCC (n = 1842 participants/20 clusters): mWellcare tablet-based application. **Digital tracking component**: electronic health record storage enabling long-term monitoring and follow-up; nurses collected data (patient history, blood pressure, blood glucose, depression, tobacco and alcohol use, and current medications) on tablets. **CDSS component**: support nurses and physicians in managing patients' chronic conditions; generates recommendations for treatment plan for physicians + lifestyle modification for implementation by nurses, based on patient data and clinical algorithms. **TCC component**: SMS medication adherence and appointment reminders **Control**: training to physicians on the clinical management guidelines for hypertension and diabetes mellitus; charts on the management of these conditions were displayed prominently at the outpatient clinics; nurses' training in the management of hypertension and diabetes mellitus; we provided the EUC NCD nurses with a tablet computer (without the mWellcare system) for collecting data at the baseline visit; nurses provided and explained the lifestyle advice pamphlet (in local languages, Hindi and Kannada) to each participant (n = 1856 participants/20 clusters) **Co-interventions**: standard care
Outcomes	1. Patient/client acceptability of and satisfaction with intervention (quality of care) 2. Patients'/clients' health status and well-being (deaths; change in HbA1c, fasting plasma glucose, total cholesterol, CVD risk, and tobacco use) 3. Clients'/patients' health behaviour (change in alcohol use; depression) **Outcome assessment time points**: 12 months from start of intervention
Notes	**Funding**: the Wellcome Trust **Conflicts of interest**: "Drs Prabhakaran, Tandon, Roy, Vamadevan, and Jindal hold a copyright for the mPower Heart mHealth System, which has features on electronic storage of health records and electronic clinical decision support computation. They had/have been doing research projects implementing and evaluating EDS systems in multiple settings". **Trial registry ID**: NCT02480062

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"An independent biostatistician performed central computer-based randomization of CHCs stratified by states (Haryana and Karnataka) and within each state by the availability of NCD nurses."
Allocation concealment (selection bias)	Low risk	"An independent biostatistician performed central computer-based randomization of CHCs stratified by states (Haryana and Karnataka) and within each state by the availability of NCD nurses."
Blinding of participants and personnel (performance bias)	High risk	"Given the nature of the cluster-randomized trial design, neither personnel nor participants were blinded to the intervention."

Prabhakaran 2019 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Assessments at study end were carried out by independent outcome assessors."
Incomplete outcome data (attrition bias) All outcomes	Low risk	3698 enroled participants; 3324 (90%) completed with reasons provided
Selective reporting (reporting bias)	Low risk	Outcomes listed in the protocol were all fully reported.
Other bias	Low risk	No other bias apparent

Prinja 2017

Study characteristics	
Methods	**Aim**: to improve antenatal care, delivery, postnatal care, neonatal care, and childhood vaccination coverage **Study design**: controlled before-and-after study **Cluster features**: four community blocks containing 69 villages **Recruitment**: household enumeration was undertaken in the randomly selected villages to identify and enlist all mothers in the relevant categories; the number of women to be interviewed per village was calculated by probability proportional to size method based on the relative size of the village. **Study dates**: April 2015 to August 2015
Participants	**Inclusion criteria**: mothers with children aged 29 days to 6 months and mothers with children aged 12 to 23 months on the date of survey **Sample size**: 3304 clients (after propensity score matching); number of HCWs was not reported **Age**: mean age 28 to 34 years/group **Sex**: 100% female **Country**: India **Setting**: community-level care in rural villages in Kaushambi district in Uttar Pradesh state
Interventions	**Intervention**: digital tracking + CDSS (pregnancy care, n = 534 mothers; childhood immunisation, n = 1019 mothers): ReMiND Java-based application (pregnancy care or childhood vaccination). **Digital tracking component**: tailored content, guides the ASHA through the course of a woman's pregnancy and newborn childcare: register each pregnant woman, update her ANC record during home visits on the mobile application, track her from pregnancy into the postpartum period, track the health of the newborn, track the status of routine immunisation until two years of age **CDSS component**: locally relevant audio and visual prompts to help ASHAs during their home visits, provide appropriate counselling and support during home visits, provide timely and appropriate health information (e.g. reminders to ASHAs for the next due counselling); it helps them to prioritise home visits; and it employs algorithms to assist in the early identification, treatment, and rapid referral to appropriate care of any danger signs amongst pregnant women or neonates **Control**: standard care by ASHAs (pregnancy care, n = 534 mothers; childhood immunisation, n = 1019 mothers; pre-intervention survey, n = 198 mothers in control and intervention clusters)

Prinja 2017 *(Continued)*

	Co-interventions: standard antenatal, delivery and postnatal care; EPI (Expanded Program on Immunisation) immunisations
Outcomes	1. Provider's adherence to recommended practice (ANC weight measurements, blood pressure, blood test, and urine test) 2. Clients' utilisation of primary health care and/or services (childhood immunisation coverage; ANC visits; institutional deliveries) 3. Clients' health behaviour (IFA consumption) **Outcome assessment time points**: NA
Notes	**Funding**: USAID, New Delhi, India **Conflicts of interest**: "The authors declare that no competing interests exist".

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	"Pre- and post-quasi-experimental design." "Propensity score matched samples from intervention and control areas in pre-intervention and post-intervention periods were analysed using difference-indifference method to estimate the impact."
Allocation concealment (selection bias)	High risk	"Pre- and post-quasi-experimental design."
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible to blind participants and personnel; the intervention was compared to standard care.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessment at endpoint survey interviews with unblinded subjects; not reported whether interviewers were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data amongst the selected propensity score-matched participants.
Selective reporting (reporting bias)	Low risk	Comprehensive report. Outcomes within the broad outcome categories listed in the protocol were reported. Consequently, we did not suspect selective reporting bias.
Other bias	Low risk	No other bias apparent

Shiferaw 2016

Study characteristics

Methods	**Aim**: to improve delivery and postnatal care service utilisation by use of an mHealth application during antenatal care **Study design**: non-randomised, controlled cluster trial **Cluster features**: 10 health centres

Shiferaw 2016 *(Continued)*

	Recruitment: record review of women who visited the selected health facilities for ANC, delivery and PNC with 12 months follow-up (longitudinal follow-up part of study) **Study dates**: no information
Participants	**Inclusion criteria**: women visiting the health centres for antenatal care, delivery, or postnatal care **Sample size**: 1224 clients (longitudinal part of study); 15 HCWs **Age**: 15 to 50 years **Sex**: 100% female **Country**: Ethiopia **Setting**: 10 health facilities in rural and urban Semen Shewa Zone, Amhara region
Interventions	**Intervention**: digital tracking + CDSS + TCC (n = 5 clusters/622 women): mHealth smartphone application. **Digital tracking component**: register clients who came to the health facility for ANC, delivery care or PNC. This generated a code for longitudinal follow-up and HCW reminders for follow-up with patients. **CDSS component**: screening tool for risk stratification: assisted the health worker in deciding who was eligible to receive 'Routine ANC/Basic care' versus 'Specialized Care', based on the responses given to the screening questions on the 'Integrated Antenatal, labor, delivery, Newborn and Postnatal card' as they were expected to complete for each mother per the Ministry of Health protocol. **TCC component**: voice call to set up appointment for ANC or PNC check-up **Control**: standard care with no mHealth intervention (n = 5 clusters/602 women) **Co-interventions**: ANC, PNC and delivery care at the health centres
Outcomes	1. Clients' utilisation of primary health care and/or services (antenatal visits at health centres; health centre deliveries; postnatal care at health centres) **Outcome assessment time points**: 12 months from start of intervention
Notes	**Funding**: United Nations Population Fund (UNFPA) Ethiopia Country Office **Conflicts of interest**: MT and MA were employees of the UNFPA Ethiopia Country Office when the study was under implementation. All other authors declared that they had no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomised
Allocation concealment (selection bias)	High risk	Not randomised
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible to blind participants and personnel; the intervention was compared to no intervention.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All outcomes were based on health centre records: "facility record review using a standard checklist"

Shiferaw 2016 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	High risk	Per-protocol analyses; only women with follow-up records were selected for analysis. From the authors: "women who had ANC, delivery, or PNC visits in the 6 months before follow-up assessment at 12 months"
Selective reporting (reporting bias)	Low risk	Outcomes relevant to study's aim ("to determine whether an mHealth intervention and training of health providers on client-centered care can improve maternity service utilization") were fully reported.
Other bias	Low risk	No other biases are apparent

Shiffman 2000

Study characteristics	
Methods	**Aim**: to support implementation of the American Academy of Pediatrics (AAP) guideline on office management of asthma exacerbations in children **Study design**: non-randomised cluster study (at the level of children) nested in a before-and-after study (at the level of paediatricians) **Cluster features**: paediatricians **Recruitment**: paediatricians were randomly drawn from a directory of paediatricians listed in Connecticut cities and towns within a 20-mile radius of New Haven. Each physician enrolled 10 consecutive children in the intervention and control phases. **Study dates**: September 1996 to October 1998
Participants	**Inclusion criteria**: children between 5 and 18 years old, who presented to a non-hospital setting with acute exacerbations of asthma **Sample size**: 65 clients; 11 HCWs **Age**: control phase mean: 10.3 years (range: 5.0 to 17.4), intervention phase mean: 10.8 years (range: 5.0 to 17.8) **Sex**: no information on children **Country**: USA **Setting**: primary care paediatricians in rural, peri-urban, and urban Connecticut
Interventions	**Intervention**: digital tracking + CDSS (n = 74): AsthMonitor tablet application. **Digital tracking component**: structured documentation of the clinical encounter using a pen-stylus. **CDSS component**: asthma guidelines and treatment aid: dynamically-generated recommendations based on the AAP practice parameter, assistance with calculation of predicted peak expiratory flow rate and medication dosages **Control**: usual paediatrician acute asthma exacerbation care in non-hospital setting (n = 91) **Co-interventions**: clinical treatment for acute asthma received during office visit
Outcomes	1. Provider's adherence to recommended practice (hospital referrals) 2. Patients'/clients' health status and well-being (improvement in asthma severity) 3. Clients' utilisation of primary health care and/or services* (emergency visits; hospitalisations; primary care re-visits* **Outcome assessment time points**: end of intervention

Shiffman 2000 *(Continued)*

	*emergency visits and hospitalisations occurred one week from the end of intervention; primary care re-visits occurred one week from the start of the intervention.
Notes	**Funding**: The Robert Wood Johnson Foundation and the National Library of Medicine **Conflicts of interest**: Dr. Shiffman is a Robert Wood Johnson Generalist Physician Faculty Scholar.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not randomised
Allocation concealment (selection bias)	High risk	Children were allocated to control or intervention during different phases.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Physicians and patients were masked to study hypothesis but not to intervention group.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Study assistant collecting data was masked to study hypothesis; no details reported on whether masked to intervention group
Incomplete outcome data (attrition bias) All outcomes	Low risk	8% of participants per group were withdrawn or excluded from analyses with reasons provided.
Selective reporting (reporting bias)	Low risk	All outcomes reported in the methods section were fully reported.
Other bias	High risk	More participants in the intervention group had higher severity of illness which was examined in analysis of covariance - significant confounding effects were discovered for several parameters. High adherence to guidelines in the control group (suspected Hawthorne effect)

Suryavanshi 2020

Study characteristics

Methods	**Aim**: to increase outreach worker (ORW) capacity to assist women in overcoming barriers that limit the uptake of HIV Prevention of Mother-to-Child Transmission (PMTCT) services **Study design**: cluster-randomised controlled trial **Cluster features**: a cluster was defined as one Integrated Counselling and Testing Centre (ICTC), all enroled outreach workers (ORW) affiliated with that ICTC (each ORW is assigned to one ICTC), and enroled HIV-positive pregnant/postpartum women assigned to their care. **Recruitment**: four study-employed Field Coordinators (one per district) consented ORWs affiliated with ICTCs in each district. Enroled ORWs consented HIV-positive women assigned to their care. **Study dates**: April 2015 to March 2017
Participants	**Inclusion criteria**: all HIV-positive pregnant/postpartum women ≥ 18 years assigned to enroled outreach workers were eligible, irrespective of pregnancy stage/postpartum status.

Suryavanshi 2020 *(Continued)*

	Sample size: outreach workers (ORWs) N = 116; HIV+ pregnant and breastfeeding women (N = 1191) **Age**: median age of outreach workers = 37 years; median age of HIV+ pregnant and breastfeeding women = 25 years **Sex**: 100% female **Country**: India (urban and rural) **Healthcare Setting**: Integrated Counselling and Testing Centers (ICTC) and home visits
Interventions	**Intervention**: digital Tracking + CDSS + TCC COMBIND behavioural training programme and a tablet computer loaded with a mHealth application (COMBIND mHealth component) **Digital tracking component:** digital data collection during home visits **CDSS component:** ORW-patient communication during home visits; risk assessment and educational support (programmed algorithms based on questions regarding pregnancy/ breastfeeding status and responses to previous questions) **TCC component:** appointment reminders sent via automatic SMS alerts to ORW and client cell phones **Control**: standard-of-care (SOC) outreach worker (ORW) training for HIV prevention of mother-to-child transmission (PMTCT) **Co-interventions**: management of anaemia, hypertension, gestational diabetes and other pregnancy-related problems
Outcomes	1. Clients' utilisation of PHC and/or service health status (proportion of infants who received nevirapine prophylaxis, proportion of infants who received early infant diagnosis (DNA PCR)) 2. Patients'/clients' health behaviour (proportion of women on ART at delivery, proportion of women practising exclusive breastfeeding for six months, proportion of infants who never missed any early infant diagnosis visit) 3. Patients'/clients' health status and well-being (maternal and infant mortality) **Outcome assessment time points**: 6 weeks, 6 months, 12 months, 18 months
Notes	**Funding**: this study was supported by the President's emergency plan for AIDS relief (PEPFAR) through the US Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry (CDC/ATSDR) Cooperative Agreement Grant Number U01 GH000731. This research was also supported in part by the Fogarty International Center of the US National Institutes of Health under award number D43TW009574. **Conflicts of interest**: under a licensing agreement between Emocha Mobile Health, Inc. and Johns Hopkins University, R Bollinger and J McKenzie-White are entitled to royalties on an invention described in this article. R. Bollinger is also a Board of Directors member of Emocha Mobile Health, Inc. This arrangement has been reviewed and approved by Johns Hopkins University in accordance with its conflict of interest policies. **Trial registry ID:** no published protocol or trial registration

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	ICTCs were randomised to standard-of-care (SOC) or COMBIND by study statistician.

Suryavanshi 2020 *(Continued)*

Allocation concealment (selection bias)	Low risk	All study investigators were blinded to the treatment assignment for the entire duration of the study.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No mention of blinding of clients and healthcare providers
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All study data for both the arms were collected following identical procedures by field co-ordinators and interviewers who were blinded to the randomisation assignments of enroled ORWs and women.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Of the 884 women included in the primary outcome analysis, 759 (86%) had the desired outcome for at least one endpoint
Selective reporting (reporting bias)	Unclear risk	No documentation of a published protocol or trial registration
Other bias	Unclear risk	ORWs in the SOC arm may have increased the quality and consistency of their PMTCT services due to the Hawthorne effect; the sample size for individual primary and secondary outcomes was lower than originally planned, thus some of the analyses may be underpowered.

Uddin 2016

Study characteristics	
Methods	**Aim**: to alert health workers of upcoming vaccinations of infants and to send an alert to mothers of these upcoming vaccinations **Study design**: controlled before-and-after study **Cluster features**: 40 randomly selected EPI (Expanded Programme on Immunisation) centres **Recruitment**: no information **Study dates**: April 2013 to March 2014
Participants	**Inclusion criteria**: pregnant women over 18 years old, mothers with children aged 0 to 11 months **Sample size**: 4158 clients; number of HCWs was not reported **Age**: approximately half of the mothers were under 25 years old and 11% to 26% had completed primary education or higher. **Sex**: 100% female **Country**: Bangladesh **Setting**: two rural hard-to-reach upazilas (subdistricts) in Sunamgonj district, which has the most haors (wetlands) in Bangladesh and two Dhaka urban zones from the six zones with the most street dwellers (out of 10 total zones)
Interventions	**Intervention**: digital tracking + CDSS + TCC (n = 1040): mTika smartphone application. **Digital tracking component**: smart phone-based registration of pregnant women, scheduling, vaccination reminders for health workers and smartphone and web-based EPI monitoring by supervisors. **CDSS component**: EPI providers could use smartphones to access mTika, allowing them to review the number of children

Uddin 2016 *(Continued)*

	scheduled for vaccination and their immunisation details for a given session. Health workers recorded vaccines administered directly to mTika, automatically updating the child's future vaccination schedule and reminders. At the end of each EPI session, mTika identified children who had missed their vaccinations, enabling follow-up. Additionally, EPI supervisors could monitor vaccinators' daily performance remotely through the web-based platform. **TCC component**: SMS birth notifications from mothers, automated SMS vaccination reminders to mothers **Control**: no information (n = 2080) **Co-interventions**: none
Outcomes	1. Clients' utilisation of primary health care and/or services (child vaccination coverage) **Outcome assessment time points**: end of intervention
Notes	**Funding**: Grand Challenges Canada **Conflicts of interest**: the authors reported no conflicts of interest.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	No randomisation procedure. From the authors: "We matched control and intervention areas based on: population density, total fertility rate, population served by local health facilities, and vaccination coverage."
Allocation concealment (selection bias)	Unclear risk	No description of allocation concealment; likely not used considering lack of randomisation procedure
Blinding of participants and personnel (performance bias) All outcomes	High risk	Although it was not clearly stated, participants and personnel were not blinded to group assignment, and it would have been difficult to do so as the intervention group received SMS messages for upcoming vaccinations and controls did not.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	There was no mention of blinding of the outcome assessors.
Incomplete outcome data (attrition bias) All outcomes	High risk	Only 33% of children sampled at endline (389/1040) were included in analyses. Participants at baseline were not necessarily those who provided data at endline. From the authors: "Different children were sampled at endline than at baseline. In intervention areas, children surveyed at endline included those registered and not registered with mTika in order to evaluate community-wide vaccination coverage."
Selective reporting (reporting bias)	Unclear risk	There was no registration number provided (e.g. clinical trials NCT#) and no mention of a protocol.
Other bias	Unclear risk	There were some significant differences in demographics and mobile phone ownership between those at baseline and endline which may impact the results.

Vedanthan 2019

Study characteristics

Vedanthan 2019 *(Continued)*

Methods	**Aim**: to evaluate the impact of CHWs, equipped with behavioural communication strategies and mobile health (mHealth) technology, on linkage to hypertension care and blood pressure reduction amongst individuals with elevated blood pressure in Western Kenya **Study design**: cluster-randomised trial with three arms: 1) "usual care" (CHWs with standard training); 2) “paper-based” (CHWs trained in tailored behavioural communication, using paper-based tools); and 3) “smartphone” (CHWs with tailored behavioural communication, using smartphone technology) **Cluster features**: Community Unit (population approximately 5000), stratified by division, and there were a total of 24 clusters (eight per arm) **Recruitment**: through the AMPATH programme **Study dates**: April 2014 to August 2017
Participants	**Inclusion criteria**: 1. 18 years old and older 2. elevated BP (SBP > 140 or DBP > 90) **Sample size**: 1460 individuals were enroled (491 usual care, 500 paper-based, 469 smartphone) **Age**: mean 54.2 years (SD = 16.4) **Sex**: males and females (58% women) **Country**: Kenya **Setting**: Kosirai and Turbo divisions of Western Kenya (rural)
Interventions	**Intervention**: digital tracking + CDSS + TCC **Digital tracking component:** the smartphone is linked to the electronic health records for data entry and provides CHWs with an updated list of clients who did not go to the clinic (remain unlinked) and need a home visit for follow-up. **CDSS component:** the decision support will use branching logic and decision trees based on specific motivational messages, as well as simple clinical care algorithms appropriate for CHWs. **TCC component:** the smartphone will provide tailored messaging and specific recommendations based on inputs from the assessments. The smartphone technology allows for alternative messaging modalities, such as images and recordings. **Control**: 1. Usual care arm: the CHW referred the individual to the health facility for further evaluation and management, as per the usual AMPATH clinical care protocol. 2. Paper-based arm: the CHW was instructed to engage in behavioural, clinical, and environmental assessments, followed by a tailored behavioural and motivational engagement to help facilitate linkage to care. **Co-interventions**: none
Outcomes	**Primary outcome measures :** 1. Documented linkage to care following home-based testing [time frame: up to 5 years] 2. One-year change in systolic blood pressure amongst hypertensive individuals [time frame: up to one year] **Secondary outcome measures:**

Vedanthan 2019 *(Continued)*

	1. Percentage of hypertensive individuals whose BP is controlled (< 140/90) at the final clinic visit [time frame: up to 5 years] 2. Medication adherence [time frame: up to 5 years] 3. Behavioural changes include physical activity, diet (salt, fruit/vegetable intake), and tobacco use [time frame: up to 5 years]
Notes	**Funding**: National Heart, Lung, and Blood Institute of the National Institutes of Health under award number 1U01HL114200 **Conflicts of interest**: the authors declared that they had no competing interests. **Trial registry ID**: NCT01844596

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The randomisation process was conducted centrally by biostatisticians at Brown University.
Allocation concealment (selection bias)	Low risk	The randomisation process was conducted centrally by biostatisticians at Brown University.
Blinding of participants and personnel (performance bias) All outcomes	High risk	The participants and research staff were not blinded to intervention assignments.
Blinding of outcome assessment (detection bias) All outcomes	High risk	The participants and research staff were not blinded to intervention assignments.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	332 participants could not be matched to the electronic health record.
Selective reporting (reporting bias)	Unclear risk	Not all outcomes in the trial registration were reported.
Other bias	Unclear risk	Each study arm was conducted sequentially.

Venkateswaran 2022

Study characteristics

Methods	**Aim**: to compare the quality of antenatal care between clinics using eRegistry and those using paper-based records **Study design**: cluster-randomised controlled trial **Cluster features**: Palestinian Ministry of Health primary healthcare clinics (PHC) in the West Bank providing routine antenatal care (ANC) for low-risk pregnancies. Each clinic was a cluster. **Recruitment**: all new enrolments (women visiting the PHC for ANC services for the first time in the current pregnancy) in the eligible PHC were enroled in the study.

Venkateswaran 2022 *(Continued)*

	Study dates: January 2017 to April 2019
Participants	**Inclusion criteria**: women visiting the PHC for ANC services for the first time in their current pregnancy at primary health centres located in Bethlehem, Jenin, Nablus, Ramallah/Al-Bireh, and Salfit governorates offering ANC services reporting to the Palestinian Ministry of Health. All new enrolments (women visiting the PHC for ANC services for the first time in the current pregnancy) **Sample size**: 7367 pregnant women; 119 clinics **Age**: women of childbearing age (approx 80% aged 21 to 40 years) **Sex**: 100% female **Country**: Palestine **Setting**: primary healthcare clinics offering routine antenatal care in the West Bank, Palestine (urban)
Interventions	**Intervention**: digital tracking + CDSS +TCC eRegistry with clinical decision support **Digital tracking component:** electronic health record for antenatal care **CDSS component:** guidelines-driven antenatal care, screening and management for important conditions in routine antenatal care **TCC component:** automatic SMS appointment reminders **Control**: usual PHC antenatal care using paper medical records and registries **Co-interventions**: management of anaemia, hypertension, gestational diabetes and other pregnancy-related problems
Outcomes	1. Providers' (nurses, midwives, and doctors) adherence to recommended practice, guidelines, or protocols (screening and management of anaemia, diabetes, hypertension and abnormal foetal growth) 2. Quality of data (completeness of data collected) 3. Clients' utilisation of PHC and/or service health status (attended all routine antenatal care visits) 4. Patients'/clients' health status and well-being (adverse pregnancy outcome, moderate or severe anaemia, severe hypertension, large-for-gestational-age baby, small-for-gestational-age baby undetected before delivery, malpresentation at delivery undetected before delivery) **Outcome assessment time points**: first antenatal visit, antenatal contact at 16 weeks, 18 to 22 weeks, 32 weeks, 36 weeks, after completion of the pregnancy
Notes	**Funding**: European Research Council and Research Council of Norway **Conflicts of interest**: all authors were funded by grants from the European Research Council (Consolidator Grant, grant number 617639) and the Research Council of Norway (Globvac Grant, grant number 234376; and National Center of Research Excellence Grant, grant number 223269). The authors also declared non-financial support from the Centre for Intervention Science in Maternal and Child Health (CISMAC), University of Bergen, Norway. **Trial registry ID:** ISRCTN18008445

Risk of bias

Bias	Authors' judgement	Support for judgement

Venkateswaran 2022 *(Continued)*

Random sequence generation (selection bias)	Low risk	A statistician at the Centre for Intervention Science in Maternal and Child Health (CISMAC), University of Bergen, Norway, who was not involved in other trial activities did the randomisation.
Allocation concealment (selection bias)	Low risk	The codes were provided to the statistician as allocation groups (intervention and control for each set) after completion of analyses.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Neither the healthcare providers nor the registry staff who digitised the paper-based records could be masked to the allocation due to the nature of the intervention.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Neither the healthcare providers nor the registry staff who digitised the paper-based records could be masked to the allocation due to the nature of the intervention.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	We used Little's tests of the null hypotheses that missing values of the constituent outcomes were jointly missing completely.
Selective reporting (reporting bias)	Unclear risk	No data presented on blood pressure, haemoglobin, urine glucose test at booking visit, and foetal presentation as background characteristics since they are potentially dependent on the intervention
Other bias	Unclear risk	Potential documentation bias for foetal growth

Yan 2021

Study characteristics	
Methods	**Aim**: to determine whether a primary care-based integrated mobile health intervention (SINEMA intervention) can improve stroke management in rural China **Study design**: cluster-randomised controlled trial **Cluster features**: villages **Recruitment**: village doctors screened and invited potentially eligible patients in their villages to participate in the study. The research team conducted the final recruitment and consent process. **Study dates**: June 2017 to December 2019
Participants	**Inclusion criteria**: eligible clusters were villages with a minimum population size of 1500 and at least one village doctor who was willing to participate. Patient inclusion criteria were adults with a history of stroke diagnosed at the county or higher-level hospitals and in a clinically stable condition with at least basic communication ability. **Sample size**: villages N = 50; village doctors N = 50; patients N = 1299 **Age**: village doctors: mean age = 46.0 years; patients: mean age = 65.6 years **Sex**: village doctors: 16% female; patients: 42.6% female **Country**: China **Setting**: rural region of Hebei Province, Northern China
Interventions	**Intervention**: Digital tracking + TCC

Yan 2021 *(Continued)*

	SINEMA App — for providers linked with a voice message system for patients **Digital tracking component:** village doctors can collect, record, and retrieve patients' information and follow-up history using the Sinema App; physicians from upper-tier hospitals can review the records and monitor village doctors' performance. With the assistance of the SINEMA App, during each monthly follow-up visit, village doctors collected information about participants' health conditions, medication use, blood pressure level, etc. and provided health education to participants on medication adherence and physical activity. **TCC component:** the digital health system was linked with a third-party dispatching platform and a message bank containing more than 180 messages that we co-designed with clinical experts and local healthcare providers. These messages followed the same structure, were recorded in the local dialect, and were dispatched daily with different contents to participants. **Control**: usual care: villages in the control arm continue their usual practice without the introduction of the SINEMA activities described above. For the villages in the control arm, there were no specific healthcare services focused on stroke patients. Village doctors provided both clinical services (including but not limited to blood pressure tests and medicine prescriptions based on the needs of patients when patients walked into the clinic) and basic public health services (including four follow-up visits per year amongst people with hypertension and diabetes as required by the government).
Outcomes	1. Patient/Client health behaviour (medication adherence to anti-platelet, antihypertensive and statin therapies) 2. Patients'/clients' health status and well-being (change in systolic blood and diastolic blood pressure, health-related quality of life score, physical activity, timed up-and-go test time; stroke recurrence; stroke hospitalisation; moderate-to-severe disability, mortality) **Outcome assessment time points**: baseline, 12 months
Notes	**Funding**: United Kingdom Medical Research Council, Economic and Social Research Council, Department for International Development, and Wellcome Trust **Conflicts of interest**: the authors have declared that no competing interests exist. **Trial registry ID:** NCT03185858

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A biostatistician who was not part of the study performed the randomisation using a computer-generated random numbering system.
Allocation concealment (selection bias)	Low risk	Randomisation allocation was not revealed to any staff during patient recruitment and assessment. Village doctors were informed only after patients' baseline assessments were completed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Given the nature of the intervention, patients and health providers were not blinded to the intervention assignment.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors were kept unaware of the trial protocol and blinded throughout the study period to ensure the objectivity of assessment. Statisticians who were masked to intervention allocation conducted all statistical analyses, and allocation status was not revealed until all results were generated.
Incomplete outcome data (attrition bias)	Unclear risk	After excluding those who died during the follow-up (n = 30, 2.3%) or lost to follow-up (n = 43, 3.3%), the final analyses included 1226 participants.

Yan 2021 *(Continued)*

All outcomes

Selective reporting (reporting bias)	Low risk	All outcomes listed in the protocol were fully reported.
Other bias	Low risk	Outcomes listed in the protocol were fully reported.

AAP: American Academy of Pediatrics
AIDS: acquired immunodeficiency syndrome
AMPATH: Academic Model Providing Access to Health Care
ANC: antenatal care
ART: antiretroviral therapy
ASHAs: accredited social health activists
AWC: Anganwadi centre
AWW: Anganwadi worker
BP: blood pressure
CAS: Common Application Software
CDSS: clinical decision support systems
CHC: community health centre
CHNW: community health and nutrition workers
COMBIND: The 'COMmunity Home Based INDia (COMBIND)' study
CVD: cardiovascular disease
DNA PCR: deoxyribonucleic acid polymerase chain reaction
DBP: diastolic blood pressure
EPI: Expanded Programme on Immunization
EUC: enhanced usual care
HbA1c: haemoglobin A1c/glycosylated haemoglobin
HCW: healthcare worker
HIV: human immunodeficiency virus
ICDS(CAS): Integrated Child Development Services (Common Application Software)
ICMR: Indian Council of Medical Research
ICTC: Integrated Counselling and Testing Centre
ICT-CSS: information and communication technology (ICT) continuum of care services (CCS)
IFA: iron folic acid tablets
ImTeCHO: Innovative Mobile-phone Technology for Community Health Operations
IT: Information technology
JSK: The National Population Stabilization Fund (Jansankhya Sthirata Kosh or JSK) scheme
MNCH: Maternal, Newborn, and Child Health
MP: Madhya Pradesh (India)
mTIKA: name of an Android and web-based software used by the Bangladesh Expanded Programme on Immunization
NA: not available
NCD: non-communicable diseases
NGO: non-governmental organization
ORW: outreach worker
PHC: primary health care
PMTCT: prevention of mother-to-child transmission (for HIV)
PNC: postnatal care
NPCDCS: National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke
PSM: propensity score matching
SBP: systolic blood pressure
SD: standard deviation
SE: standard error
SMS: short message service
SOC: standard of care
TCC: targeted client communication
T-HIT: Tanzania Health Information Technology
WHO: World Health Organization

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abdel-Kader 2011	Ineligible intervention: not accessible by or primarily used via mobile device
Abidi 2018	Ineligible intervention: no digital tracking by provider
Adams 2014	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Adams 2016	Ineligible intervention: not a tracking intervention
Adjei 2015	Ineligible setting: not delivered in primary care settings
Andersson 2013	Ineligible intervention: medical records were not accessible by or primarily used via mobile device
Arbogast 2017	Ineligible intervention: no tracking on a mobile device
Atlas 2011	Ineligible intervention: no digital tracking on a mobile device
Atlas 2014	Ineligible intervention: no digital tracking on a mobile device
Atreja 2016	Ineligible setting: not in primary care
Baer 2015	Ineligible intervention: no digital tracking on a mobile device
Bailey 2016	Ineligible intervention: no digital tracking on a mobile device
Bajaj 2016	Ineligible intervention: tracking (e-diary) performed by caregivers (not by health workers)
Bell 2010	Ineligible intervention: no digital tracking on a mobile device
Beratarrechea 2019	Ineligible intervention: no digital tracking on a mobile device. The only function available at the time of the study was appointment scheduling (we confirmed with the author that the intervention's digital tracking capability was not available when the trial was conducted).
Biemba 2020	Outcomes were not relevant for this review.
Billah 2022	Ineligible comparator: the effectiveness of digital tracking was not evaluated as both arms of the trial had digital tracking.
Bloomfield 2005	Ineligible intervention: no digital tracking on a mobile device
Bobrow 2016	Ineligible intervention: no digital tracking on a mobile device
Borbolla 2007	Ineligible intervention: no digital tracking on a mobile device
Bourgeois 2010	Ineligible intervention: no digital tracking on a mobile device
Bowman 2015	Ineligible intervention: targeted clinical communication with no mobile digital tracking
Castillo 2019	Ineligible intervention: tracking + telemonitoring
Dregan 2014	Ineligible intervention: no digital tracking on a mobile device
Feldstein 2006a	Ineligible intervention: no digital tracking on a mobile device

Study	Reason for exclusion
Feldstein 2006b	Ineligible intervention: no digital tracking on a mobile device
Fiks 2009	Ineligible intervention: no digital tracking on a mobile device
Fiks 2013	Ineligible intervention: no digital tracking on a mobile device
Forrest 2013	Ineligible intervention: no digital tracking on a mobile device
Fricton 2011	Ineligible intervention: no digital tracking on a mobile device
Gill 2011	Ineligible intervention: no digital tracking on a mobile device
Gill 2012	Ineligible intervention: no digital tracking on a mobile device
Grant 2015	Ineligible intervention: no digital tracking on a mobile device
Gupta 2014	Ineligible intervention: no digital tracking on a mobile device
Holbrook 2011	Ineligible intervention: no digital tracking on a mobile device
Hsu 2013	Ineligible intervention: no digital tracking on a mobile device
Lim 2011	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Lim 2016	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Lim 2019	Ineligible intervention: no digital tracking on a mobile device
Lo 2007	Ineligible intervention: no digital tracking on a mobile device
Lokman 2015	Ineligible intervention: not a health provider intervention
Luo 2019	Ineligible setting: not in primary care
Mann 2012	Ineligible intervention: no digital tracking on a mobile device
Martins 2017	Ineligible intervention: no digital tracking on a mobile device
McGinn 2013	Ineligible intervention: no digital tracking on a mobile device
McKinstry 2013	Ineligible intervention: not a health provider intervention
McNabb 2015	Ineligible study design: pre-post study without any control group
Mekonnen 2019 (excl)	Ineligible intervention: mobile text reminders only with no digital tracking
Miloh 2016	Ineligible setting: not in primary care
O'Connor 2011	Ineligible intervention: no digital tracking on a mobile device
Orrell 2015	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Park 2012	Ineligible setting: not a primary care intervention
Quinn 2009	Ineligible intervention: no direct face-to-face provider-client service delivery interaction

Study	Reason for exclusion
Quinn 2012	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Quinn 2014	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Redfern 2020	Ineligible intervention: the provider side of the intervention was not mobile (integrated consumer-directed e-health portal vs. usual care)
Robbins 2012	Ineligible intervention: not accessible by or primarily used via mobile device
Santero 2018	Ineligible study design: uncontrolled pre-post study
Sarrasst 2021	Ineligible intervention: no digital tracking on a mobile device
Sequist 2005	Ineligible intervention: not accessible by or primarily used via mobile device
Sequist 2012	Ineligible intervention: not accessible by or primarily used via mobile device
Shah 2012	Ineligible intervention: not a digital tracking intervention
Shaikh 2015	Ineligible intervention: not accessible by or primarily used via mobile device
Shelley 2011	Ineligible intervention: not accessible by or primarily used via mobile device
Shrestha 2019	Ineligible intervention: not mobile tracking (technology device-enabled care)
Silveira 2019	Ineligible study design: app development and field study; no comparison group
Singh 2020	Ineligible intervention: no digital tracking: female community health volunteer capacity building followed by regular supervision and monitoring and mobile phone text messaging to expectant mothers
Sumayya 2021	Ineligible setting: not conducted in a primary care setting
Szilagyi 2015	Ineligible intervention: not accessible by or primarily used via mobile device
Tajmir 2017	Ineligible setting: not conducted in primary care
Tamblyn 2010	Ineligible intervention: not accessible by or primarily used via mobile device
Tang 2012	Ineligible intervention: not accessible by or primarily used via mobile device
Taveras 2013	Ineligible intervention: not accessible by or primarily used via mobile device
Taveras 2017	Ineligible intervention: not accessible by or primarily used via mobile device
Tian 2015	Ineligible intervention: not a digital tracking intervention
Vollmer 2014	Ineligible intervention: not accessible by or primarily used via mobile device
Weingart 2013	Ineligible intervention: no direct face-to-face provider-client service delivery interaction
Westgard 2019	Ineligible study design: only one cluster per arm
Wu 2015	Ineligible intervention: no direct face-to-face provider-client service delivery interaction

Study	Reason for exclusion
Zurovac 2011	Ineligible intervention: no digital tracking
Zurovac 2012	Ineligible intervention: no digital tracking

Characteristics of ongoing studies *[ordered by study ID]*

Bassi 2022

Study name	
Methods	Cluster-randomised trial in 16 villages/peri-urban areas in Andhra Pradesh and Haryana
Participants	Primary healthcare physicians, non-physician health workers (such as the accredited social health activists [ASHA] and non-pregnant community participants (villagers)
Interventions	Mobile clinical decision-support system for identification and management of individuals with diabetes in primary care settings
Outcomes	Difference in HbA1c (glycosylated haemoglobin) measured at baseline and end-line between the two study arms
Starting date	Recruitment was carried out between January and August 2019 in Guntur and between August 2019 and January 2020 in Rohtak.
Contact information	Vivekanand Jha The George Institute for Global Health, 308-309, Third Floor, Elegance Tower, Plot No. 8, Jasola District Centre, New Delhi, 110025, India
Notes	The IMPACT diabetes study is funded by the European Foundation for the Study of Diabetes/Sanofi Collaborative Programme.

Bates 2018

Study name	Evaluating the impact of Marie Stopes International's digital family planning counselling application on the uptake of long-acting and permanent methods of contraception in Vietnam and Ethiopia: a study protocol for a multi-country cluster-randomised controlled trial
Methods	Cluster-randomised controlled trial
Participants	Women of reproductive age 18 to 49 years
Interventions	**Digital tracking + CDSS** Digital Counselling Application (DCA), a job aid for use by the provider during client family planning counselling. It is a tablet application that assists providers during counselling sessions to guide their clients through the process of making a decision about which contraceptive method best fits their lifestyle and needs. The application gathers basic information on the client, their medical eligibility and their lifestyle. Based on this information, the app provides a list of recommended methods based on the information provided, with those best fitting the clients' responses listed at the top
Outcomes	Primary outcome measures

Bates 2018 *(Continued)*

	1. Uptake of long-acting and permanent contraceptive methods (LAPM) measured via telephone questionnaire with client within one day of counselling 2. Client satisfaction (scaled), measured via telephone questionnaire with client within one day of counselling
Starting date	June 2016
Contact information	Laura Bates: The Nuffield Centre for International Health & Development, Leeds Institute of Health Sciences, Level 10 Worsley Building, Clarendon Way, Leeds, LS2 9NL, United Kingdom Emily Robinson: Emily.Robinson@mariestopes.org
Notes	Trial registration: ISRCTN11040557

Blanchet 2016

Study name	A mixed-methods protocol to evaluate the effect and cost-effectiveness of an Integrated electronic Diagnosis Approach (IeDA) for the management of childhood illnesses at primary health facilities in Burkina Faso
Methods	Stepped-wedge cluster-randomised trial
Participants	Children aged under five years old who attend the health centre for consultation at the day of the visit of the researchers
Interventions	**Digital tracking + CDSS**: integrated ediagnostic approach (IeDA) **Control**: standard care
Outcomes	Adherence to guidelines, correct disease classification and prescription
Starting date	September 2014
Contact information	Karl Blanchet, karl.blanchet@lshtm.ac.uk
Notes	**Trial registry ID**: NCT02341469; last update posted 11 January 2018

CTRI/2019/12/022435

Study name	Development and impact of healthcare decision-support system on treatment outcomes of patients with diabetes and hypertension in a peri-urban community
Methods	Randomised, parallel-group trial
Participants	Adults in the catchment area of the Urban Health and Training Centre (UHTC) in Indira Colony with diabetes or hypertension
Interventions	A digital health intervention for tracking patients with diabetes or hypertension with decision support and targeted client communication
Outcomes	HbA1c, blood pressure
Starting date	Date of first enrolment: 20 December 2019

CTRI/2019/12/022435 *(Continued)*

Contact information	Dr MV Saraswathi: drsmv.tmc@gmail.com
Notes	Trial registry last updated 13 December 2019

Gong 2019

Study name	System-integrated technology-enabled model of care to improve the health of stroke patients in rural China
Methods	Cluster-randomised controlled trial
Participants	Stroke survivors in Nanhe county, a rural area of Hebei province, China
Interventions	Digital tracking with clinical decision support and targeted client communication Village doctors in the intervention arm (1) receive systematic cascade training by stroke specialists on clinical guidelines, essential medicines and behaviour change; (2) conduct monthly follow-up visits with the support of a mobile phone application designed for this study; (3) participate in virtual group activities with other village doctors; 4) receive performance feedback and payment Stroke survivors participate in a health education and project briefing session, receive monthly follow-up visits by village doctors and receive a voice message call daily as reminders for medication use and physical activities
Outcomes	Primary outcome: systolic blood pressure
Starting date	23 June 2017
Contact information	Principal Investigator: Lijing L Yan, Duke Kunshan Unviersity: Lijing.yan@duke.edu
Notes	Trial registration: ClinicalTrials.gov NCT03185858 (last updated 17 September 2020)

Green 2015

Study name	Do clinical decision-support reminders for medical providers improve isoniazid preventative therapy prescription rates among HIV-positive adults?
Methods	Randomised controlled trial
Participants	HIV-positive patients ≥ 16 years; HIV care clinics
Interventions	**Digital tracking + CDSS** The intervention to be studied involves providing clinic-based medical care providers (e.g. nurses, clinical officers, medical officers, consultants) with patient-specific clinical reminders regarding TB that are generated from a patient's electronic medical record and based on accepted clinical algorithms for TB screening and treatment.
Outcomes	Primary outcome measures: 1. Prescription of isoniazid within three months of patient's initial encounter Secondary outcome measures: 1. Time to isoniazid prophylactic therapy (IPT) initiation

Green 2015 *(Continued)*

	2. Initiation of isoniazid prophylactic therapy (IPT) 3. Isoniazid prophylactic therapy (IPT) completion
Starting date	April 2014
Contact information	Paul Biondich: : pbiondic@regenstrief.org
Notes	Trial registration: NCT01934309 (last updated 23 March 2023)

Lejone 2020

Study name	Peer-educator-coordinated vs nurse-coordinated ART refill for adolescents and young adults living with HIV in Lesotho (PEBRA)
Methods	Cluster-randomised, open-label, superiority trial
Participants	Adolescents and young people living with HIV in three districts of Lesotho, Southern Africa
Interventions	Tracking with targeted client communication using the PEBRA model and PEBRApp
Outcomes	Primary outcome: viral suppression at 12 months
Starting date	4 November 2019
Contact information	Alain Amstutz: Department of Medicine, Clinical Research Unit, Swiss Tropical and Public Health Institute, Socinstrasse 57, 4051, Basel, Switzerland
Notes	Clinial trial registation: NCT03969030 (last updated 2 June 2021)

Lygidakis 2019

Study name	Community- and mHealth-based integrated management of diabetes in primary healthcare in Rwanda (D^2Rwanda): the protocol of a mixed-methods study including a cluster-randomised controlled trial
Methods	Cluster-randomised controlled trial
Participants	Adult patients (male and female) aged between 21 and 80 years with diabetes
Interventions	Home-Based Care Practitioners (HBCPs) programme HBCPs will actively encourage the use of a mobile app by assisting patients to access it (this process is known as "facilitated access"). The app will enable: (i) the registration of measurements, such as blood glucose and weight; (ii) the registration of concerns and questions in a diary; (iii) the reception of alerts and notifications for appointments at the health facilities, and; (iv) access to advice on lifestyle improvement and other patient educational material.
Outcomes	Primary outcome measures: 1. Change in HbA1c Secondary outcomes: 1. Medication adherence

Lygidakis 2019 *(Continued)*

	2. Number of dropouts and lost appointments 3. Mortality, number of complications, number of referrals 4. Health literacy 5. Health-related quality of life (HRQoL) 6. Diabetes-related distress 7. Percentage of patients with at least one measurement of: HbA1c, fasting blood glucose (FBG) levels, creatinine, urine proteins, blood pressure, body mass index (BMI) 8. FBG, creatinine, urine proteins, blood pressure, BMI 9. Number of smokers, number of cigarettes per day, alcohol intake per week
Starting date	January 2019
Contact information	Dr Charilaos Lygidakis: charilaos.lygidakis@uni.lu
Notes	Trial registration: NCT03376607 (last updated 21 February 2021)

Morkrid 2021

Study name	eRegCom: communication strategies to healthcare providers and women from an electronic maternal and child health registry – a cluster-randomised controlled trial
Methods	Cluster-randomised controlled trial
Participants	Health workers and pregnant women receiving antenatal care in primary healthcare clinics in the West Bank and Gaza strip, Palestine
Interventions	Participating clinics are randomly allocated to one of four groups: Group 1: continues to use standard care: an MCH eRegistry that provides interactive checklists with clinical decision support Group 2: women who are attending antenatal care also receive SMS messages from the clinic throughout their pregnancy and six weeks postpartum to remind them of appointments and improve their healthcare-seeking behaviour Group 3: healthcare providers receive performance feedback for 12 months Group 4: clinics receive both the interventions described above. Information is collected from the MCH eRegistry monthly.
Outcomes	The proportion of women who receive appropriate screening and management for anaemia, hypertension, and diabetes; and the proportion of all timely routine ANC visits that a woman was eligible for, where the woman attended
Starting date	1 December 2019
Contact information	Dr J. Frederik Frøen: frederik.froen@fhi.no
Notes	Trial registration: ISRCTN Registry, ISRCTN10520687 (last updated 18 January 2023)

Nagraj 2023

Study name	SMARThealth pregnancy: feasibility & acceptability of a complex intervention for high-risk pregnant women in rural India
Methods	Unblinded, parallel-group, cluster-randomised controlled study design
Participants	Pregnant women with cardiometabolic disease in Jhajjar District, Haryana and Guntur district, Andhra Pradesh, India
Interventions	Mobile clinical decision-support system for high-risk pregnant women in rural India (SMARThealth pregnancy)
Outcomes	Primary outcome: The primary objective of this pilot study is to address the uncertainties around feasibility: (i) how many Primary Health Centres (PHCs) accepted the invitation to participate in a trial; (ii) whether the intervention is feasible with respect to participant recruitment rates, (iii) retention of pregnant women in the trial to six weeks postpartum; (iv) acceptability and feasibility of outcome measures (to measure the efficacy within a definitive trial); (v) fidelity to the study protocol Secondary outcomes: (i) Acceptability of the intervention (ii) Process evaluation measures including rates of detection, referral and follow-up of high-risk pregnant women (iii) Clinical outcomes of mean haemoglobin and mean systolic and diastolic blood pressures at six weeks postpartum
Starting date	
Contact information	
Notes	Trial registration: www.ClinicalTrials.gov, identifier: NCT03968952 (last updated 4 November 2020) Pilot trial results only - awaiting full trial

NCT02909179

Study name	Measuring the impact of a mobile health system to support healthy pregnancies and improve newborn survival
Methods	Randomised controlled trial
Participants	Pregnant women
Interventions	**Digital tracking + CDSS + TCC**: mCARE-II: provides guided client enumeration and follow-up support to community health workers, automated workflow scheduling, risk assessment, client prioritisation and stratification and client-based demand generation messaging **Control:** standard care
Outcomes	Neonatal mortality, perinatal mortality
Starting date	June 2016

NCT02909179 *(Continued)*

Contact information	Alain B Labrique, PhD, MHS, MS: alabriqu@gmail.com; Kelsey L Zeller, MSPH: zeller.kelsey@gmail.com
Notes	Trial registration: NCT02909179 (last updated 13 July 2023)

NCT03189004

Study name	Assessing the impact of mobile phone technology to improve health nutrition and population (HNP) service utilisation in rural Bangladesh through pilot intervention
Methods	Non-randomised
Participants	Mothers of children aged 0 to 23 months
Interventions	Impact of mobile phone technology to improve the health, nutrition and population (HNP) service utilisation in rural Bangladesh: identification and registration of pregnant women and services for them; birth notification; childhood vaccination services under EPI; newly married couple identification; e-referral; e-monitoring
Outcomes	ANC coverage, PNC coverage, contraceptive prevalence rate, EPI coverage
Starting date	April 2016
Contact information	Jasim Uddin PhD, jasim@icddrb.org; Tuhin Biswas, MPH, tuhin.biswas@icddrb.org
Notes	Trial registration: NCT03189004 (last updated 11 February 2022)

NCT05511701

Study name	Preventing ischaemic heart disease with mHealth (mobile health), electronic decision support and community health workers (PRIMECare)
Methods	Cluster-randomised controlled trial
Participants	Adults aged 40 to 74 years with high CVD risk living in the catchment area of 18 primary care clinics (PCCs) in three different provinces (Quilmes, La Rioja, and San Juan) in Argentina
Interventions	Tracking with clinical decision support and targeted client communication Participants who reside in the catchment area of intervention primary care clinics (PCCs) will receive the multi-component intervention with a central data management system linking digital mHealth (mobile health) screening tool for CHWs, electronic appointment scheduling, which is integrated with the clinic's electronic appointment system, point-of-care testing (POCT) for lipids, clinical decision support for medication initiation, and an SMS reminder system for adherence to medications and lifestyle changes, while participants who reside in the catchment area of usual care PCCs will receive usual care with paper-based guidelines used by community health workers and providers.
Outcomes	Primary outcome: Difference in mean change in absolute CVD risk, calculated using the Framingham cardiovascular disease lab-based risk equation, between study arms at 12 months Secondary outcomes:

NCT05511701 *(Continued)*

	• The difference between study arms at 12 months in the mean change in LDL-C, systolic BP, smoking rates, medical costs, medication possession, medication intensity, adverse drug reactions to statins and antihypertensives, QALY • Number of hospitalisations, emergency room visits, outpatient visits and procedures, and primary care clinic visits • Number of deaths from all causes
Starting date	14 October 2022
Contact information	Name: Shafika Abrahams-Gessel, AB Phone number: 6174324385 Email: sabraham@hsph.harvard.edu
Notes	

Peiris 2016

Study name	Systematic medical assessment, referral and treatment for diabetes care in China using lay family health promoters: protocol for the SMARTDiabetes cluster- randomised controlled trial
Methods	Cluster randomised controlled trial
Participants	People with type 2 diabetes
Interventions	SMARTDiabetes mobile health management system
Outcomes	Primary outcome: patients achieving ≥ 2 "ABC" goals (HbA1c < 7.0 %, blood pressure < 140/80 mmHg and LDL cholesterol < 100 mg/dL or 2.6 mmol/L) at the end of follow-up
Starting date	August 2017
Contact information	Puhong Zhang, zpuhong@georgeinstitute.org.cn
Notes	Trial registration: NCT02726100 (last updated 12 March 2021)

Velen 2022

Study name	Harnessing new mHealth technologies to Strengthen the Management of Multidrug-Resistant Tuberculosis in Vietnam (V-SMART trial): a protocol for a randomised controlled trial
Methods	Randomised controlled trial
Participants	Males and females > 15 years with bacteriologically confirmed pulmonary and/or extrapulmonary rifampicin resistant (RR) or multidrug-resistant (MDR)-TB
Interventions	Patients randomised into the intervention arm, in addition to standard care practices, will have a mobile application downloaded onto their smartphones to support their treatment journey. Patients who do not have a smartphone will be loaned one as part of the study. The application was specifically designed for the study and will allow patients direct communication with their designated healthcare worker and provide a platform to report their medication adherence and identification of potential treatment adverse events on a daily basis. The application will also allow healthcare workers to support patients through direct messaging and communicating selected

Velen 2022 *(Continued)*

	treatment monitoring indicators as they become available, directly on the application. The application is intended to provide a 'bridge' for communication between patients and healthcare workers outside their routine visits; this will allow for more prompt identification of treatment adherence problems or investigation of potential adverse events, ultimately improving successful treatment outcomes. Patients will be encouraged to use the App daily for the duration of their treatment (8 to 11 months for short regimen or 18 to 20 months on long regimen).
Outcomes	Treatment success - the proportion of randomised patients with treatment success (defined as treatment completion and/or bacteriological cure) after 24 months
Starting date	1 July 2020
Contact information	Dr Kavindhran Velen: Kavi.velen@sydney.edu.au
Notes	Trial registration: ACTRN12620000681954 (last updated 22 June 2020)

Venkateshmurthy 2018

Study name	m-Power Heart Project - a nurse-care coordinator-led, mHealth-enabled intervention to improve the management of hypertension in India: study protocol for a cluster-randomised trial
Methods	Parallel-group, cluster-randomised trial with the community health centre (CHC) as the unit of randomisation
Participants	Inclusion criteria: 1. Age ≥ 30 years 2. On treatment for hypertension or opportunistically screened and diagnosed with hypertension, with a blood pressure of ≥ 160/90 mmHg 3. With or without comorbidities (diabetes mellitus, left ventricular hypertrophy, chronic kidney disease, heart failure, coronary artery disease, and peripheral vascular disease)
Interventions	An electronic decision support system (EDSS) used by a trained nurse-care coordinator (NCC)
Outcomes	Primary outcome: Difference in the mean change of SBP, from baseline to 12 months, between the intervention and enhanced care arms Secondary outcome(s): • Difference in the mean change from baseline to 12 months between the intervention and enhanced care arms in: DBP, fasting blood sugar, glycated haemoglobin (HbA1C), blood urea and serum creatinine, eGFR and albumin to creatinine ratio • Difference in the proportion of patients from baseline to 12 months between the intervention and enhanced care arms in controlled blood pressure (< 140/90 mmHg), albuminuria (urine albumin to creatinine ratio > 30 mg/g), visiting the CHC regularly (number of actual visits to the CHC/number of visits suggested by the EDSS > 80%), compliance to antihypertensive medication/s • Cost-effectiveness of the intervention compared to standard treatment • All outcomes will be assessed at the end of the intervention, i.e. 12 months.
Starting date	6 April 2017
Contact information	Dorairaj Prabhakaran Public Health Foundation of India, Plot 47, Sector 44, Gurgaon, India

Venkateshmurthy 2018 (Continued)	
	Center for Chronic Disease Control, C-1/52, 2nd Floor, Safdarjung Development Area, New Delhi, India
Notes	Trial registration: ClinicalTrials.gov: NCT03164317 (last updated 29 July 2021)

ANC: antenatal care
ART: antiretroviral therapy
ASHA: accredited social health activists
BMI: body mass index
BP: blood pressure
CDSS: clinical decision support systems
CHW: community health worker
CVD: cardiovascular disease
DBP: diastolic blood pressure
DCA: Digital Counselling Application
EDSS: electronic decision support system
eGFR: estimated glomerular filtration rate
EPI: Expanded Programme on Immunization
FBG: fasting blood glucose
HbA1c: haemoglobin A1c/ glycosylated haemoglobin
HBCP: Home-Based Care Practitioners
HIV: human immunodeficiency virus
HNP: health, nutrition and population
HRQoL: health-related quality of life
IeDA: Integrated electronic Diagnosis Approach
IPT: isoniazid prophylactic therapy
LAPM: long-acting and permanent contraceptive methods
LDL(-C): low density lipoprotein cholesterol
mCARE II: a digital health intervention package, specifically a second phase of the mCARE system, aimed at improving maternal and newborn health outcomes in Bangladesh through a mobile-based approach
MCH: maternal and child health
MDR: multidrug-resistant
NCC: nurse-care coordinator
PCC: primary care clinic
PEBRA: Peer Educator-Based Refill of ART
PHC: Primary Health Centre
PNC: Post-natal care
POCT: point-of-care testing
PRIMECare: 'Preventing ischaemic heart disease with mHealth (mobile health), electronic decision support and community health workers'
QALY: quality-adjusted life year
RR: rifampicin resistant
SBP: systolic blood pressure
SMARTDiabetes:
SMS: short message service
TB: tuberculosis
TCC: targeted client communication
UHTC: Urban Health and Training Centre
V-SMART: Strengthen the Management of Multidrug-Resistant Tuberculosis in Vietnam (V-SMART trial)

DATA AND ANALYSES

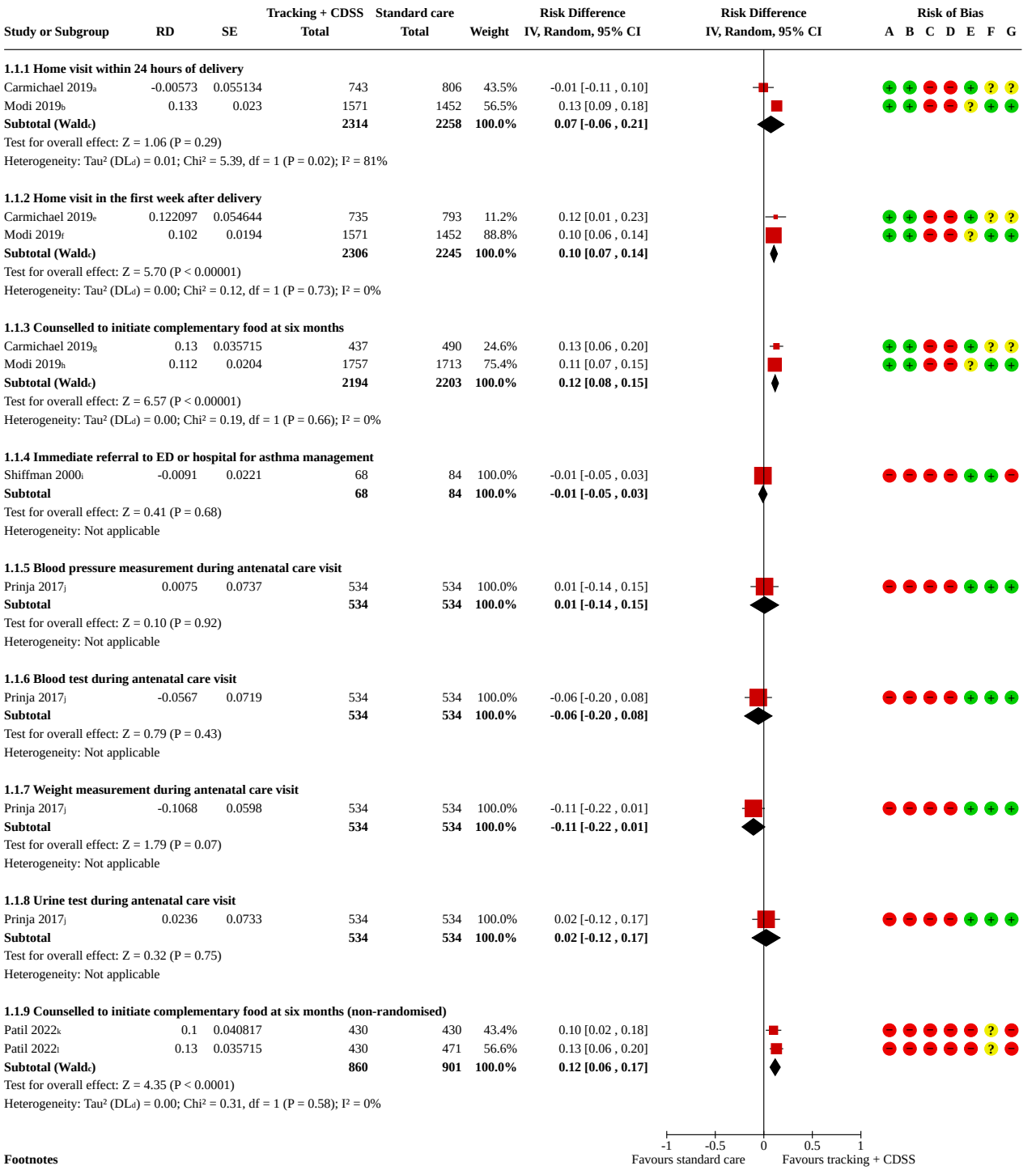
Comparison 1. Tracking with clinical decision support compared to standard care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Provider adherence to recommended practice (dichotomous outcomes)	5		Risk Difference (IV, Random, 95% CI)	Subtotals only
1.1.1 Home visit within 24 hours of delivery	2	4572	Risk Difference (IV, Random, 95% CI)	0.07 [-0.06, 0.21]
1.1.2 Home visit in the first week after delivery	2	4551	Risk Difference (IV, Random, 95% CI)	0.10 [0.07, 0.14]
1.1.3 Counselled to initiate complementary food at six months	2	4397	Risk Difference (IV, Random, 95% CI)	0.12 [0.08, 0.15]
1.1.4 Immediate referral to ED or hospital for asthma management	1	152	Risk Difference (IV, Random, 95% CI)	-0.01 [-0.05, 0.03]
1.1.5 Blood pressure measurement during antenatal care visit	1	1068	Risk Difference (IV, Random, 95% CI)	0.01 [-0.14, 0.15]
1.1.6 Blood test during antenatal care visit	1	1068	Risk Difference (IV, Random, 95% CI)	-0.06 [-0.20, 0.08]
1.1.7 Weight measurement during antenatal care visit	1	1068	Risk Difference (IV, Random, 95% CI)	-0.11 [-0.22, 0.01]
1.1.8 Urine test during antenatal care visit	1	1068	Risk Difference (IV, Random, 95% CI)	0.02 [-0.12, 0.17]
1.1.9 Counselled to initiate complementary food at six months (non-randomised)	1	1761	Risk Difference (IV, Random, 95% CI)	0.12 [0.06, 0.17]
1.2 Provider adherence to recommended practice (continuous outcomes)	1		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.2.1 Number of home visits in first month after delivery	1	3023	Mean Difference (IV, Random, 95% CI)	0.75 [0.47, 1.03]
1.3 Client's health behaviour	3		Risk Difference (IV, Random, 95% CI)	Subtotals only
1.3.1 At least 90 iron-folic acid tablets consumed during pregnancy (RCTs)	2	4576	Risk Difference (IV, Random, 95% CI)	0.03 [-0.01, 0.07]
1.3.2 Early initiation of breastfeeding	2	4576	Risk Difference (IV, Random, 95% CI)	0.08 [0.05, 0.12]
1.3.3 Exclusive breastfeeding for 6 months	2	4340	Risk Difference (IV, Random, 95% CI)	0.09 [-0.02, 0.21]
1.3.4 Bath delayed at least 2 days	1	1500	Risk Difference (IV, Random, 95% CI)	-0.04 [-0.15, 0.08]
1.3.5 Kangaroo Mother Care	1	3023	Risk Difference (IV, Random, 95% CI)	-0.00 [-0.03, 0.03]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.3.6 At least 90 iron-folic acid tablets consumed during pregnancy - non-randomised (Prinja)	1	1068	Risk Difference (IV, Random, 95% CI)	0.13 [0.09, 0.17]
1.3.7 Nothing applied to the umbilical cord	1	1480	Risk Difference (IV, Random, 95% CI)	-0.02 [-0.07, 0.03]
1.3.8 Skin-to-skin care	1	1544	Risk Difference (IV, Random, 95% CI)	0.05 [0.00, 0.10]
1.4 Patient/client health status and well-being (desirable outcomes)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
1.4.1 Improved asthma severity during office visit	1	152	Risk Ratio (M-H, Random, 95% CI)	1.30 [0.96, 1.75]
1.5 Patient/client health status and well-being (undesirable outcomes)	2		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
1.5.1 Stillbirths	1	8230	Risk Ratio (M-H, Random, 95% CI)	0.82 [0.62, 1.08]
1.5.2 Neonatal deaths	1	8230	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.76, 1.30]
1.5.3 Infant deaths	1	8230	Risk Ratio (M-H, Random, 95% CI)	0.96 [0.81, 1.15]
1.5.4 Low birth weight (≤ 2kg)	1	3023	Risk Ratio (M-H, Random, 95% CI)	0.53 [0.38, 0.73]
1.5.5 Pneumonia/fever in the last two weeks	1	3470	Risk Ratio (M-H, Random, 95% CI)	1.13 [1.03, 1.24]
1.5.6 HIV-positive following test	1	658	Risk Ratio (M-H, Random, 95% CI)	0.77 [0.48, 1.24]
1.6 Client utilisation of primary healthcare and/or services (risk ratio)	4		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
1.6.1 Number of HIV tests performed in antenatal women	1	1698	Risk Ratio (M-H, Random, 95% CI)	1.09 [0.97, 1.24]
1.6.2 At least two tetanus injections during pregnancy (RCTs)	1	298	Risk Ratio (M-H, Random, 95% CI)	1.05 [0.98, 1.13]
1.6.3 Emergency department visit within one week of the doctor's office visit for asthma	1	152	Risk Ratio (M-H, Random, 95% CI)	0.11 [0.01, 1.99]
1.6.4 Hospitalisation within one week of the doctor's office visit for asthma	1	152	Risk Ratio (M-H, Random, 95% CI)	0.18 [0.01, 3.35]
1.6.5 At least two tetanus injections during pregnancy (non-randomised) - Prinja	1	1068	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.92, 1.01]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.7 Client utilisation of primary healthcare and/or services (risk difference)	4		Risk Difference (IV, Random, 95% CI)	Subtotals only
1.7.1 Full childhood immunisation (RCTs)	3	4602	Risk Difference (IV, Random, 95% CI)	0.01 [-0.02, 0.05]
1.7.2 Women gave birth in a health facility	2	4834	Risk Difference (IV, Random, 95% CI)	-0.01 [-0.04, 0.02]
1.7.3 Current use of any modern method of contraception	1	1413	Risk Difference (IV, Random, 95% CI)	0.06 [-0.01, 0.14]
1.7.4 Full childhood immunisation (non-randomised) - Prinja	1	2038	Risk Difference (IV, Random, 95% CI)	-0.06 [-0.08, -0.04]
1.8 Client utilisation of primary health care and/or services (odds ratio)	3		Odds Ratio (IV, Random, 95% CI)	Subtotals only
1.8.1 At least three antenatal care visits	2	2535	Odds Ratio (IV, Random, 95% CI)	1.38 [1.32, 1.44]
1.8.2 Women giving birth in a health facility - randomised (Hacket)	1	571	Odds Ratio (IV, Random, 95% CI)	1.96 [1.21, 3.17]
1.8.3 Women giving birth in a health facility non randomised (Prinja, Ilozumba)	2	2536	Odds Ratio (IV, Random, 95% CI)	1.10 [0.66, 1.85]

Analysis 1.1. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 1: Provider adherence to recommended practice (dichotomous outcomes)



Footnotes

[a]At least one home visit within 24 h of delivery, amongst women who had a home delivery. Cluster-RCT adjusted for design effect using ICC = 0.2.
[b]Home visit within 24 hours of delivery (for home delivery) or within 24 hours of return to home from hospital, difference in proportions. Cluster-RCT adjusted for maternal age, education, parity, ca
[c]CI calculated by Wald-type method.
[d]Tau² calculated by DerSimonian and Laird method.
[e]Any visit in the first week. Cluster-RCT adjusted for design effect using ICC = 0.2.
[f]At least two home visits within first week after delivery, difference in proportions. Cluster-RCT adjusted for maternal age, education, parity, caste, poverty, and cluster.
[g]Any home visit related to complementary feeding. Cluster-RCT adjusted for maternal age, household size, whether a woman belonged to a scheduled caste or tribe, literacy, lack of formal education,
[h]Counselled to initiate complementary food at six months. Cluster-RCT adjusted for maternal age, education, parity, caste, poverty, and cluster.
[i]Unadjusted data from non-randomised cluster study.

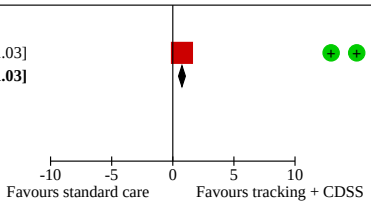
Analysis 1.1. (Continued)

[h]Counselled to initiate complementary food at six months. Cluster-RCT adjusted for maternal age, education, parity, caste, poverty, and cluster.
[i]Unadjusted data from non-randomised cluster study.
[j]Difference in difference (percentage change from baseline). Propensity score matched on religion, caste, occupation of father and education of mother.
[k]Mothers who recalled being counselled about the right time to start complementary feeding by CHNW. Data from Madhya Pradesh. Cluster-RCT matching pairs of intervention-comparison villages
[l]Mothers who recalled being counselled about the right time to start complementary feeding by CHNW. Data from Bihar. Cluster-RCT matching pairs of intervention-comparison villages using the ne

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.2. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 2: Provider adherence to recommended practice (continuous outcomes)

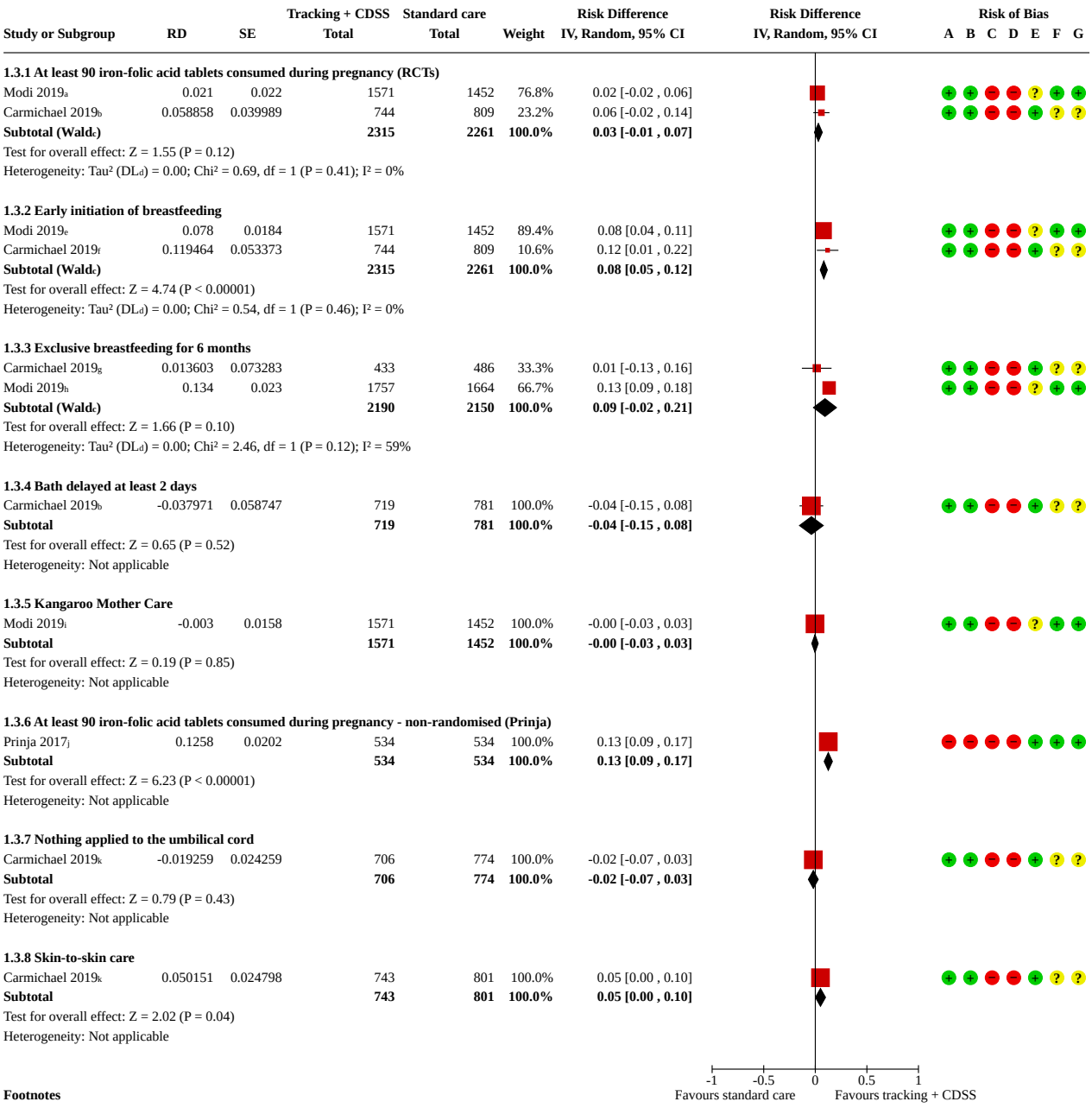
Study or Subgroup	MD	SE	Tracking + CDSS Total	Standard care Total	Weight	Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI	Risk of Bias A B C D E F G
1.2.1 Number of home visits in first month after delivery								
Modi 2019[a]	0.75	0.1429	1571	1452	100.0%	0.75 [0.47 , 1.03]		+ + − − ? + +
Subtotal			**1571**	**1452**	**100.0%**	**0.75 [0.47 , 1.03]**		
Test for overall effect: Z = 5.25 (P < 0.00001)								
Heterogeneity: Not applicable								



Footnotes
[a]Number of home visits in the first month after birth, difference in cluster means. Cluster-RCT adjusted for maternal age, education, parity, caste, poverty, and cluster.

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.3. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 3: Client's health behaviour



Footnotes

[a]Consumed at least 100 iron-folic acid tablets during pregnancy. Adjusted effect size for maternal age, education, parity, caste, and below poverty line card.
[b]Cluster-RCT adjusted for design effect using ICC = 0.2.
[c]CI calculated by Wald-type method.
[d]Tau² calculated by DerSimonian and Laird method.
[e]Early initiation (within 1 hour) of breastfeeding in infants 1-4 months. Estimate adjusted for maternal age, education, parity, caste, and below poverty line card.
[f]Immediate breastfeeding (within 1 hours of delivery). Cluster-RCT adjusted for design effect using ICC = 0.2.
[g]Exclusive breastfeeding for 6 months amongst infants ≥ 6 months. Cluster-RCT adjusted for design effect using ICC = 0.2.
[h]Practiced exclusive breastfeeding until just under 6 months of age. Mothers with infants 6 to 9 months. Estimate adjusted for maternal age, education, parity, caste, and below poverty line card.
[i]Mothers with infants 1-4 months. Estimate adjusted for maternal age, education, parity, caste, and below poverty line card.
[j]≥ 100 iron–folic acid consumption during antenatal care. Propensity score matched sample on religion, caste, occupation of father and education of mother.
[k]Cluster-RCT adjusted for maternal age, household size, whether a woman belonged to a scheduled caste or tribe, literacy, lack of formal education, having a Below Poverty Line (BPL) card (which q

Risk of bias legend

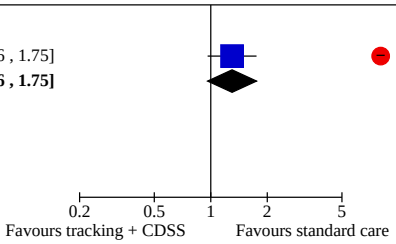
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)

Analysis 1.3. (Continued)

(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.4. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 4: Patient/client health status and well-being (desirable outcomes)

Study or Subgroup	Tracking + CDSS Events	Total	Standard care Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Risk of Bias A B C D E F G
1.4.1 Improved asthma severity during office visit							
Shiffman 2000[a]	41	68	39	84	100.0%	1.30 [0.96 , 1.75]	− − − − + + −
Subtotal		**68**		**84**	**100.0%**	**1.30 [0.96 , 1.75]**	
Total events:	41		39				
Test for overall effect: Z = 1.71 (P = 0.09)							
Heterogeneity: Not applicable							



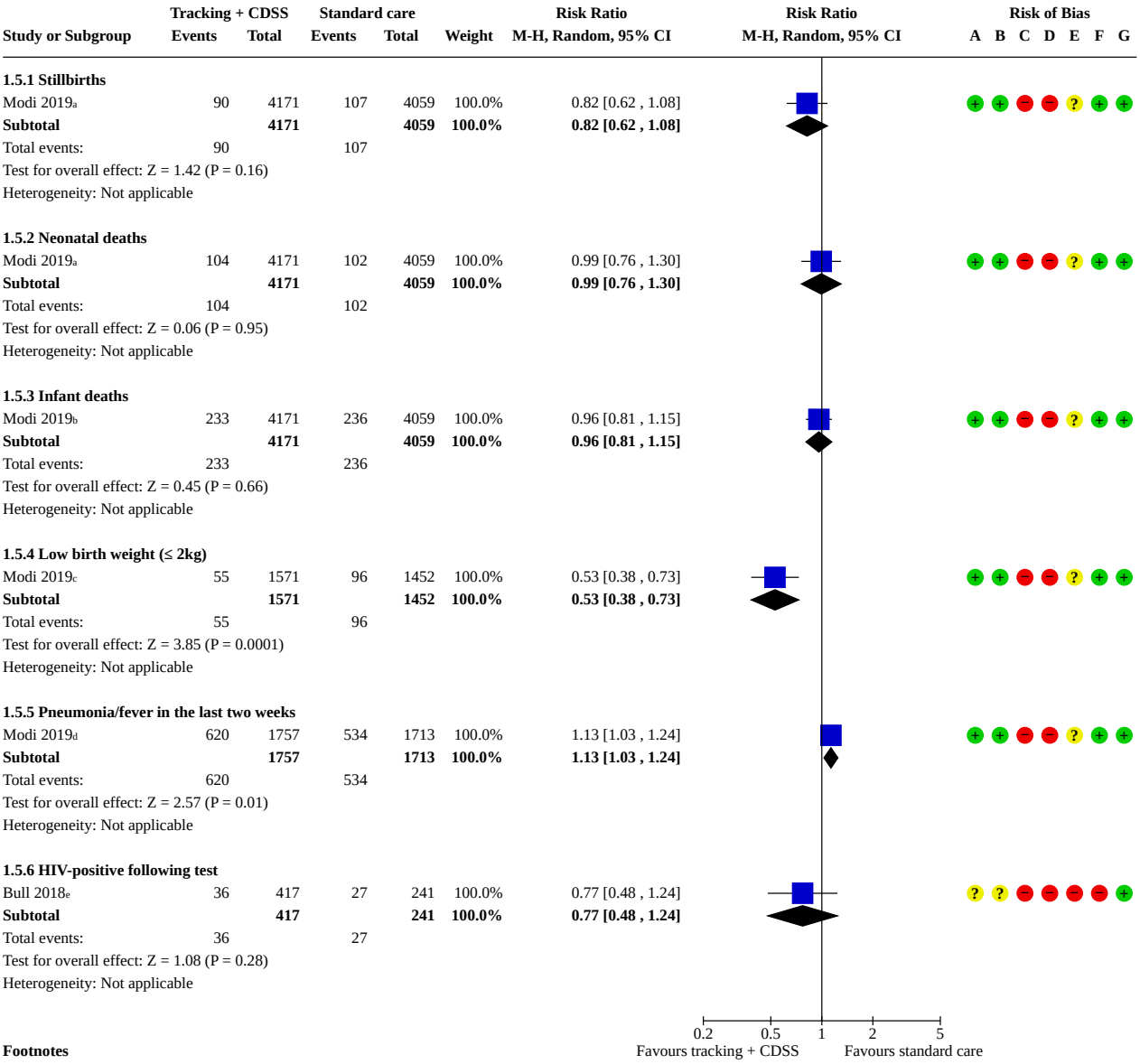
Footnotes

[a]Unadjusted data from non-randomised cluster study.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.5. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 5: Patient/client health status and well-being (undesirable outcomes)



Footnotes

[a]Unadjusted data from cluster-RCT; denominator is the number of live births during one year of study period.

[b]Unadjusted data from cluster-RCT, denominator is the number of live births during one year of study period.

[c]Low birthweight in infants 1-4 months of age. Adjusted risk difference -3.1% (-4.8 to -1.3); adjusted for maternal age, education, parity, caste, and below poverty line card.

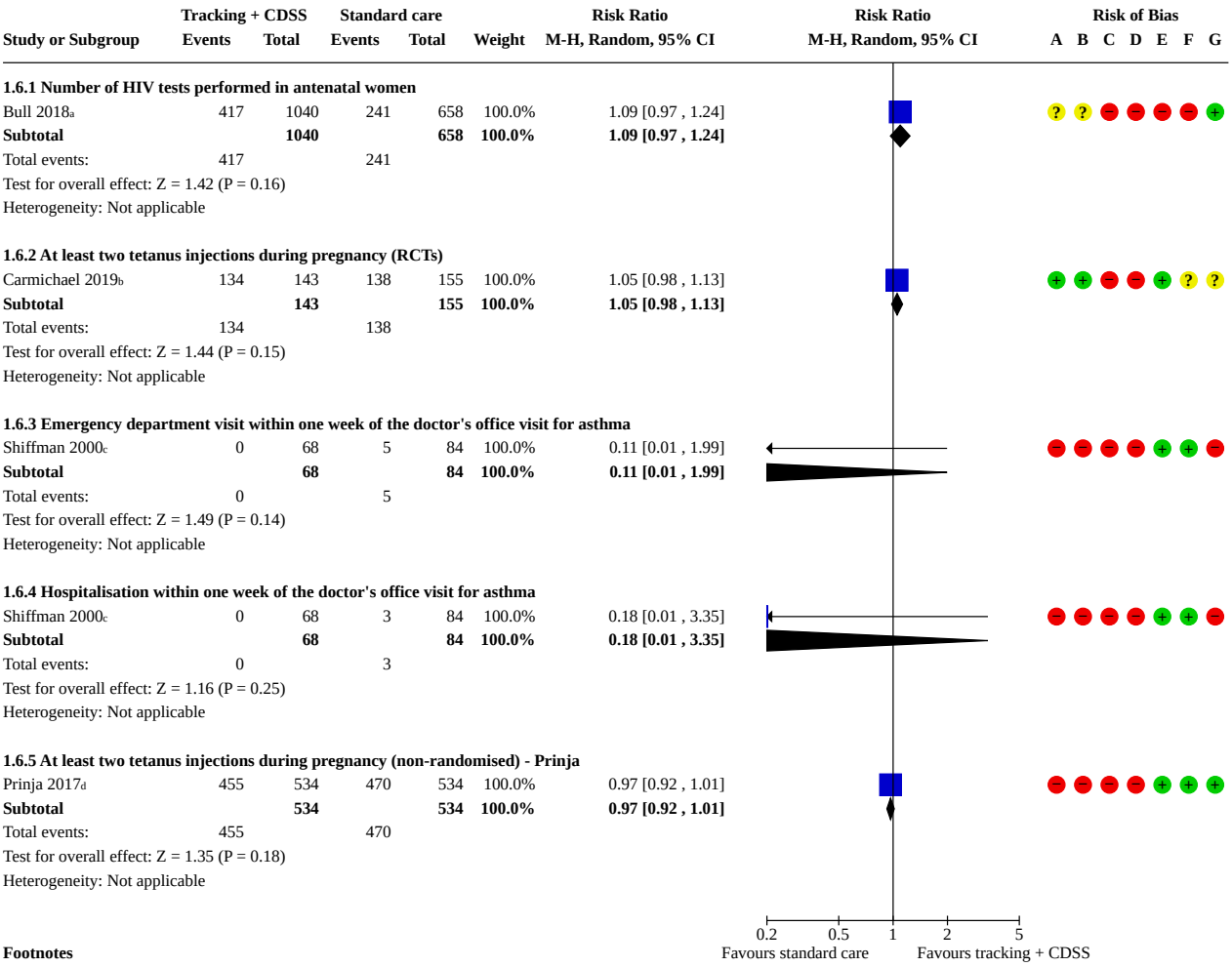
[d]Pneumonia/fever in infants 6-9 months of age. Adjusted risk difference 3.6% (0.1 to 7.1); adjusted for maternal age, education, parity, caste, and below poverty line card.

[e]Unadjusted data from cluster-RCT.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.6. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 6: Client utilisation of primary healthcare and/or services (risk ratio)



Footnotes

[a]Unadjusted data from cluster-RCT. Electronic records compared with paper records.

[b]Cluster-RCT adjusted for design effect using ICC = 0.2.

[c]Unadjusted data from non-randomised cluster study.

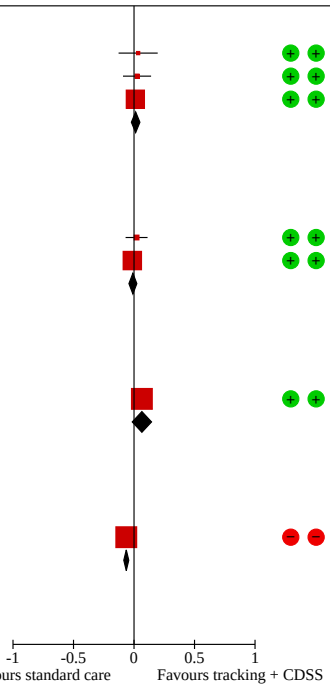
[d]≥ two tetanus toxoid injections during antenatal care. Controlled before-and-after study with propensity score matched sample. Data are intervention group vs control group at endpoint

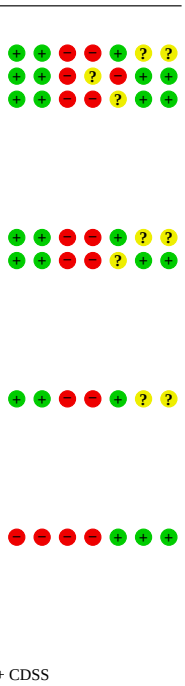
Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.7. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 7: Client utilisation of primary healthcare and/or services (risk difference)

Study or Subgroup	RD	SE	Tracking + CDSS Total	Standard care Total	Weight	Risk Difference IV, Random, 95% CI
1.7.1 Full childhood immunisation (RCTs)						
Carmichael 2019[a]	0.034	0.082432	437	490	4.8%	0.03 [-0.13 , 0.20]
Chen 2016[b]	0.025	0.0592	101	104	9.2%	0.03 [-0.09 , 0.14]
Modi 2019[c]	0.011	0.0194	1757	1713	86.0%	0.01 [-0.03 , 0.05]
Subtotal (Wald[d])			**2295**	**2307**	**100.0%**	**0.01 [-0.02 , 0.05]**
Test for overall effect: Z = 0.74 (P = 0.46)						
Heterogeneity: Tau² (DL[e]) = 0.00; Chi² = 0.12, df = 2 (P = 0.94); I² = 0%						
1.7.2 Women gave birth in a health facility						
Carmichael 2019[f]	0.021	0.04628	741	809	13.0%	0.02 [-0.07 , 0.11]
Modi 2019[g]	-0.014	0.0179	1571	1713	87.0%	-0.01 [-0.05 , 0.02]
Subtotal (Wald[d])			**2312**	**2522**	**100.0%**	**-0.01 [-0.04 , 0.02]**
Test for overall effect: Z = 0.57 (P = 0.57)						
Heterogeneity: Tau² (DL[e]) = 0.00; Chi² = 0.50, df = 1 (P = 0.48); I² = 0%						
1.7.3 Current use of any modern method of contraception						
Carmichael 2019[h]	0.065	0.040671	712	701	100.0%	0.07 [-0.01 , 0.14]
Subtotal			**712**	**701**	**100.0%**	**0.07 [-0.01 , 0.14]**
Test for overall effect: Z = 1.60 (P = 0.11)						
Heterogeneity: Not applicable						
1.7.4 Full childhood immunisation (non-randomised) - Prinja						
Prinja 2017[i]	-0.064	0.0105	1019	1019	100.0%	-0.06 [-0.08 , -0.04]
Subtotal			**1019**	**1019**	**100.0%**	**-0.06 [-0.08 , -0.04]**
Test for overall effect: Z = 6.10 (P < 0.00001)						
Heterogeneity: Not applicable						





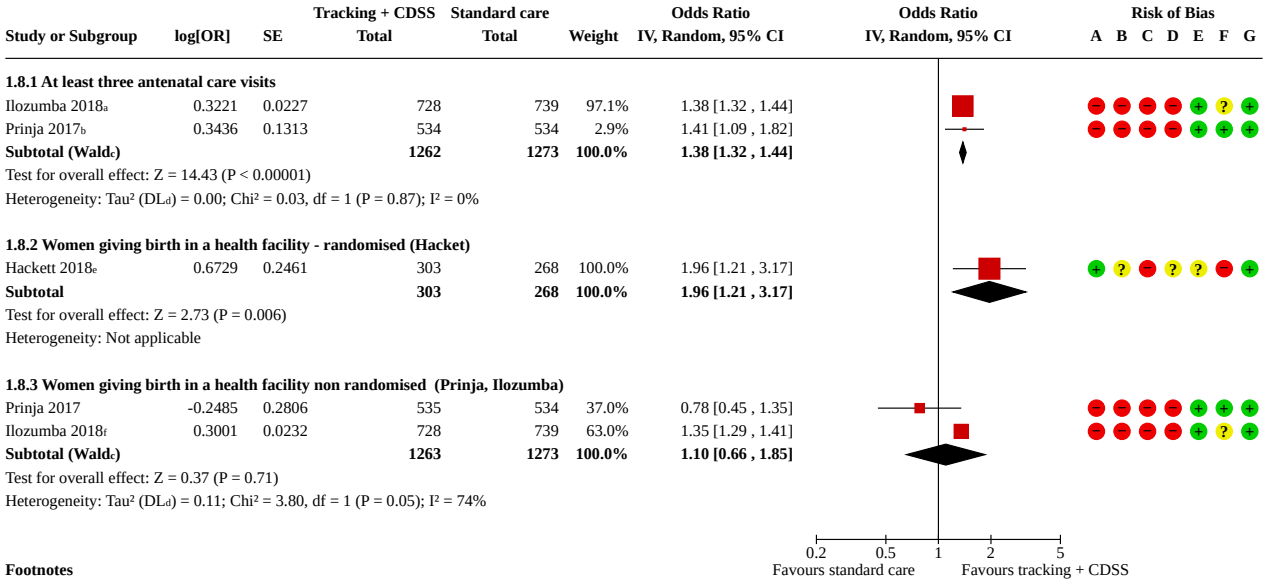
Footnotes

[a]Fully immunised (except measles). Cluster-RCT adjusted for maternal age, household size, whether a woman belonged to a scheduled caste or tribe, literacy, lack of formal education, having a Bel
[b]Five-vaccine immunisation coverage (received 1 dose of BCG and measles and 3 doses of HBV, DPT, OPV).
[c]Received all three doses of pentavalent vaccines. Effect size adjusted for maternal age, education, parity, caste, and below poverty line card.
[d]CI calculated by Wald-type method.
[e]Tau² calculated by DerSimonian and Laird method.
[f]Facility delivery. Cluster-RCT adjusted for maternal age, household size, whether a woman belonged to a scheduled caste or tribe, literacy, lack of formal education, having a Below Poverty Line (
[g]Delivery at hospital. Adjusted for maternal age, education, parity, caste, and below poverty line card.
[h]Cluster-RCT adjusted for maternal age, household size, whether a woman belonged to a scheduled caste or tribe, literacy, lack of formal education, having a Below Poverty Line (BPL) card (which
[i]Difference-in-difference at endpoint survey. Propensity score matched sample on religion, caste, occupation of father and education of mother.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 1.8. Comparison 1: Tracking with clinical decision support compared to standard care, Outcome 8: Client utilisation of primary health care and/or services (odds ratio)



Footnotes

[a]Four or more ANC visits. Adjusted for caste and religion.
[b]≥3 ANC visits. Propensity score matched sample on religion, caste, occupation of father and education of mother.
[c]CI calculated by Wald-type method.
[d]Tau² calculated by DerSimonian and Laird method.
[e]Facility Delivery. Adjusted OR for clustering and significant variables associated with facility delivery.
[f]Delivering at a health center. Adjusted for caste and education.

Risk of bias legend

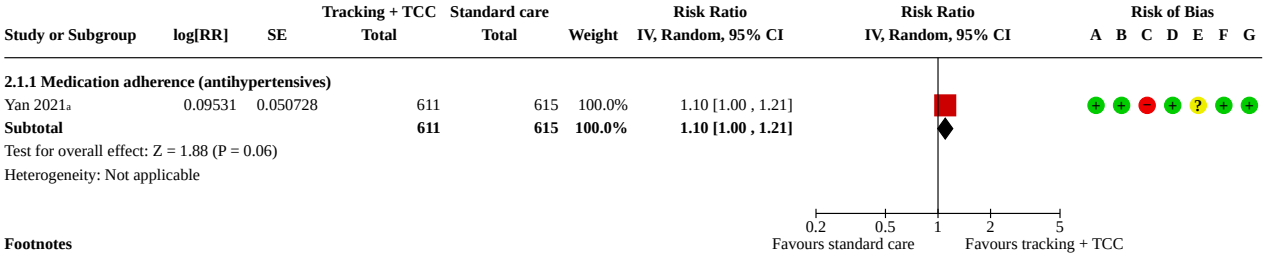
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Comparison 2. Tracking with targeted client communication compared to standard care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.1 Client's health behaviour	1		Risk Ratio (IV, Random, 95% CI)	Subtotals only
2.1.1 Medication adherence (antihypertensives)	1	1226	Risk Ratio (IV, Random, 95% CI)	1.10 [1.00, 1.21]
2.2 Patient/client health status and well-being (dichotomous outcomes)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
2.2.1 Women who gave birth at home	1	525	Risk Ratio (M-H, Random, 95% CI)	0.41 [0.26, 0.64]
2.2.2 Neonatal deaths	1	379	Risk Ratio (M-H, Random, 95% CI)	0.74 [0.36, 1.52]
2.3 Patient/client health status and well-being (inverse variance)	1		Risk Ratio (IV, Random, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.3.1 Deaths in stroke patients over 12 months	1	1226	Risk Ratio (IV, Random, 95% CI)	0.52 [0.28, 0.96]
2.4 Patient/client health status and well-being (continuous outcomes)	1		Mean Difference (IV, Random, 95% CI)	Subtotals only
2.4.1 Change in systolic blood pressure	1	1226	Mean Difference (IV, Random, 95% CI)	-2.80 [-4.90, -0.70]
2.4.2 Change in health-related quality of life	1	1226	Mean Difference (IV, Random, 95% CI)	0.04 [0.02, 0.06]
2.5 Client utilisation of primary healthcare and/or services - hospitalisations for stroke	1		Risk Ratio (IV, Random, 95% CI)	Subtotals only

Analysis 2.1. Comparison 2: Tracking with targeted client communication compared to standard care, Outcome 1: Client's health behaviour



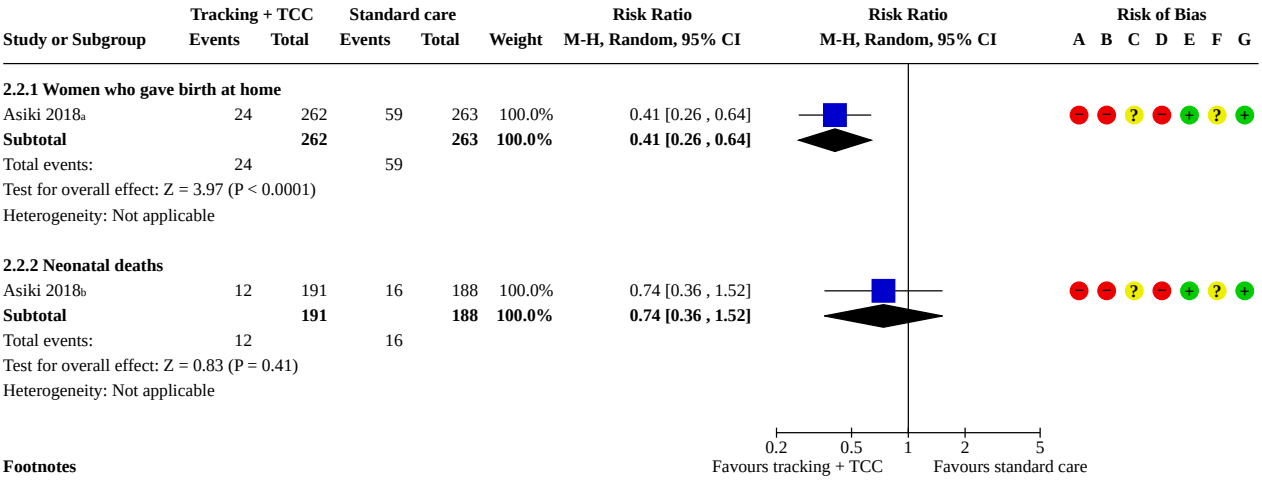
Footnotes

aCluster-RCT adjusted for baseline outcome, township, sex, and age; removing outliers in the outcome variable.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 2.2. Comparison 2: Tracking with targeted client communication compared to standard care, Outcome 2: Patient/client health status and well-being (dichotomous outcomes)



Footnotes

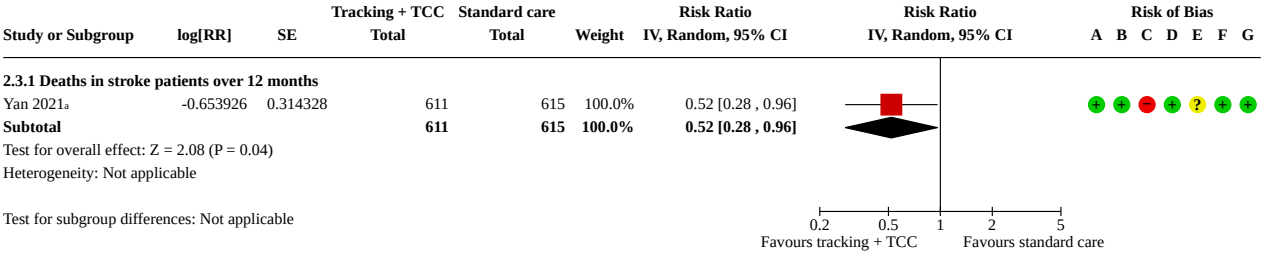
[a]Self-report. Adjusted OR (95% CI): 0.38 (0.15 to 0.97); adjusted for age, education, tribe, religion, distance to nearest health centre, visit by village health worker.

[b]Unadjusted data from cluster-RCT.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 2.3. Comparison 2: Tracking with targeted client communication compared to standard care, Outcome 3: Patient/client health status and well-being (inverse variance)



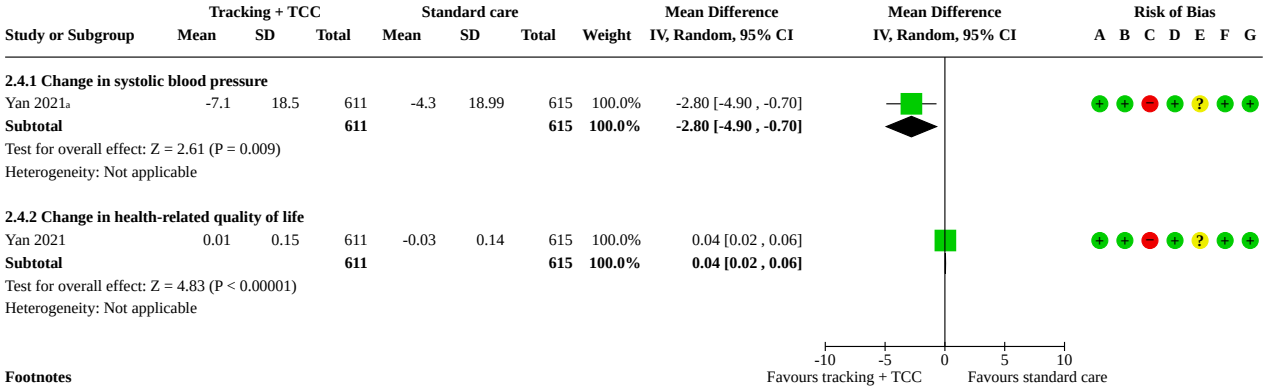
Footnotes

[a]Cluster-RCT adjusted for baseline outcome, township, sex, and age; removing outliers in the outcome variable.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 2.4. Comparison 2: Tracking with targeted client communication compared to standard care, Outcome 4: Patient/client health status and well-being (continuous outcomes)



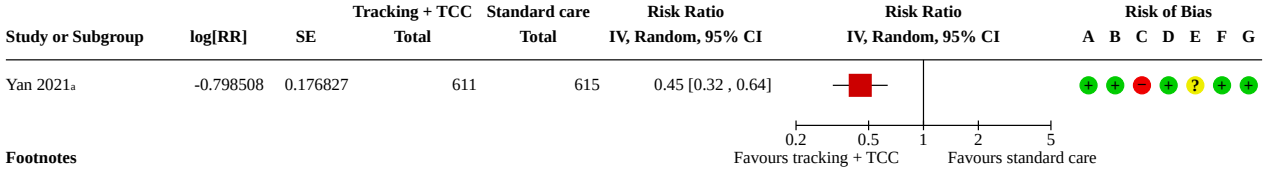
Footnotes

[a]Cluster-RCT adjusted for baseline outcome, township, sex, and age; removing outliers in the outcome variable.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 2.5. Comparison 2: Tracking with targeted client communication compared to standard care, Outcome 5: Client utilisation of primary healthcare and/or services - hospitalisations for stroke



Footnotes

[a]Cluster-RCT adjusted for baseline outcome, township, sex, and age; removing outliers in the outcome variable.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Comparison 3. Tracking with clinical decision support and targeted client communication compared to standard care

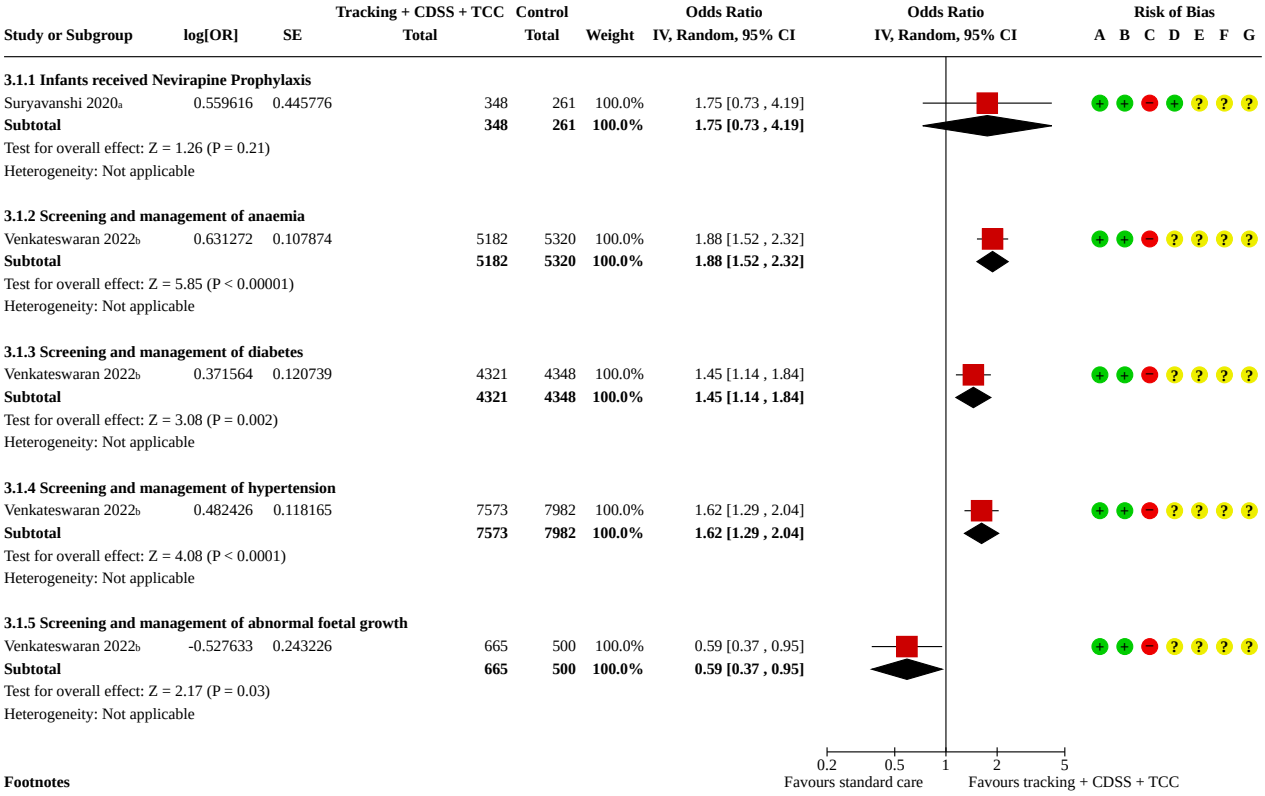
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1 Provider adherence to recommended practice	2		Odds Ratio (IV, Random, 95% CI)	Subtotals only
3.1.1 Infants received Nevirapine Prophylaxis	1	609	Odds Ratio (IV, Random, 95% CI)	1.75 [0.73, 4.19]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1.2 Screening and management of anaemia	1	10502	Odds Ratio (IV, Random, 95% CI)	1.88 [1.52, 2.32]
3.1.3 Screening and management of diabetes	1	8669	Odds Ratio (IV, Random, 95% CI)	1.45 [1.14, 1.84]
3.1.4 Screening and management of hypertension	1	15555	Odds Ratio (IV, Random, 95% CI)	1.62 [1.29, 2.04]
3.1.5 Screening and management of abnormal foetal growth	1	1165	Odds Ratio (IV, Random, 95% CI)	0.59 [0.37, 0.95]
3.2 Quality of data about services provided	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3.2.1 Data missing for gestational age at delivery	1	6367	Risk Ratio (M-H, Random, 95% CI)	0.96 [0.81, 1.14]
3.2.2 Data missing for birthweight at delivery	1	6367	Risk Ratio (M-H, Random, 95% CI)	0.90 [0.77, 1.04]
3.2.3 Data missing for haemoglobin at delivery	1	6367	Risk Ratio (M-H, Random, 95% CI)	0.77 [0.71, 0.84]
3.2.4 Data missing for blood pressure at delivery	1	6367	Risk Ratio (M-H, Random, 95% CI)	1.16 [1.08, 1.24]
3.3 Client's health behaviour	2		Odds Ratio (IV, Random, 95% CI)	Subtotals only
3.3.1 Physical activity levels	1	8642	Odds Ratio (IV, Random, 95% CI)	1.17 [0.91, 1.50]
3.3.2 HIV+ve women on ART at delivery	1	438	Odds Ratio (IV, Random, 95% CI)	1.41 [0.81, 2.45]
3.3.3 HIV+ve women exclusive breastfeeding at 6 months	1	695	Odds Ratio (IV, Random, 95% CI)	1.74 [0.95, 3.17]
3.4 Patient/client health status and well-being (dichotomous outcomes)	5		Odds Ratio (IV, Random, 95% CI)	Subtotals only
3.4.1 Deaths	1	3698	Odds Ratio (IV, Random, 95% CI)	0.61 [0.35, 1.06]
3.4.2 High-risk individuals achieving optimal BP levels (systolic blood pressure < 140 mmHg)	1	8642	Odds Ratio (IV, Random, 95% CI)	1.01 [0.76, 1.34]
3.4.3 New cardiovascular disease events during follow-up	1	8642	Odds Ratio (IV, Random, 95% CI)	0.58 [0.42, 0.80]
3.4.4 Maternal mortality (before the baby reached 18 months) in HIV+ve mothers	1	1156	Odds Ratio (IV, Random, 95% CI)	0.56 [0.23, 1.35]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.4.5 Infant mortality before the baby reaches 18 months	1	1191	Odds Ratio (IV, Random, 95% CI)	1.60 [0.37, 6.91]
3.4.6 Hypertensive individuals whose BP is controlled (< 140/90)	1	933	Odds Ratio (IV, Random, 95% CI)	0.95 [0.63, 1.43]
3.4.7 Adverse pregnancy outcome	1	6367	Odds Ratio (IV, Random, 95% CI)	0.99 [0.87, 1.12]
3.4.8 Moderate or severe anaemia	1	6367	Odds Ratio (IV, Random, 95% CI)	0.82 [0.51, 1.31]
3.4.9 Severe hypertension	1	6367	Odds Ratio (IV, Random, 95% CI)	0.61 [0.27, 1.37]
3.4.10 Large-for-gestational-age baby	1	6367	Odds Ratio (IV, Random, 95% CI)	1.06 [0.90, 1.25]
3.5 Patient/client health status and well-being (continuous outcomes)	2		Mean Difference (IV, Random, 95% CI)	Subtotals only
3.5.1 Mean change in systolic blood pressure (SBP)	2	11966	Mean Difference (IV, Random, 95% CI)	0.29 [-2.55, 3.13]
3.5.2 Mean change in body mass index (BMI)	2	11966	Mean Difference (IV, Random, 95% CI)	-0.36 [-1.21, 0.48]
3.5.3 Mean change in glycated haemoglobin (HbA1c)	1	3324	Mean Difference (IV, Random, 95% CI)	0.08 [-0.27, 0.43]
3.5.4 Change in fasting plasma glucose	1	3324	Mean Difference (IV, Random, 95% CI)	8.40 [-9.60, 26.40]
3.5.5 Change in total cholesterol	1	3324	Mean Difference (IV, Random, 95% CI)	-2.50 [-7.10, 2.10]
3.5.6 Change in predicted 10-year risk of CVD	1	3324	Mean Difference (IV, Random, 95% CI)	-0.40 [-2.30, 1.50]
3.5.7 Change in tobacco use	1	3324	Mean Difference (IV, Random, 95% CI)	-0.05 [-0.47, 0.37]
3.5.8 Change in alcohol use	1	3325	Mean Difference (IV, Random, 95% CI)	0.70 [-3.70, 5.10]
3.5.9 Change in depression score	1	3324	Mean Difference (IV, Random, 95% CI)	-1.60 [-4.40, 1.20]
3.5.10 Change in diastolic blood pressure (DBP)	1	8642	Mean Difference (IV, Random, 95% CI)	-0.60 [-4.29, 3.09]
3.5.11 Change in quality of life	1	8642	Mean Difference (IV, Random, 95% CI)	0.00 [-0.01, 0.01]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.6 Client utilisation of primary healthcare and/or services (odds ratio)	2		Odds Ratio (IV, Random, 95% CI)	Subtotals only
3.6.1 Linkage to care	1	933	Odds Ratio (IV, Random, 95% CI)	1.21 [0.71, 2.05]
3.6.2 At least four antenatal care visits	1	1185	Odds Ratio (IV, Random, 95% CI)	1.31 [1.00, 1.72]
3.6.3 Women who gave birth at a health facility	1	1224	Odds Ratio (IV, Random, 95% CI)	1.98 [1.53, 2.56]
3.6.4 Postnatal care in a health facility	1	1224	Odds Ratio (IV, Random, 95% CI)	2.77 [2.12, 3.61]
3.7 Client utilisation of primary healthcare and/or services (odds ratio) - never-missed early infant diagnosis visit	1		Odds Ratio (IV, Random, 95% CI)	Subtotals only
3.7.1 Never missed early infant diagnosis visit	1	1183	Odds Ratio (IV, Random, 95% CI)	0.92 [0.63, 1.35]
3.8 Client utilisation of primary healthcare and/or services (dichotomous)	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3.8.1 Fully vaccinated- rural	1	136	Risk Ratio (M-H, Random, 95% CI)	1.39 [1.08, 1.79]
3.8.2 Fully vaccinated - urban	1	210	Risk Ratio (M-H, Random, 95% CI)	1.68 [1.24, 2.30]
3.9 Patient/client acceptability/satisfaction with the intervention	1		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
3.9.1 Reported "slightly/much better" change in quality of care	1	3324	Risk Ratio (M-H, Random, 95% CI)	1.02 [1.00, 1.03]

Analysis 3.1. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 1: Provider adherence to recommended practice



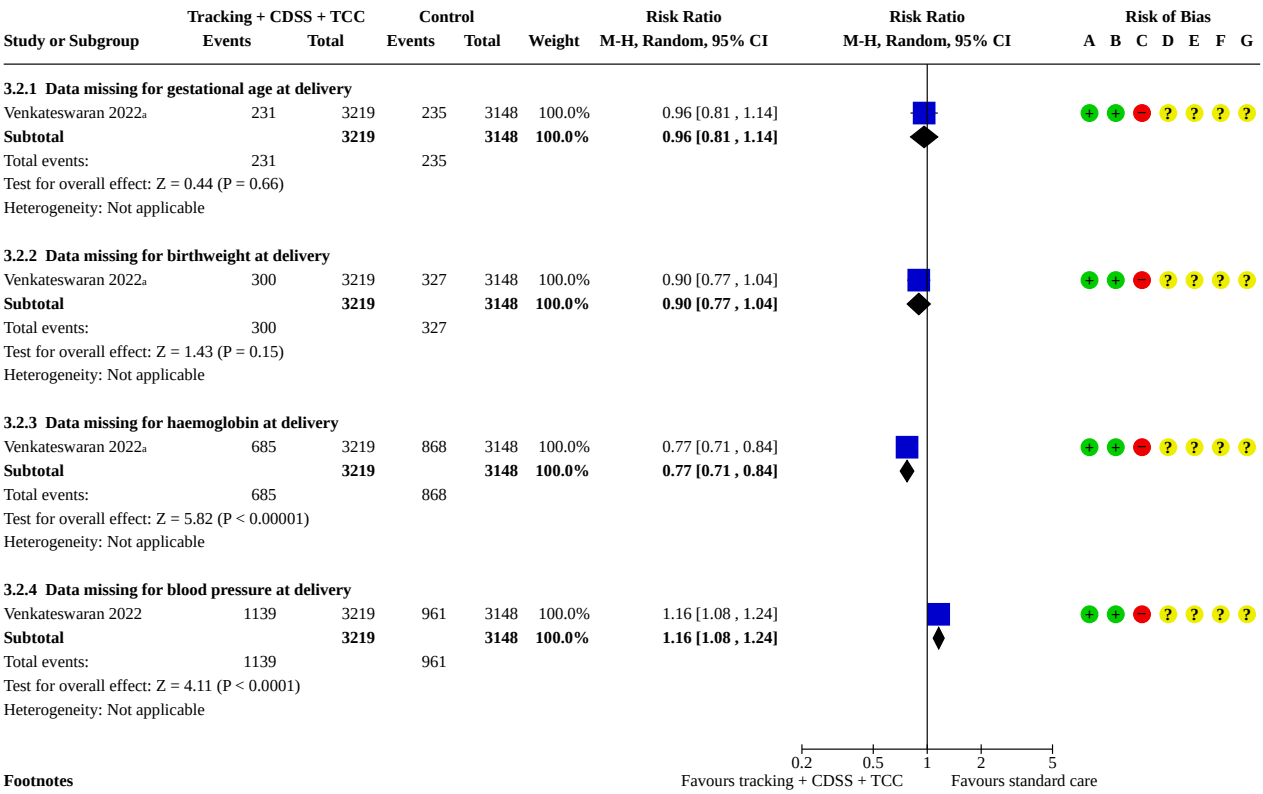
Footnotes

[a]Cluster-RCT adjusted for district, maternal characteristics, and outreach worker characteristics.
[b]Cluster-RCT adjusted for clustering and for repeated antenatal care visits by a woman.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.2. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 2: Quality of data about services provided



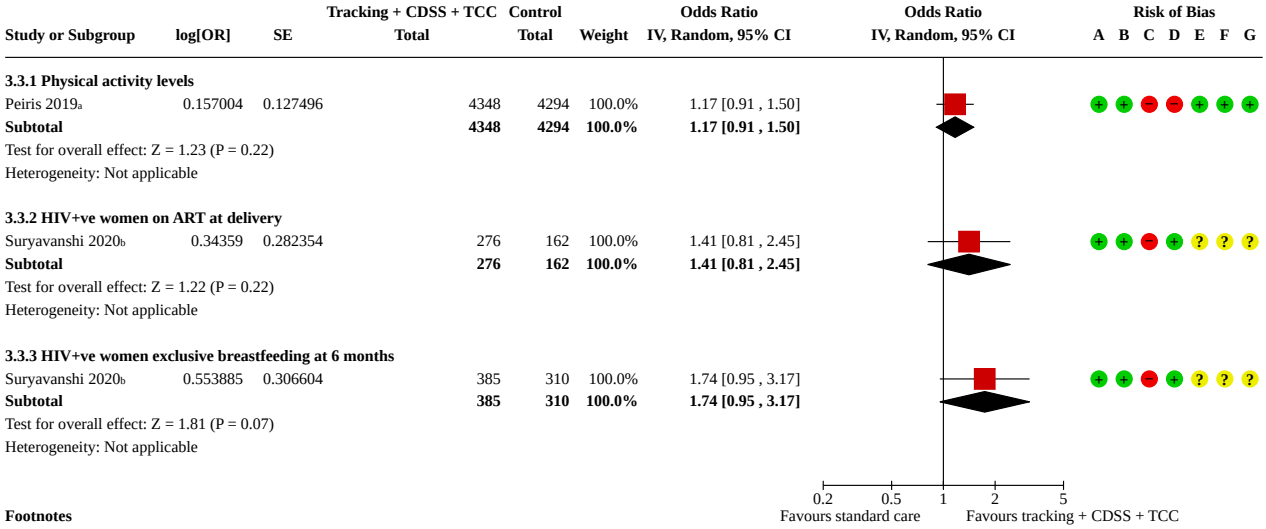
Footnotes

[a]Unadjusted raw data from cluster-RCT.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.3. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 3: Client's health behaviour



Footnotes

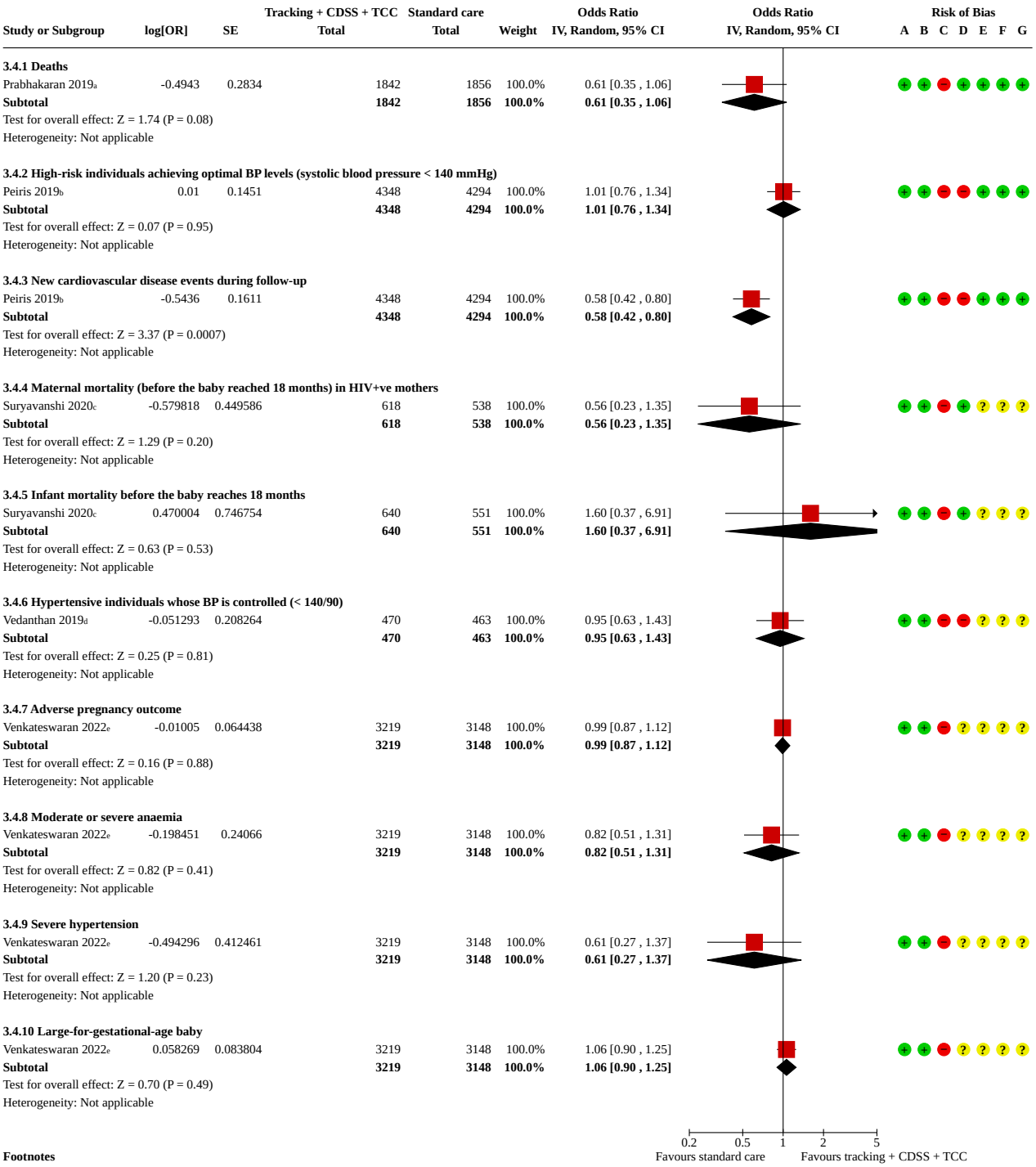
[a]Cluster-RCT adjusted for baseline BP measurement and with clusters as a random effect. ICC = 0.014

[b]Cluster-RCT adjusted for district, maternal characteristics, and outreach worker characteristics.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.4. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 4: Patient/client health status and well-being (dichotomous outcomes)



Footnotes

[a]Unadjusted data from cluster-RCT.
[b]Cluster-RCT adjusted for baseline measurement and with clusters as a random effect.
[c]Cluster-RCT adjusted for district, maternal characteristics, and outreach worker characteristics.
[d]Incorporates multiple imputations and the bootstrap, and fully adjusted for: baseline SBP, follow-up time, age, gender, enrolment in national health insurance, tobacco and/or alcohol use, employment status, [illegible]
[e]Cluster-RCT adjusted for clustering and for repeated antenatal care visits by a woman.

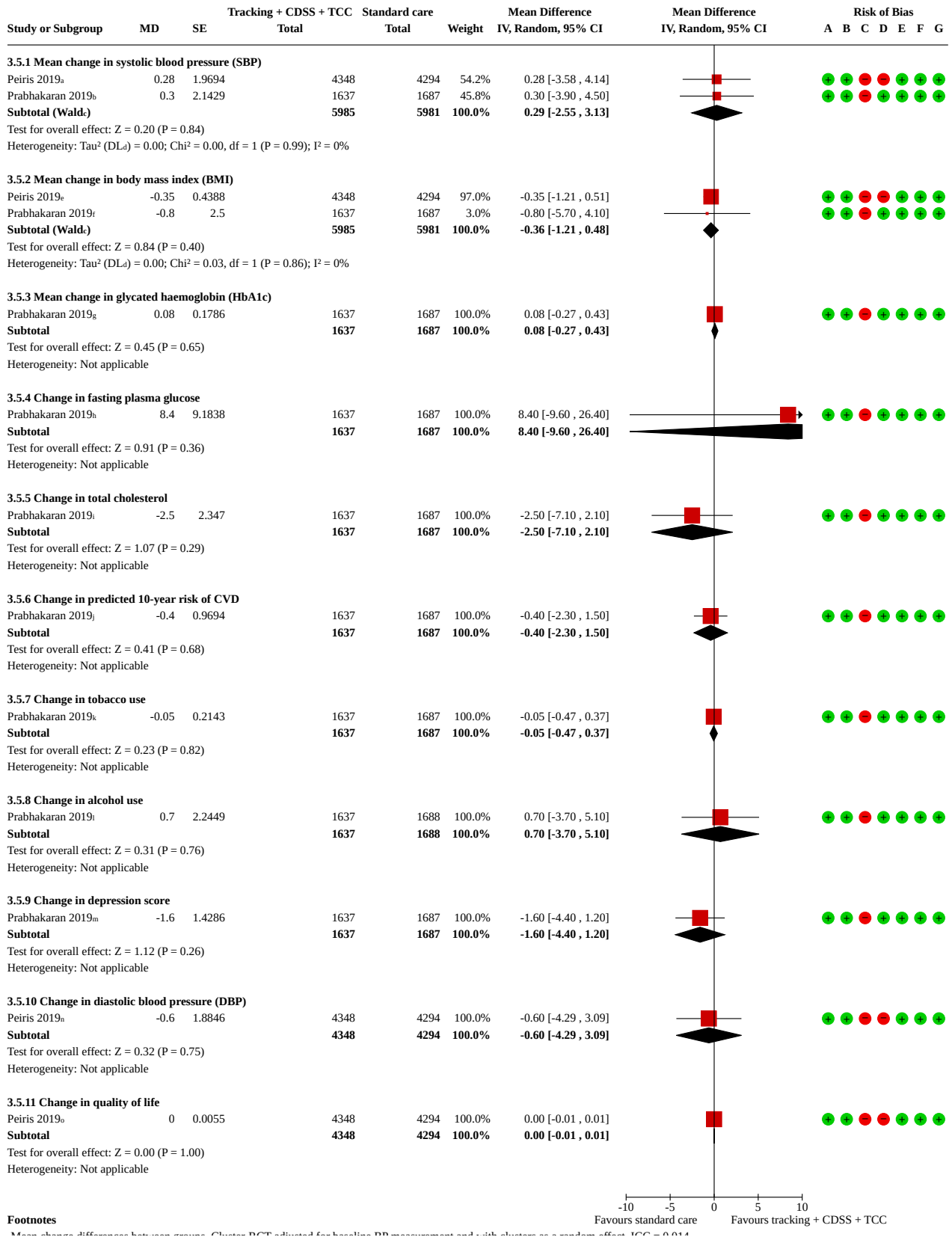
Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)

Analysis 3.4. (Continued)

(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.5. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 5: Patient/client health status and well-being (continuous outcomes)



Footnotes

Analysis 3.5. (Continued)

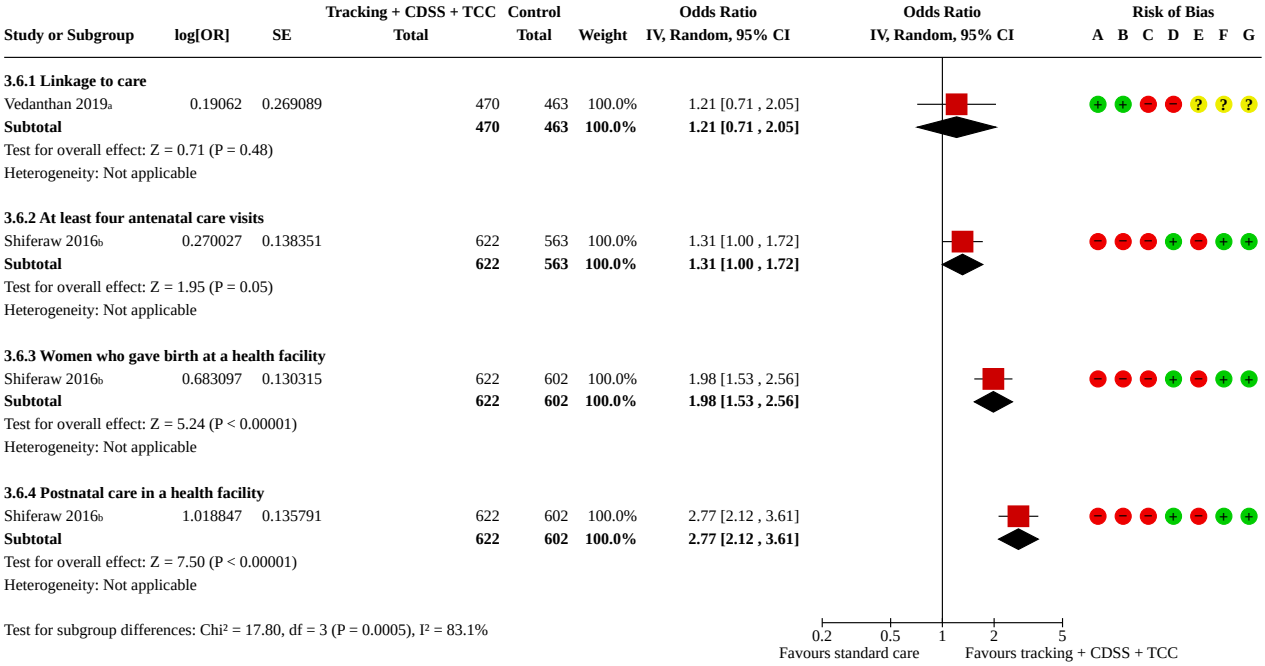
Footnotes

[a]Mean change differences between groups. Cluster-RCT adjusted for baseline BP measurement and with clusters as a random effect. ICC = 0.014
[b]Mean change differences between groups of participants with hypertension. Cluster-RCT adjusted for education, lipid-lowering drugs, aspirin use, peripheral vascular disease, smoking status and cluster
[c]CI calculated by Wald-type method.
[d]Tau² calculated by DerSimonian and Laird method.
[e]Mean change differences between groups. Cluster-RCT adjusted for baseline BMI measurement and with clusters as a random effect. ICC < 0.001.
[f]Mean change differences between groups of participants with hypertension. Cluster-RCT adjusted for height, sex, marital status, education, employment, blood pressure medication, diabetes medication,
[g]Change amongst participants with diabetes. Cluster-RCT adjusted for age, employed, anti-hyperglycemic drugs, peripheral vascular disease, alcohol use and clusters as a random effect..
[h]Cluster-RCT adjusted for diabetes medication, peripheral vascular disease, and clusters as a random effect.
[i]Cluster-RCT adjusted for height, employment, blood pressure medication, smoking, alcohol drinking, physical activity, and clusters as a random effect.
[j]Change in predicted 10-year risk of CVD with the recalibrated Framingham risk score. Cluster-RCT adjusted for age, employment, blood pressure medication, smoking, and clusters as a random effect.
[k]Change in tobacco use using modified CARRS questionnaire. Cluster-RCT adjusted for height, sex, marital status, education, employment, blood pressure medication, diabetes medication, lipid-lowerin
[l]Change in alcohol use measured with Alcohol Use Disorder Identification Test (AUDIT)). Cluster-RCT adjusted for own baseline values, age, sex, marital status, education, employment, and clusters as
[m]Change in depression score measured with Patient Health Questionnaire-9. Cluster-RCT adjusted for age, sex, baseline alcohol, education, and cluster as a random effect.
[n]Cluster-RCT adjusted for baseline BP measurement and with clusters as a random effect. ICC = 0.014
[o]Change in EuroQol quality of life dimension questionnaire (EQ5D) from baseline. Cluster-RCT adjusted for baseline BP measurement and with clusters as a random effect. ICC = 0.014

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.6. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 6: Client utilisation of primary healthcare and/or services (odds ratio)



Footnotes

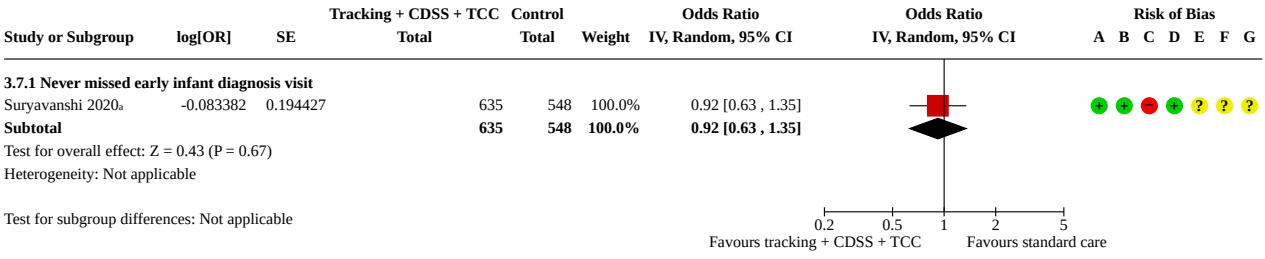
[a]Incorporates multiple imputation and the bootstrap, and fully adjusted for: baseline SBP, follow-up time, age, gender, enrolment in national health insurance, tobacco and/or alcohol use, employment

[b]Adjusted for having four ANC visits, institutional delivery and postnatal care visit within 6 hours of delivery, age, residence, and parity.

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.7. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 7: Client utilisation of primary healthcare and/or services (odds ratio) - never-missed early infant diagnosis visit



Footnotes

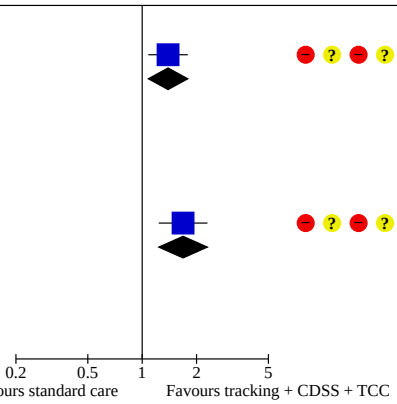
[a]Cluster-RCT adjusted for district, maternal characteristics, and outreach worker characteristics. Negatively worded outcome - higher levels of "never missed an appointment" are better

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.8. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 8: Client utilisation of primary healthcare and/or services (dichotomous)

Study or Subgroup	Tracking + CDSS + TCC Events	Total	Standard care Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Risk of Bias A B C D E F G
3.8.1 Fully vaccinated- rural							
Uddin 2016[a]	53	69	37	67	100.0%	1.39 [1.08 , 1.79]	
Subtotal		**69**		**67**	**100.0%**	**1.39 [1.08 , 1.79]**	
Total events:	53		37				
Test for overall effect: Z = 2.57 (P = 0.01)							
Heterogeneity: Not applicable							
3.8.2 Fully vaccinated - urban							
Uddin 2016[a]	56	98	38	112	100.0%	1.68 [1.24 , 2.30]	
Subtotal		**98**		**112**	**100.0%**	**1.68 [1.24 , 2.30]**	
Total events:	56		38				
Test for overall effect: Z = 3.29 (P = 0.0010)							
Heterogeneity: Not applicable							



Footnotes

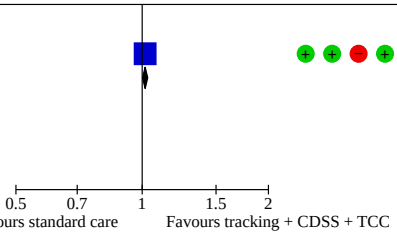
[a]Fully vaccinated (BCG + Penta3 + MR)

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Analysis 3.9. Comparison 3: Tracking with clinical decision support and targeted client communication compared to standard care, Outcome 9: Patient/client acceptability/satisfaction with the intervention

Study or Subgroup	Tracking + CDSS + TCC Events	Total	Standard care Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Risk of Bias A B C D E F G
3.9.1 Reported "slightly/much better" change in quality of care							
Prabhakaran 2019[a]	1581	1637	1603	1687	100.0%	1.02 [1.00 , 1.03]	
Subtotal		**1637**		**1687**	**100.0%**	**1.02 [1.00 , 1.03]**	
Total events:	1581		1603				
Test for overall effect: Z = 2.24 (P = 0.03)							
Heterogeneity: Not applicable							



Footnotes

[a]Unadjusted data from cluster-RCT. Participants' feedback on changes in quality of care as slightly/much better; about the same; or somewhat/much worse. Quality of care is the composite

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

ADDITIONAL TABLES

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings

Effectiveness of tracking with clinical decision support system (CDSS) compared to usual care in primary care

Patient or population: healthcare providers using clinical decision support system tools and patients receiving care from such providers

Setting: primary healthcare settings in India (Carmichael 2019; Ilozumba 2018; Modi 2019; Patil 2022; Peiris 2019), Tanzania (Bull 2018; Hackett 2018), China (Chen 2016) and USA (Shiffman 2000)

Intervention: digital tracking with mobile clinical decision support system (Tracking + CDSS)

Comparison: standard care or no intervention (standard care could be providers using decision support tools on paper or usual care that did not involve any additional follow-up)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with usual care	Risk with tracking with clinical decision support (CDSS) compared to standard care				
A. Providers' adherence to recommended practices, guidelines, or protocol						
Provider adherence to recommended practice (dichotomous outcomes) - Home visit by a CHW within 24 hours of delivery	405 per 1000	**28 more visits per 1000** (from 24 fewer to 85 more per 1000)	**Risk difference 0.07** (-0.06 to 0.21)	4572 (2 RCTs)	⨁◯◯◯ Very low[6,9,a,b,c]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who receive a home visit 24 hours after delivery because the certainty of this evidence is very low.
Provider adherence to recommended practice (dichotomous outcomes) - Home visit by a CHW in the first week after delivery	364 per 1000	**36 more visits per 1000** (from 25 more to 51 more per 1000)	**Risk difference 0.10** (0.07 to 0.14)	4531 (2 RCTs)	⨁⨁◯◯ Low[6,9,a,c]	Tracking + CDSS compared to usual care may slightly increase the number of women who received a home visit in the first week after delivery.
Provider adherence to recommended practice (dichotomous outcomes) - Counselled to initiate complementary food at six months (RCT)	547 per 1000	**66 more mothers counselled per 1000** (from 44 more to 82 more per 1000)	**Risk difference 0.12** (0.08 to 0.15)	4397 (2 RCTs)	⨁⨁◯◯ Low[6,9,a,c]	Tracking + CDSS compared to usual care may result in a small increase in the number of mothers counselled to initiate complementary feeding for their infant at six months.
Provider adherence to recommended practice (dichotomous outcomes) - Counselled to initiate	data not available	data not available	**Risk difference 0.12** (0.06 to 0.17)	1761 (1 observational study)	⨁◯◯◯ Very low[2,c,d]	It is uncertain whether tracking + CDSS compared with usual care affects the number of mothers counselled to initiate complementary feeding for

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings *(Continued)*

complementary food at six months (non-randomised)						their infant at six months because the certainty of the evidence is very low.
Provider adherence to recommended practice (dichotomous outcomes) - Immediate referral to Emergency Department or hospital for asthma management	24 per 1000	**0 fewer referrals per 1000** (from 1 fewer to 1 more per 1000)	**Risk difference -0.01** (-0.05 to 0.03)	152 (1 observational study)	⊕◯◯◯ Very low[1,e,f]	It is uncertain whether tracking + CDSS compared with usual care affects the number of children receiving an immediate referral to a hospital following an office visit for asthma because the certainty of the evidence is very low.
Provider adherence to recommended practice (dichotomous outcomes) - Blood pressure measurement during antenatal care visit (% coverage)	481 per 1000	**5 more per 1000 coverage** (from 67 fewer to 72 more per 1000)	**Risk difference 0.01** (-0.14 to 0.15)	1068 (1 observational study)	⊕◯◯◯ Very low[8,c,e,h]	It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded blood pressure measurements because the certainty of the evidence is very low.
Provider adherence to recommended practice (dichotomous outcomes) - Blood test during antenatal care visit (% coverage)	616 per 1000	**37 fewer per 1000 coverage** (from 123 fewer to 49 more per 1000)	**Risk difference -0.06** (-0.20 to 0.08)	1068 (1 observational study)	⊕◯◯◯ Very low[8,c,e,h]	It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded blood tests because the certainty of the evidence is very low.
Provider adherence to recommended practice (dichotomous outcomes) - Weight measurement during antenatal care visit (% coverage)	848 per 1000	**93 fewer per 1000 coverage** (from 187 fewer to 8 more per 1000)	**Risk difference -0.11** (-0.22 to 0.01)	1068 (1 observational study)	⊕◯◯◯ Very low[8,c,e,i]	It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded weight measurements because the certainty of the evidence is very low.
Provider adherence to recommended practice (dichotomous outcomes) - Urine test during antenatal care visit (% coverage)	545 per 1000	**11 per 1000 more coverage** (from 65 fewer to 93 more per 1000)	**Risk difference 0.02** (-0.12 to 0.17)	1068 (1 observational study)	⊕◯◯◯ Very low[8,c,e]	It is uncertain whether tracking + CDSS compared with usual care affects the proportion of antenatal care visits with recorded urine tests because the certainty of the evidence is very low.
Provider adherence to recommended practice (continuous outcomes) - Number of CHW home visits in first month after delivery	data not available	**MD 0.75 higher** (from 0.47 higher to 1.03 higher)	-	3023 (1 RCT)	⊕⊕◯◯ Low[9,a,c,j]	Tracking + CDSS compared to usual care may slightly increase the number of community health worker (CHW) home visits in the first month after delivery.
B. Time between presentation and appropriate management						
No studies evaluated this outcome.						No evidence

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings *(Continued)*

C. Quality of data about services provided						
No studies evaluated this outcome.						No evidence
D. Clients' health behaviour						
Client's health behaviour (dichotomous outcomes) - The mother reports that nothing was applied to the umbilical cord	329 per 1000	**7 fewer mothers per 1000** (from 23 fewer to 10 more per 1000)	**Risk difference -0.02** (-0.07 to 0.03)	1480 (1 RCT)	⊕◯◯◯ Very low[6,a,c,h]	It is uncertain whether tracking + CDSS compared with usual care affects the number of maternal respondents who report that nothing was applied to the umbilical cord following delivery because the certainty of the evidence is very low.
Client's health behaviour (dichotomous outcomes) - Provided skin-to-skin care to their newborn	580 per 1000	**29 more newborns per 1000** (from 0 more to 58 more per 1000)	**Risk difference 0.05** (0.00 to 0.10)	1544 (1 RCT)	⊕⊕◯◯ Low[6,a,c]	Tracking + CDSS compared to usual care may result in a small increase in the number of mothers who report they provided skin-to-skin care to their newborn.
Client's health behaviour - At least 90 iron-folic acid tablets consumed during pregnancy (RCT)	465 per 1000	**14 more women per 1000** (from 5 fewer to 33 more per 1000)	**Risk difference 0.03** (-0.01 to 0.07)	4576 (2 RCTs)	⊕◯◯◯ Very low[7,9,a,c]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who consume at least 90 iron-folate tablets during pregnancy because the certainty of the evidence is very low.
Client's health behaviour - At least 90 iron-folic acid tablets consumed during pregnancy (non-randomised)	data not available	data not available	**Risk difference 0.13** (0.09 to 0.17)	1068 (1 observational study)	⊕◯◯◯ Very low[8,c,l]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who consume at least 90 iron-folate tablets during pregnancy because the certainty of the evidence is very low.
Client's health behaviour - Early initiation of breastfeeding	629 per 1000	**50 more newborns per 1000** (from 31 more to 75 more per 1000)	**Risk difference 0.08** (0.05 to 0.12)	4540 (2 RCTs)	⊕⊕◯◯ Low[6,9,a]	Tracking + CDSS compared to usual care may slightly increase the number of mothers who initiate breastfeeding early in their newborns.
Client's health behaviour - Exclusive breastfeeding for 6 months	504 per 1000	**45 more babies per 1000** (from 10 fewer to 106 more per 1000)	**Risk difference 0.09** (-0.02 to 0.21)	4309 (2 RCTs)	⊕◯◯◯ Very low[6,9,a,c,i]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who exclusively breastfeed for six months because the certainty of the evidence is very low.
Client's health behaviour - Bath delayed at least 2 days (this is beneficial to	480 per 1000	**19 fewer babies per 1000**	**Risk difference -0.04** (-0.15 to 0.08)	1500 (1 RCT)	⊕◯◯◯ Very low[6,a,c,i]	It is uncertain whether tracking + CDSS compared with usual care affects the number of newborns who have their first bath

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings *(Continued)*

protect the baby protect from infection)		(from 72 fewer to 38 more per 1000)				delayed at least two days because the certainty of the evidence is very low.
Client's health behaviour - Kangaroo Mother Care	167 per 1000	**0 more babies per 1000** (from 5 fewer to 5 more per 1000)	**Risk difference -0.00** (-0.03 to 0.03)	3023 (1 RCT)	⊕◯◯◯ Very low[9,a,c]	It is uncertain whether tracking + CDSS compared with usual care affects the number of newborns who receive Kangaroo Mother Care because the certainty of the evidence is very low.
E. Clients' health status and well-being						
Patient/client health status and well-being (desirable outcomes) - Improved asthma severity during office visit	464 per 1000	**139 more children per 1000** (from 19 fewer to 348 more per 1000)	**RR 1.30** (0.96, 1.75)	152 (1 observational study)	⊕◯◯◯ Very low[1,e,f,i]	It is uncertain whether tracking + CDSS, compared with usual care, improves asthma severity in children during a doctor's office visit because the certainty of the evidence is very low.
Patient/client health status and well-being (undesirable outcomes) - Stillbirths	26 per 1000	**5 fewer stillbirths per 1000** (from 10 fewer to 2 more per 1000)	**RR 0.82** (0.62, 1.08)	8230 (1 RCT)	⊕◯◯◯ Very low[9,a,c,i]	It is uncertain whether tracking + CDSS compared with usual care affects the number of stillbirths because the certainty of the evidence is very low.
Patient/client health status and well-being (undesirable outcomes) - Neonatal deaths	25 per 1000	**0 fewer neonatal deaths per 1000** (from 6 fewer to 8 more per 1000)	**RR 0.99** (0.76 to 1.30)	8230 (1 RCT)	⊕◯◯◯ Very low[9,a,c,h]	It is uncertain whether tracking + CDSS compared with usual care affects the number of neonatal deaths because the certainty of the evidence is very low.
Patient/client health status and well-being (undesirable outcomes) - Infant deaths	58 per 1000	**2 fewer infant deaths per 1000** (from 11 fewer to 9 more per 1000)	**RR 0.96** (0.81 to 1.15)	8230 (1 RCT)	⊕◯◯◯ Very low[9,a,c,h]	It is uncertain whether tracking + CDSS compared with usual care affects the number of infant deaths because the certainty of the evidence is very low.
Patient/client health status and well-being (undesirable outcomes) - Low birthweight (≤ 2 kg)	66 per 1000	**31 fewer low birthweight babies per 1000** (from 41 fewer to 18 fewer per 1000)	**RR 0.53** (0.38 to 0.73)	3023 (1 RCT)	⊕⊕◯◯ Low[9,a,c]	Tracking + CDSS compared to usual care may reduce the number of low birthweight babies born ≤ 2 kg.
Patient/client health status and well-being (undesirable outcomes) - Pneumo-	312 per 1000	**41 more infants with pneumonia per 1000**	**RR 1.13** (1.03 to 1.24)	3470 (1 RCT)	⊕⊕◯◯ Low[9,a,c]	Tracking + CDSS compared to usual care may increase the number of infants with pneumonia or fever in the past two weeks seeking care from an Ac-

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings *(Continued)*

nia/fever in last two weeks		(from 9 more to 75 more per 1000)				credited Social Health Activist (ASHA)
Patient/client health status and well-being (undesirable outcomes) - HIV-positive following test	112 per 1000	**26 fewer positive tests per 1000** (from 58 fewer to 27 more per 1000)	**RR 0.77** (0.48 to 1.24)	658 (1 RCT)	⊕◯◯◯ Very low[7,c,k]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women testing positive for HIV during antenatal HIV testing because the certainty of the evidence is very low.
F. Clients' utilisation of primary health care and/or services						
Client utilisation of primary health care and/or services (risk difference) - Full childhood immunisation (RCTs)	700 per 1000	**7 fewer fully immunised children per 1000** (from 23 fewer to 10 more per 1000)	**Risk difference 0.01** (-0.02 to 0.05)	4602 (3 RCTs)	⊕⊕◯◯ Low[5,6,9,a,h]	Tracking + CDSS compared to usual care may result in little or no difference in the number of fully immunised children under five years.
Client utilisation of primary health care and/or services (risk difference) - Full childhood immunisation (non-randomised)	data not available	data not available	**Risk difference -0.06** (-0.08 to -0.04)	2038 (1 observational study)	⊕◯◯◯ Very low[8,c,d]	It is uncertain whether tracking + CDSS compared with usual care affects the number of children under five years fully immunised because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk difference) - Women gave birth in a health facility	887 per 1000	**9 fewer women per 1000** (from 35 fewer to 18 more per 1000)	**Risk difference -0.01** (-0.04 to 0.02)	4834 (2 RCTs)	⊕◯◯◯ Very low[6,9,a,c]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women giving birth in a health facility because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk difference) - Current use of any modern method of contraception	151 per 1000	**11 more women per 1000** (from 2 fewer to 21 more per 1000)	**Risk difference 0.07** (-0.01 to 0.14)	1413 (1 RCT)	⊕◯◯◯ Very low[6,a,c]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women currently using modern contraceptive methods because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk ratio) - Number of women who have HIV tests performed during an antenatal visit	366 per 1000	**33 more women per 1000** (from 11 fewer to 88 more per 1000)	**RR 1.09** (0.97 to 1.24)	1698 (1 RCT)	⊕◯◯◯ Very low[7,c,i,k]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who have HIV tests performed during an antenatal visit because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk ratio) - At least two	882 per 1000	**44 more women per 1000**	**RR 1.05** (0.98 to 1.13)	298 (1 RCT)	⊕◯◯◯ Very low[6,a,c]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who have at least two

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings *(Continued)*

tetanus injections during pregnancy (RCT)		(from 18 fewer to 115 more)				tetanus injections during pregnancy because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk ratio) - At least two tetanus injections during pregnancy (non-randomised)	880 per 1000	**26 fewer women per 1000** (from 70 fewer to 9 more per 1000)	**RR 0.97** (0.92 to 1.01)	1068 (1 observational study)	⊕◯◯◯ Very low[8,c,d,h]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women who have at least two tetanus injections during pregnancy because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk ratio) - Emergency Department visit within one week of the doctor's office visit for asthma	60 per 1000	**53 fewer children per 1000** (from 59 fewer to 59 more per 1000)	**RR 0.11** (0.01 to 1.99)	152 (1 observational study)	⊕◯◯◯ Very low[1,e,f]	It is uncertain whether tracking + CDSS compared with usual care affects the number of children who had an Emergency Department visit within one week of a doctor's visit for asthma because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (risk ratio) - Hospitalisation within one week of the doctor's office visit for asthma	36 per 1000	**29 fewer children per 1000** (from 35 fewer to 84 more per 1000)	**RR 0.18** (0.01 to 3.35)	152 (1 observational study)	⊕◯◯◯ Very low[1,e,f]	It is uncertain whether tracking + CDSS compared with usual care affects the children who were hospitalised within one week of a doctor's office visit for asthma because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - At least three antenatal care visits	data not available	data not available	**OR 1.38** (1.32 to 1.44)	2535 (2 observational studies)	⊕◯◯◯ Very low[3,8,c,e]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women receiving at least three antenatal visits during pregnancy because the certainty of the evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - Women giving birth in a health facility (RCT)	data not available	data not available	**OR 1.96** (1.21 to 3.17)	571 (1 RCT)	⊕⊕◯◯ Low[4,a,i]	Tracking + CDSS compared to usual care may increase the number of women giving birth in a health facility.
Client utilisation of primary health care and/or services (odds ratio) - Women giving birth in a health facility (Non-randomised)	data not available	data not available	**OR 1.10** (0.66 to 1.85)	2536 (2 observational studies)	⊕◯◯◯ Very low[3,8,c,h,l,m]	It is uncertain whether tracking + CDSS compared with usual care affects the number of women giving birth in a health facility because the certainty of the evidence is very low.
G. Provider acceptability or satisfaction with the intervention						
No studies evaluated this outcome.						No evidence
H. Client acceptability of/satisfaction with the intervention						

Table 1. Comparison 1 (details): Tracking with clinical decision support (Tracking + CDSS) compared to usual care in primary healthcare settings *(Continued)*

No studies evaluated this outcome.	No evidence
I. Resource use	
No studies evaluated this outcome.	No evidence
J. Unintended consequences	
No studies evaluated this outcome.	No evidence

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

ASHA: Accredited Social Health Activists ; **CDSS:** clinical decision support system; **CHW:** community health worker; **CI:** confidence interval; **MD:** mean difference; **HIV:** human immunodeficiency virus ; **OR:** odds ratio; **RCT:** randomised controlled trial; **RR:** risk ratio

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations
[a]Unclear risk of bias due to lack of allocation concealment and blinding of participants, but the study was a cluster design
[b]Downgraded one level for serious inconsistency as I^2 was 75% to 100%; one study showed no difference between groups, whilst one study was in favour of the intervention
[c]Downgraded one level for indirectness as studies were conducted in one country
[d]Downgraded two levels for very serious risk of bias due to selection bias, lack of blinding, risk of confounding bias, selection bias, incomplete outcome data and measurement bias
[e]Downgraded two levels for high risk of bias due to being a non-randomised trial
[f]Downgraded two levels for indirectness due to being a very small single study performed at an academic practice in a high-income country
[g]Downgraded one level for imprecision due to few events
[h]Downgraded one level for imprecision as the confidence intervals ranged from a small-to-moderate decrease to a small-to-moderate increase in effect
[i]Downgraded one level for imprecision as confidence intervals included the possibility of a small or no effect AND important benefit or harm
[j]Three studies were cluster-randomised trials, but one (Prinja) was a non-randomised before-after trial
[k]Downgraded two levels for very serious risk of bias due to lack of blinding, high attrition rates and potential selective reporting
[l]Downgraded two levels for serious risk of bias due to selection bias and lack of blinding
[m]Downgraded one level for inconsistency as I^2 was 50% to 75%

Studies
[1]Shiffman 2000
[2]Patil 2022
[3]Ilozumba 2018
[4]Hackett 2018
[5]Chen 2016
[6]Carmichael 2019
[7]Bull 2018
[8]Prinja 2017
[9]Modi 2019

Table 2. Comparison 2 (details): Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary healthcare settings

Effectiveness of tracking with targeted client communication (Tracking + TCC) compared to usual care in primary care

Patient or population: healthcare providers using digital tracking with targeted client communication and clients receiving care from such providers

Setting: primary healthcare settings in China (Yan 2021) and Uganda (Asiki 2018)

Intervention: digital tracking with mobile targeted client communication (Tracking + TCC)

Comparison: standard care or no intervention (standard care without digital interventions or usual care that did not involve any additional follow-up)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with usual care	Risk with tracking with targeted client communication compared to standard care				
A. Clients' timeliness of receiving and accessing healthcare services and information						
No studies assessed this outcome.						No evidence
B. Quality of data about services provided						
No studies assessed this outcome.						No evidence
C. Clients' health behaviour						
Client's health behaviour - Medication adherence (antihypertensives)	512 per 1000	**51 more per 1000** (from 0 fewer to 108 more)	**RR 1.10** (1.00 to 1.21)	1226 (1 RCT)	⊕⊕◯◯ Low[1,a]	Tracking + TCC compared to usual care may increase medication adherence at 12 months in patients who have had a stroke.
D. Clients' health status and well-being						
Patient/client health status and well-being (dichotomous outcomes) - Women who gave birth at home	224 per 1000	**132 fewer per 1000** (from 166 fewer to 81 fewer)	**RR 0.41** (0.26 to 0.64)	525 (1 observational study)	⊕◯◯◯ Very low[2,a,b]	It is uncertain whether tracking + TCC compared with usual care affects the number of women who give birth at home because the certainty of the evidence is very low.
Patient/client health status and well-being (dichotomous outcomes) - Neonatal deaths	85 per 1000	**22 fewer deaths per 1000** (from 54 fewer to 44 more)	**RR 0.74** (0.36 to 1.52)	379 (1 observational study)	⊕◯◯◯ Very low[2,a,b,c]	It is uncertain whether tracking + TCC compared with usual care affects the number of neonatal deaths because the certainty of the evidence is very low.
Patient/client health status and well-being (inverse variance)	31 per 1000	**15 fewer deaths per 1000**	**RR 0.52** (0.28 to 0.96)	1226 (1 RCT)	⊕⊕◯◯ Low[1,a]	Tracking + TCC compared to usual care may reduce the number of hospitalisa-

Table 2. Comparison 2 (details): Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary healthcare settings *(Continued)*

- Deaths in stroke patients follow-up: mean 12 months		(from 22 fewer to 1 fewer)				tions for stroke deaths over 12 months in patients who have had a stroke.
Patient/client health status and well-being (continuous outcomes) - Change in systolic blood pressure amongst stroke survivors	-	MD **2.8 lower** (4.9 lower to 0.7 lower)	-	1226 (1 RCT)	⨁⨁◯◯ Low[1,a]	Tracking + TCC compared to usual care may slightly reduce systolic blood pressure at 12 months in patients who have had a stroke.
Patient/client health status and well-being (continuous outcomes) - Change in health-related quality of life (EQ-5D) amongst stroke survivors	-	MD **0.04 higher** (0.02 higher to 0.06 higher)	-	1226 (1 RCT)	⨁⨁◯◯ Low[1,a]	Tracking + TCC compared to usual care may slightly improve the health-related quality of life at 12 months in stroke survivors.
E. Clients' utilisation of primary healthcare services						
Client utilisation of primary health care and/or services - hospitalisations for stroke follow-up: mean 12 months	93 per 1000	**51 fewer hospitalisations per 1000** (from 63 fewer to 33 fewer)	**RR 0.45** (0.32 to 0.64)	1226 (1 RCT)	⨁⨁◯◯ Low[1,a]	Tracking + TCC compared to usual care may reduce the number of hospitalisations for stroke over 12 months in patients who have had a stroke.
F. Provider acceptability or satisfaction with the intervention						
No studies assessed these outcomes.						No evidence
G. Client acceptability of/satisfaction with the intervention						
No studies assessed these outcomes.						No evidence
H. Resource use						
No studies assessed these outcomes.						No evidence
I. Unintended consequences						
No studies assessed these outcomes.						No evidence

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **MD:** mean difference; **RCT:** randomised controlled trial; **RR:** risk ratio: **TCC:** targeted client communication

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Table 2. Comparison 2 (details): Tracking with targeted client communication (Tracking + TCC) compared to usual care in primary healthcare settings *(Continued)*

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

[a]Downgraded two levels for very serious directness for being a small trial, in one country, with few events

[b]Downgraded two levels for very serious risk of bias due to lack of randomisation and blinding

[c]Downgraded one level for imprecision as the confidence intervals ranged from a small-to-moderate decrease to a small-to-moderate increase in effect

Studies

[1]Yan 2021

[2]Asiki 2018

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings

Effect of tracking clients' health service use and status combined with decision support conducted via a mobile device and targeted client communication accessible via a mobile device (Tracking + CDSS + TCC) compared to usual care

Patient or population: healthcare providers using clinical decision support and targeted client communication tools and patients receiving care from such providers in primary care

Setting: primary healthcare settings in Bangladesh (Uddin 2016), Ethiopia (Shiferaw 2016), India (Peiris 2019; Prabhakaran 2019; Suryavanshi 2020), Kenya (Vedanthan 2019), and Palestine (Venkateswaran 2022).

Intervention: Tracking + CDSS + TCC

Comparison: standard care or no intervention (standard care with providers using decision support tools on paper, paper-based information booklet on management or usual care that did not involve any additional follow-up

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with usual care	Risk with tracking with clinical decision support and targeted client communication compared to standard care				
A. Providers' adherence to recommended practice						
Provider adherence to recommended practice - Infants received Nevirapine Prophylaxis	858 per 1000	**56 more per 1000** (from 43 fewer to 104 more)	**OR 1.75** (0.73 to 4.19)	609 (1 RCT)	⨁⨁◯◯ Low[1,a,b]	Tracking + TCC + CDSS compared with usual care may lead to a small increase in the number of infants of HIV+ve mothers receiving Nevirapine prophylaxis but the confidence interval includes both an increase and a decrease in numbers.

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

Provider adherence to recommended practice - Screening and management of anaemia	289 per 1000	**144 more per 1000** (from 93 more to 196 more)	**OR 1.88** (1.52 to 2.32	10,502 (1 RCT)	⊕⊕⊕○ Moderate[2,a]	Tracking + TCC + CDSS compared with usual care probably leads to higher guideline adherence for screening and managing anaemia amongst women receiving antenatal care.
Provider adherence to recommended practice - Screening and management of diabetes	397 per 1000	**91 more per 1000** (from 32 more to 151 more)	**OR 1.45** (1.14 to 1.84)	8669 (1 RCT)	⊕⊕⊕○ Moderate[2,a]	Tracking + TCC + CDSS compared with usual care probably leads to slightly higher guideline adherence for screening and managing hypertension amongst women in antenatal care.
Provider adherence to recommended practice - Screening and management of hypertension	947 per 1000	**20 more per 1000** (from 12 more to 27 more)	**OR 1.62** (1.29 to 2.04)	15,555 (1 RCT)	⊕⊕⊕○ Moderate[2,a]	Tracking + TCC + CDSS compared with usual care probably leads to higher guideline adherence for screening and managing hypertension in antenatal patients.
Provider adherence to recommended practice - Screening and management of abnormal foetal growth	788 per 1000	**101 fewer per 1000** (from 209 fewer to 9 fewer)	**OR 0.59** (0.37 to 0.95)	1165 (1 RCT)	⊕⊕⊕○ Moderate[2,a]	Tracking + TCC + CDSS compared with usual care probably leads to lower guideline adherence for screening and managing abnormal foetal growth in antenatal patients.
B. Time between presentation and appropriate management						
No study assessed this outcome.						No evidence
C. Clients' timeliness of receiving and accessing healthcare services and information						
No study assessed this outcome.						No evidence
D. Quality of data about services provided						
Quality of data about services provided - Data missing for gestational age at delivery	75 per 1000	**3 fewer per 1000** (from 14 fewer to 10 more)	**RR 0.96** (0.81 to 1.14)	6367 (1 RCT)	⊕⊕○○ Low[2,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference to the amount of missing data on gestational age at delivery for women who have just given birth.
Quality of data about services provided - Data missing for birthweight at delivery	104 per 1000	**10 fewer per 1000** (from 24 fewer to 4 more)	**RR 0.90** (0.77 to 1.04)	6367 (1 RCT)	⊕⊕○○ Low[2,a,b]	Tracking + TCC + CDSS compared to usual care may make little or no difference in the amount of missing data on birthweight at delivery for women who have just given birth.
Quality of data about services provided - Data missing for haemoglobin at delivery	276 per 1000	**63 fewer per 1000** (from 80 fewer to 44 fewer)	**RR 0.77** (0.71 to 0.84)	6367 (1 RCT)	⊕⊕⊕○ Moderate[2,a]	Tracking + TCC + CDSS compared to usual care probably leads to slightly less missing data for haemoglobin at delivery in women who have just given birth.

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

Quality of data about services provided - Data missing for blood pressure at delivery	305 per 1000	**49 more per 1000** (from 24 more to 73 more)	**RR 1.16** (1.08 to 1.24)	6367 (1 RCT)	⊕⊕⊕◯ Moderate[2,a]	Tracking + TCC + CDSS compared to usual care probably leads to slightly more missing data for blood pressure at delivery in women who have just given birth.
E. Clients' health behaviour						
Client's health behaviour - Physical activity levels	259 per 1000	**31 more per 1000** (from 18 fewer to 86 more)	**OR 1.17** (0.91 to 1.51)	8642 (1 RCT)	⊕◯◯◯ Very low[7,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared to usual care affects the physical activity levels of adults at high risk of cardiovascular disease because the certainty of this evidence is very low.
Client's health behaviour - Women on ART at delivery	802 per 1000	**49 more per 1000** (from 36 fewer to 106 more)	**OR 1.41** (0.81 to 2.45)	478 (1 RCT)	⊕⊕◯◯ Low[1,a,b]	Tracking + TCC + CDSS compared to usual care may make little or no difference to the number of HIV-positive pregnant women on antiretroviral therapy (ART) at delivery.
Client's health behaviour - Exclusive breastfeeding at 6 months	468 per 1000	**137 more per 1000** (from 13 fewer to 268 more)	**OR 1.74** (0.95 to 3.17)	695 (1 RCT)	⊕⊕◯◯ Low[1,a,b]	Tracking + TCC + CDSS compared to usual care may increase the number of HIV-positive women who are exclusively breastfeeding at 6 months, but the confidence interval also includes a small decrease.
F. Clients' health status and well-being						
Patient/client health status and well-being (dichotomous outcomes) - Deaths	11 per 1000	**4 fewer per 1000** (from 7 fewer to 1 more)	**OR 0.61** (0.35 to 1.06)	3698 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS may reduce the number of deaths in patients with hypertension and diabetes, but the confidence interval includes no difference in deaths.
Patient/client health status and well-being (dichotomous outcomes) - High-risk individuals achieving optimal BP levels (systolic blood pressure < 140 mmHg)	392 per 1000	**2 more per 1000** (from 63 fewer to 72 more)	**OR 1.01** (0.76 to 1.34)	11,966 (1 RCT)	⊕◯◯◯ Very low[7,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared with usual care improves the number of high-cardiovascular risk patients who achieve optimal systolic blood pressure (< 140 mm/hg) because the certainty of this evidence is very low.
Patient/client health status and well-being (dichotomous outcomes) - New cardiovascular disease events during follow-up	14 per 1000	**6 fewer per 1000** (from 8 fewer to 3 fewer)	**OR 0.58** (0.42 to 0.80)	8642 (1 RCT)	⊕⊕◯◯ Low[7,a,d]	Tracking + TCC + CDSS compared with usual care may reduce new cardiovascular events in high-cardiovascular risk adults over a 6-18 month follow-up period.
Patient/client health status and well-be-	37 per 1000	**16 fewer per 1000**	**OR 0.56**	1156 (1 RCT)	⊕◯◯◯	It is uncertain whether tracking + TCC + CDSS compared with usu-

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

ing (dichotomous outcomes) - Maternal mortality (before the baby reached 18 months) in HIV+ve mothers		(from 28 fewer to 12 more)	(0.23 to 1.35)		Very low[1,a,b,g]	al care affects maternal mortality before the baby reaches 18 months old in HIV-positive mothers because the certainty of this evidence is very low.
Patient/client health status and well-being (dichotomous outcomes) - Infant mortality before the baby reaches 18 months	11 per 1000	**6 more per 1000** (from 7 fewer to 60 more)	**OR 1.60** (0.37 to 6.91)	1191 (1 RCT)	⊕◯◯◯ Very low[1,a,b,g]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects infant mortality before the baby reaches 18 months old in HIV-positive mothers because the certainty of this evidence is very low.
Patient/client health status and well-being (dichotomous outcomes) - Hypertensive individuals whose BP is controlled (< 140/90) at 5 years	data not available	data not available	**OR 0.95** (0.63 to 1.43)	933 (1 RCT)	⊕◯◯◯ Very low[4,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared to usual care affects the number of adults with hypertension whose blood pressure is controlled (< 140/90) because the certainty of this evidence is very low.
Patient/client health status and well-being (dichotomous outcomes) - Adverse pregnancy outcome	219 per 1000	**2 fewer per 1000** (from 23 fewer to 20 more)	**OR 0.99** (0.87 to 1.12)	6367 (1 RCT)	⊕⊕◯◯ Low[2,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference in the number of adverse pregnancy outcomes in women receiving antenatal care.
Patient/client health status and well-being (dichotomous outcomes) - Moderate or severe anaemia	14 per 1000	**2 fewer per 1000** (from 7 fewer to 4 more)	**OR 0.82** (0.51 to 1.31)	6367 (1 RCT)	⊕⊕◯◯ Low[2,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference in the number of antenatal women with moderate or severe anaemia.
Patient/client health status and well-being (dichotomous outcomes) - Severe hypertension	5 per 1000	**2 fewer per 1000** (from 4 fewer to 2 more)	**OR 0.61** (0.27 to 1.37)	6367 (1 RCT)	⊕⊕◯◯ Low[2,a,b]	Tracking + TCC + CDSS compared to usual care may lead to a very small decrease in the number of antenatal women with severe hypertension, but the confidence interval includes both an increase and a decrease.
Patient/client health status and well-being (dichotomous outcomes) - Large-for-gestational-age baby	109 per 1000	**6 more per 1000** (from 10 fewer to 24 more)	**OR 1.06** (0.90 to 1.25)	6367 (1 RCT)	⊕⊕◯◯ Low[2,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference to the number of antenatal women with a large-for-gestational-age baby.
Patient/client health status and well-being (continuous outcomes) - Mean change in systolic blood pressure (SBP)	data not available	MD **0.29 higher** (2.55 lower to 3.13 higher)	-	8642 (2 RCTs)	⊕◯◯◯ Very low[6,7,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects systolic blood pressure in adults with an increased risk of cardiovascular disease be-

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

						cause the certainty of this evidence is very low.
Patient/client health status and well-being (continuous outcomes) - Mean change in body mass index (BMI) Kg/m^2	data not available	MD **0.36 lower** (1.21 lower to 0.48 higher)	-	11,966 (2 RCTs)	⊕◯◯◯ Very low[6,7,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects body mass index in adults with hypertension or diabetes because the certainty of this evidence is very low.
Patient/client health status and well-being (continuous outcomes) - Mean change in glycated haemoglobin (HbA1c)	data not available	MD **0.08 higher** (0.27 lower to 0.43 higher)	-	3324 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference to the mean change in HbA1c in adults with hypertension or diabetes.
Patient/client health status and well-being (continuous outcomes) - Change in fasting plasma glucose (mg/dL)	data not available	MD **8.4 higher** (9.6 lower to 26.4 higher)	-	3324 (1 RCT)	⊕◯◯◯ Very low[6,a,e]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects fasting plasma glucose in adults with an increased risk of cardiovascular disease because the certainty of this evidence is very low.
Patient/client health status and well-being (continuous outcomes) - Change in total cholesterol (mg/dL) [200 mg/dL is normal; 240 mg/dL is high]	data not available	MD **2.5 lower** (7.1 lower to 2.1 higher)	-	3324 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference to the change in total cholesterol levels in adults with hypertension or diabetes.
Patient/client health status and well-being (continuous outcomes) - Change in predicted 10-year risk of CVD (modified Framingham) % [< 10% is low; 10-20% is mod; > 20% is high risk]	data not available	MD **0.4 lower** (2.3 lower to 1.5 higher)	-	3324 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference to predicted 10-year risk of cardiovascular disease in adults with hypertension or diabetes.
Patient/client health status and well-being (continuous outcomes) - Change in tobacco use % as per the Centre for Cardio-metabolic Risk Reduction in South Asia (CARRS) Questionnaire[f]	data not available	MD **0.05 lower** (0.47 lower to 0.37 higher)	-	3324 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS compared to usual care may make little or no difference to tobacco use in adults with hypertension or diabetes.

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

Patient/client health status and well-being (continuous outcomes) - Change in alcohol use (AUDIT score range 0-40)	data not available	MD **0.7 higher** (3.7 lower to 5.1 higher)	-	3325 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS compared to usual care may make little or no difference to alcohol use in adults with hypertension or diabetes.
Patient/client health status and well-being (continuous outcomes) - Change in depression score PHQ-9 (scores 0-27)	data not available	MD **1.6 lower** (4.4 lower to 1.2 higher)	-	3324 (1 RCT)	⊕⊕◯◯ Low[6,a,b]	Tracking + TCC + CDSS compared to usual care may make little or no difference in depression scores in adults with hypertension or diabetes.
Patient/client health status and well-being (continuous outcomes) - Change in diastolic blood pressure (DBP) mmHg	data not available	MD **0.6 lower** (4.29 lower to 3.09 higher)	-	8642 (1 RCT)	⊕◯◯◯ Very low[7,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared to usual care affects diastolic blood pressure in adults with hypertension and diabetes because the certainty of this evidence is very low.
Patient/client health status and well-being (continuous outcomes) - Change in quality of life (EQ5D) (score 0 = dead 1 = full life)	data not available	MD **0** (0.01 lower to 0.01 higher)	-	8642 (1 RCT)	⊕◯◯◯ Very low[7,a,b,d]	It is uncertain whether tracking + TCC + CDSS compared to usual care affects health-related quality of life amongst adults at high risk of cardiovascular disease because the certainty of this evidence is very low.
G. Client utilisation of primary healthcare services						
Client utilisation of primary health care and/or services (dichotomous) - Fully vaccinated - rural	552 per 1000	**215 more per 1000** (from 44 more to 436 more)	**RR 1.39** (1.08 to 1.79)	136 (1 observational study)	⊕◯◯◯ Very low[3,a,c]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of children in a hard-to-reach rural setting who are fully vaccinated because the certainty of this evidence is very low.
Client utilisation of primary health care and/or services (dichotomous) - Fully vaccinated - urban	339 per 1000	**231 more per 1000** (from 81 more to 441 more)	**RR 1.68** (1.24 to 2.30)	210 (1 observational study)	⊕◯◯◯ Very low[3,a,c]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of children over 298 days old in a hard-to-reach urban setting who are fully vaccinated because the certainty of this evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - Linkage to care	data not available	data not available	**OR 1.21** (0.71 to 2.05)	933 (1 RCT)	⊕◯◯◯ Very low[4,a,b,d]	It is uncertain whether tracking + TCC + CDSS, compared with usual care, improves patient linkage to care because the certainty of this evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - At least	234 per 1000	**52 more per 1000** (from 0 fewer to 111 more)	**OR 1.31** (1.00 to 1.72)	1224 (1 observational study)	⊕◯◯◯ Very low[5,a,c]	It is uncertain whether tracking + TCC + CDSS compared with usual care increases the number of pregnant women who attended at least four antenatal care visits

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

four antenatal care visits						because the certainty of this evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - Women who gave birth at a health facility	267 per 1000	**152 more per 1000** (from 91 more to 216 more)	**OR 1.98** (1.53 to 2.56)	1224 (1 observational study)	⊕◯◯◯ Very low[5,a,c]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of women who gave birth at a health facility because the certainty of this evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - Postnatal care in a health facility	206 per 1000	**212 more per 1000** (from 149 more to 278 more)	**OR 2.77** (2.12 to 3.61)	1224 (1 observational study)	⊕◯◯◯ Very low[5,a,c]	It is uncertain whether tracking + TCC + CDSS compared with usual care affects the number of women who received postnatal care in a health facility because the certainty of this evidence is very low.
Client utilisation of primary health care and/or services (odds ratio) - Never missed early infant diagnosis visit	600 per 1000	**20 fewer per 1000 missed a visit** (from 114 fewer to 69 more)	**OR 0.92** (0.63 to 1.35))	1183 (1 RCT)	⊕⊕◯◯ Low[1,a,b]	Tracking + TCC + CDSS compared with usual care may make little or no difference to the number of pregnant women who never missed an early infant diagnosis visit.
H. Provider acceptability of/satisfaction with the intervention						
No study assessed these outcomes.						No evidence
I. Client acceptability of/ satisfaction with the intervention						
Patient/client acceptability/satisfaction with the intervention - Reported "slightly/much better" change in quality of care	950 per 1000	**19 more per 1000** (from 0 fewer to 29 more)	**RR 1.02** (1.00 to 1.03)	3324 (1 RCT)	⊕⊕⊕◯ Moderate[6,a]	Tracking + TCC + CDSS compared to usual care probably slightly increases the number of adults with hypertension or diabetes reporting a "slightly/ much better" change in quality of care.
J. Resource use						
No study assessed these outcomes.						No evidence
K. Unintended consequences						
No study assessed these outcomes.						No evidence

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

AUDIT: Alcohol Use Disorders Identification Test; **ART:** antiretroviral therapy; **BMI:** body mass index; **BP:** blood pressure; **CARRS:** Centre for Cardio-metabolic Risk Reduction in South Asia Questionnaire; **CI:** confidence interval; **CVD:** cardiovascular disease ; **DBP:** diastolic blood pressure; **HbA1c:** haemoglobin A1c; **HIV:** human immunodeficiency virus; **MD:** mean difference; **OR:** odds ratio; **PHQ-9:** Patient health questionnaire-9 ; **RCT:** randomised controlled trial; **RR:** risk ratio; **SBP:** systolic blood pressure; **TCC:** targeted client communication

GRADE Working Group grades of evidence

Table 3. Comparison 3 (details): Tracking with clinical decision support and targeted client communication (Tracking + CDSS + TCC) compared to usual care in primary healthcare settings *(Continued)*

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations
[a]Downgraded one level for indirectness as studies were conducted in one country
[b]Downgraded one level for imprecision as the confidence intervals ranged from a small-to-moderate decrease to a small-to-moderate increase in effect
[c]Downgraded two levels for very serious risk of bias due to lack of randomisation and blinding
[d]Downgraded one level for serious risk of bias due to lack of blinding
[e]Downgraded two levels for very serious imprecision as the confidence intervals ranged from a large decrease to a large increase in effect
[f]"Within the past 6 months, do you currently consume tobacco: regularly (once a week); occasionally (< once a week) or not at all?"
[g]Downgraded one level for imprecision due to the small number of event numbers
Studies
[1]Suryavanshi 2020
[2]Venkateswaran 2022
[3]Uddin 2016
[4]Vedanthan 2019
[5]Shiferaw 2016
[6]Prabhakaran 2019
[7]Peiris 2019

APPENDICES

Appendix 1. Tracking + CDSS Outcomes

Tracking + CDSS outcomes

Study ID	Outcome	Outcome definition
Dichotomous outcomes		
Modi 2019	Provider's adherence to recommended practice	At least two home visits by ASHA within first week of delivery (data are weighted mean of clusters (95% CI) - primary outcome)
Carmichael 2019	Provider's adherence to recommended practice	Any visit in the first week (%)
Carmichael 2019	Provider's adherence to recommended practice	At least one home visit within 24 h of delivery, amongst women who had a home delivery (%)
Modi 2019	Provider's adherence to recommended practice	ASHA visited at home within 24 hours of delivery (in case of home delivery) or within 24 hours of return to home from hospital in case of hospital delivery - Practice of newborn care immediately after delivery

(Continued)

Shiffman 2000	Provider's adherence to recommended practice	Immediate referral to ED or hospital
Modi 2019	Provider's adherence to recommended practice	Counselled to initiate complementary food at six months - Counselling mothers of infants aged six to nine months by ASHA
Carmichael 2019	Provider's adherence to recommended practice	Any home visit related to complementary feeding (%)
Patil 2022	Provider's adherence to recommended practice	% of mothers who recalled being counselled about the right time to start complementary feeding by CHNW
Prinja 2017	Provider's adherence to recommended practice	Weight measurement, ANC
Prinja 2017	Provider's adherence to recommended practice	Blood pressure, ANC
Prinja 2017	Provider's adherence to recommended practice	Blood test, ANC
Prinja 2017	Provider's adherence to recommended practice	Urine test, ANC
Carmichael 2019	Provider's adherence to recommended practice	Nothing applied to the umbilical cord (%)
Carmichael 2019	Provider's adherence to recommended practice	Skin-to-skin care (%)
Shiffman 2000	Patients'/clients' health status and well-being	Improvement in asthma severity during office visit
Bull 2018	Patients'/clients' health status and well-being	HIV-positive following HIV test; intervention: electronic records, control: paper records
Modi 2019	Patients'/clients' health status and well-being	Infant deaths
Modi 2019	Patients'/clients' health status and well-being	Stillbirths
Modi 2019	Patients'/clients' health status and well-being	Neonatal deaths
Modi 2019	Patients'/clients' health status and well-being	Low birthweight (≤ 2.0 kg) at the time of birth - Care-seeking for maternal and neonatal complications
Modi 2019	Patients'/clients' health status and well-being	Suffered from pneumonia/fever within last two weeks - Health-seeking and vaccination amongst children aged six to nine months
Shiffman 2000	Clients' utilisation of primary health care and/or services	ED visits

(Continued)

Shiffman 2000	Clients' utilisation of primary health care and/or services	Hospitalisation
Shiffman 2000	Clients' utilisation of primary health care and/or services	Primary care re-visit
Chen 2016	Clients' utilisation of primary health care and/or services	Five-vaccine immunisation coverage (received 1 dose of BCG and measles and 3 doses of HBV, DPT, OPV)
Prinja 2017	Clients' utilisation of primary health care and/or services	Full childhood (age up to 2 years) immunisation
Carmichael 2019	Clients' utilisation of primary health care and/or services	Fully immunised (except measles) (%)
Modi 2019	Clients' utilisation of primary health care and/or services	Received all three doses of pentavalent vaccines - Health-seeking and vaccination amongst children aged six to nine months
Prinja 2017	Clients' utilisation of primary health care and/or services	≥ 3 ANC visits
Ilozumba 2018	Clients' utilisation of primary health care and/or services	Attended four or more ANC visits
Prinja 2017	Clients' utilisation of primary health care and/or services	≥ 2 tetanus toxoid, ANC
Carmichael 2019	Provider's adherence to recommended practice	At least 2 tetanus toxoid injections (%)
Hackett 2018	Clients' utilisation of primary health care and/or services	Facility delivery
Carmichael 2019	Provider's adherence to recommended practice	Facility delivery (%)
Prinja 2017	Clients' utilisation of primary health care and/or services	Institutional delivery
Modi 2019	Clients' utilisation of primary health care and/or services	Delivery at hospital - Coverage and quality of maternal health services during pregnancy
Ilozumba 2018	Clients' utilisation of primary health care and/or services	Delivering at a health centre
Carmichael 2019	Clients' utilisation of primary health care and/or services	Current use of any modern method of contraception (%)
Bull 2018	Clients' utilisation of primary health care and/or services	HIV tests; intervention: electronic records, control: paper records
Carmichael 2019	Clients' health behaviour	Consumed at least 90 iron-folic acid tablets (%)
Prinja 2017	Clients' health behaviour	≥ 100 iron-folic acid consumption, ANC

(Continued)

Modi 2019	Clients' health behaviour	Consumed at least 100 iron-folic acid tablets during pregnancy - Coverage and quality of maternal health services during pregnancy
Modi 2019	Clients' health behaviour	Early initiation (within 1 hour) of breastfeeding - Practice of newborn care immediately after delivery
Carmichael 2019	Clients' health behaviour	Immediate breastfeeding (within 1 hour of delivery) (%)
Carmichael 2019	Clients' health behaviour	Bath delayed by at least 2 days (%)
Modi 2019	Clients' health behaviour	Kangaroo Mother Care - Mother/family practised following this at home during the first month after delivery
Modi 2019	Clients' health behaviour	Practised exclusive breastfeeding until just under 6 months of age - Nutritional outcomes amongst children aged six to nine months
Carmichael 2019	Clients' health behaviour	Exclusive breastfeeding for 6 months amongst infants ≥ 6 months
Continuous outcomes		
Modi 2019	Provider's adherence to recommended practice	Number of ASHA home visits in first month - Practice of newborn care immediately after delivery

Appendix 2. Tracking + TCC outcomes

Tracking + TCC outcomes

Study ID	Outcome	Outcome definition
Asiki 2018	Patients'/clients' health status and well-being	Home delivery
Asiki 2018	Patients'/clients' health status and well-being	Neonatal deaths
Yan 2021	Patient/client well-being	Change in systolic blood pressure, mean (SD), mm Hg
Yan 2021	Patient/client well-being	Change in health-related quality of life score, mean (SD)
Yan 2021	Patient/client health behaviour	Medication adherence to antihypertensives, n (%)
Yan 2021	Clients utilisation of PHC and/or service health status	Stroke hospitalisation in the past year, n (%)
Yan 2021	Adverse outcomes	Death, n (%)

Appendix 3. Tracking + CDSS + TCC outcomes

Tracking + CDSS + TCC outcomes

Study ID	Outcome	Outcome definition
Dichotomous outcomes		
Shiferaw 2016	Clients' utilisation of primary health care and/or services health status (ALL)	At least four antenatal care visits in a health centre
Shiferaw 2016	Clients' utilisation of primary health care and/or services health status (ALL)	Delivery in a health centre
Shiferaw 2016	Clients' utilisation of primary health care and/or services health status (ALL)	Post-natal care in a health centre
Uddin 2016	Clients' utilisation of primary health care and/or services health status (ALL)	Vaccination coverage in children aged 298+ days
Uddin 2016	Clients' utilisation of primary health care and/or services health status (ALL)	Vaccination coverage in children aged 298+ days
Vedanthan 2019	Clients' utilisation of primary health care and/or services health status (ALL)	Overall linkage to care
Suryavanshi 2020	Clients' utilisation of primary health care and/or services health status (ALL)	Proportion of eligible infants who never missed any early infant diagnosis visit
Suryavanshi 2020	Patients'/clients' health behaviour	Proportion of women on ART at delivery
Suryavanshi 2020	Patients'/clients' health behaviour	Proportion of women practising exclusive breastfeeding for six months
Peiris 2019	Clients'/patients' health behaviour	Active - health-enhancing physical activity
Prabhakaran 2019	Patient/client acceptability of and satisfaction with the intervention (ALL)	Participants' feedback on changes in quality of care: slightly/much better
Prabhakaran 2019	Patients'/clients' health status and well-being	Deaths
Peiris 2019	Patients'/clients' health status and well-being	Difference in proportion of high-risk individuals achieving optimal BP levels (systolic BP < 140 mmHg) between the intervention and control periods (primary outcome)
Peiris 2019	Patients'/clients' health status and well-being	New CVD events during follow-up (yes/no)
Suryavanshi 2020	Patients'/clients' health status and well-being	Maternal mortality
Suryavanshi 2020	Patients'/clients' health status and well-being	Infant mortality
Venkateswaran 2022	Patients'/clients' health status and well-being	Adverse pregnancy outcome
Venkateswaran 2022	Patients'/clients' health status and well-being	Moderate or severe anaemia
Venkateswaran 2022	Patients'/clients' health status and well-being	Severe hypertension
Venkateswaran 2022	Patients'/clients' health status and well-being	Large-for-gestational-age baby

(Continued)

Vedanthan 2019	Patients'/clients' health status and well-being	Percentage of hypertensive individuals whose BP is controlled (< 140/90) at the final clinic visit (at 5 years)
Suryavanshi 2020	Provider's adherence to recommended practice	Proportion of eligible infants who received Nevirapine prophylaxis
Venkateswaran 2022	Provider's adherence to recommended practice	Screening and management during eligible antenatal contacts (anaemia)
Venkateswaran 2022	Provider's adherence to recommended practice	Screening and management during eligible antenatal contacts (diabetes)
Venkateswaran 2022	Provider's adherence to recommended practice	Screening and management during eligible antenatal contacts (hypertension)
Venkateswaran 2022	Provider's adherence to recommended practice	Screening and management during eligible antenatal contacts (abnormal foetal growth)
Venkateswaran 2022	Quality of data about services provided	Data missing for gestational age at delivery
Venkateswaran 2022	Quality of data about services provided	Data missing for birthweight at delivery
Venkateswaran 2022	Quality of data about services provided	Data missing for haemoglobin at delivery
Venkateswaran 2022	Quality of data about services provided	Data missing for blood pressure at delivery
Continuous outcomes		
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group differences in mean change (from baseline to 1 year) in glycated haemoglobin (HbA1c) amongst participants with diabetes mellitus
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group differences in mean change (from baseline to 1 year) in systolic blood pressure amongst participants with hypertension
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group difference in mean change (from baseline to 1 year) in fasting plasma glucose
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group difference in mean change (from baseline to 1 year) in total cholesterol
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group difference in mean change (from baseline to 1 year) in predicted 10-year risk of CVD with the recalibrated Framingham risk score
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group difference in mean change (from baseline to 1 year) in tobacco use %
Prabhakaran 2019	Patients'/clients' health status and well-being	Between-group difference in mean change (from baseline to 1 year) in body mass index
Prabhakaran 2019	Clients'/patients' health behaviour	Between-group difference in mean change (from baseline to 1 year) in alcohol use (Alcohol Use Disorder Identification Test (AUDIT))
Prabhakaran 2019	Patients'/clients' health status and well-being	Depression score: Patient Health Questionnaire-9

(Continued)

Peiris 2019	Patients'/clients' health status and well-being	Change in SBP from baseline
Peiris 2019	Patients'/clients' health status and well-being	Change in DBP from baseline
Peiris 2019	Patients'/clients' health status and well-being	Change in BMI from baseline
Peiris 2019	Patients'/clients' health status and well-being	Change in EQ5D (EuroQol quality of life dimension questionnaire) from baseline

Appendix 4. Search strategies

Databases

- Cochrane Central Register of Controlled Trials, Issue 10 of 12, October 2022, part of the Cochrane Library, Wiley (searched 08 November 2022)
- Embase <1974 to 2022 Week 44>, Ovid (searched 09 November 2022)
- Global Index Medicus, WHO (https://www.globalindexmedicus.net/) (searched 09.11.2022)
- Ovid MEDLINE(R) ALL <1946 to November 08, 2022> (searched 09 November 2022)
- POPLINE (searched 07 August 2019)

Trial Registries

- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (clinicaltrials.gov/) (searched 09.11.2022)
- International Clinical Trials Registry Platform (ICTRP), WHO (www.who.int/clinical-trials-registry-platform) (searched 09.11.2022)

The Cochrane Library (Wiley)

Database	Issue/year (e.g. 3/2013)
- CDSR 9/2018 - CENTRAL 9/2018	

No.	Search terms	Results
#1	MeSH descriptor: [Health Personnel] explode all trees	7642
#2	MeSH descriptor: [Volunteers] this term only	251
#3	MeSH descriptor: [Delivery of Health Care] this term only and with qualifier(s): [manpower - MA]	1
#4	MeSH descriptor: [Delivery of Health Care, Integrated] this term only and with qualifier(s): [manpower - MA]	3
#5	(((health or medical or healthcare or frontline or front-line) near (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or (general next practitioner?)or nurse* or midwi* or "clinical officer*" or pharmacist* or dentist* or vaccinator* or supervi-	73720

(Continued)

	sor* or ((birth or childbirth or labor or labour) near (attendant? or assistant?))):ti,ab,kw	
#6	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or (non next professional?) or support or link or outreach or "out reach") near/5 (worker? or visitor? or attendant? or aide or aides or support$ or person$ or helper? or carer? or caregiver? or (care next giver?) or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or (lay next advocate*) or (lay next health) or "lay advisors" or "lay educators" or (lay next counselor*) or (lay next counsellor*) or (lay next facilitator*) or "natural helpers" or linkworker? or monitrice* or consejeras):ti,ab,kw	66225
#7	(paraprofessional? or paramedic or paramedics or (paramedical next worker?) or "paramedical personnel" or "allied health personnel" or (allied next health next worker?) or (support next worker?) or (home next health next aide?)):ti,ab,kw	957
#8	((community or village? or peer or indigenous or treatment) near/3 ("health worker?" or "health care worker?" or "healthcare worker?" or "health advisor*" or volunteer* or educator* or facilitator* or distributor* or "extension worker*" or supporter* or counselor* or counsellor*)):ti,ab,kw	1892
#9	(doula? or douladural? or (barefoot next doctor?)):ti,ab,kw	26
#10	{or #1-#9}	132579
#11	MeSH descriptor: [Medical Records] this term only	717
#12	MeSH descriptor: [Registries] this term only	838
#13	MeSH descriptor: [Electronic Health Records] this term only	286
#14	MeSH descriptor: [Health Records, Personal] this term only	45
#15	MeSH descriptor: [Health Smart Cards] this term only	0
#16	MeSH descriptor: [Medical Order Entry Systems] this term only	63
#17	MeSH descriptor: [Medical Records Systems, Computerized] this term only	197
#18	MeSH descriptor: [Forms and Records Control] this term only	53
#19	MeSH descriptor: [Clinical Coding] this term only	11
#20	MeSH descriptor: [Medical Record Linkage] this term only	29
#21	MeSH descriptor: [Health Information Management] this term only	6
#22	MeSH descriptor: [Health Information Exchange] this term only	5
#23	MeSH descriptor: [Management Information Systems] this term only	9
#24	MeSH descriptor: [Decision Support Systems, Management] this term only	8
#25	MeSH descriptor: [Decision Support Systems, Clinical] this term only	313

(Continued)

#26	MeSH descriptor: [Decision Making] this term only	1995
#27	MeSH descriptor: [Decision Support Techniques] this term only	708
#28	MeSH descriptor: [Checklist] this term only	221
#29	MeSH descriptor: [Health Information Systems] this term only	9
#30	MeSH descriptor: [Ambulatory Care Information Systems] this term only	25
#31	MeSH descriptor: [Hospital Information Systems] this term only	43
#32	(register or registers or registration or registry or registries or ((tracking or monitor*) near/2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) near/2 (record or records)) or (health next smart next card*) or hmis or ((information or decision* or case*) near (management or system* or support))):ti,ab,kw	77554
#33	((decision* near/3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or (expert next system*) or (job next aid*)):ti,ab,kw	17568
#34	("district health information" or dhis2 or motech or "mobile technology for health" or "service record" or logbook or "log book" or eregistr* or e-registr* or ((vital next event*) near/3 track*)):ti,ab,kw	178
#35	{or #11-#34}	89905
#36	MeSH descriptor: [Cell Phone] this term only	578
#37	MeSH descriptor: [Smartphone] this term only	174
#38	MeSH descriptor: [MP3-Player] this term only	20
#39	MeSH descriptor: [Computers, Handheld] this term only	228
#40	((cell* or mobile*) near/1 (phone* or telephone* or technolog* or device*)):ti,ab,kw	2531
#41	(handheld or (hand next held)):ti,ab,kw	1505
#42	(smartphone* or (smart next phone*) or cellphone* or mobiles):ti,ab,kw	1829
#43	((personal near/1 digital) or (pda near/3 (device* or assistant*)) or ((mp3 or mp4) next player*)):ti,ab,kw	222
#44	(samsung or nokia):ti,ab,kw	76
#45	(windows near/3 (mobile* or phone*)):ti,ab,kw	4
#46	android:ti,ab,kw	272
#47	(ipad* or (i next pad*) or ipod* or (i next pod*) or iphone* or (i next phone*)):ti,ab,kw	716
#48	(tablet* near/3 (device* or computer*)):ti,ab,kw	398

(Continued)

#49	MeSH descriptor: [Text Messaging] this term only	572
#50	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health):ti,ab,kw	3323
#51	(((text* or short or voice or multimedia or (multi next media) or electronic or instant) near/1 messag*) or "instant messenger"):ti,ab,kw	2400
#52	(texting or texted or texter* or ((sms or mms) near (service* or messag*)) or (interactive next voice next response*) or ivr or (voice next call*) or callback* or "voice over internet" or voip):ti,ab,kw	1623
#53	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or (google next hangout*)):ti,ab,kw	516
#54	MeSH descriptor: [Mobile Applications] this term only	309
#55	(mobile next app*):ti,ab,kw	1018
#56	MeSH descriptor: [Reminder Systems] this term only	823
#57	(remind* near/3 (text* or system* or messag*)):ti,ab,kw	1545
#58	MeSH descriptor: [Medical Informatics] this term only	67
#59	MeSH descriptor: [Medical Informatics Applications] this term only	23
#60	MeSH descriptor: [Nursing Informatics] this term only	11
#61	MeSH descriptor: [Public Health Informatics] this term only	1
#62	((medical or clinical or health or healthcare or nurs*) near/3 informatics):ti,ab,kw	246
#63	MeSH descriptor: [Computer-Assisted Instruction] this term only	1149
#64	((interactive or (computer next assisted)) near/1 (tutor* or technolog* or learn* or instruct* or software or communication)):ti,ab,kw	1376
#65	{or #36-#64}	14243
#66	#10 and #35 and #65	2744
#67	#10 and #35 and #65 with Publication year from 2017 to 2018, in Trials	654
#68	#10 and #35 and #65 with Cochrane Library publication date between Jul 2017 and Sep 2018, in Trials	883
#69	#67 or #68	991

Rerun October 2019

(Continued)

Database	Issue/year (e.g. 3/2013)
CDSR	10/2019
CENTRAL	10/2019

No.	Search terms	Results
#1	MeSH descriptor: [Health Personnel] explode all trees	8276
#2	MeSH descriptor: [Volunteers] this term only	273
#3	MeSH descriptor: [Delivery of Health Care] this term only	691
#4	MeSH descriptor: [Delivery of Health Care, Integrated] this term only	349
#5	MeSH descriptor: [Workforce] this term only	399
#6	MeSH descriptor: [Health Workforce] this term only	16
#7	(#3 or #4) and (#5 or #6)	10
#8	(((health or medical or healthcare or frontline or front-line) near (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or (general next practitioner?)or nurse* or midwi* or "clinical officer*" or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) near (attendant? or assistant?))):ti,ab,kw	98270
#9	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or (non next professional?) or support or link or outreach or "out reach") near/5 (worker? or visitor? or attendant? or aide or aides or support$ or person$ or helper? or carer? or caregiver? or (care next giver?) or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or (lay next advocate*) or (lay next health) or "lay advisors" or "lay educators" or (lay next counselor*) or (lay next counsellor*) or (lay next facilitator*) or "natural helpers" or linkworker? or monitrice* or consejeras):ti,ab,kw	80571
#10	(paraprofessional? or paramedic or paramedics or (paramedical next worker?) or "paramedical personnel" or "allied health personnel" or (allied next health next worker?) or (support next worker?) or (home next health next aide?)):ti,ab,kw	1325
#11	((community or village? or peer or indigenous or treatment) near/3 ("health worker?" or "health care worker?" or "healthcare worker?" or "health advisor*" or volunteer* or educator* or facilitator* or distributor* or "extension worker*" or supporter* or counselor* or counsellor*)):ti,ab,kw	2388
#12	(doula? or douladural? or (barefoot next doctor?)):ti,ab,kw	60
#13	{or #1-#2, #7-#12}	

(Continued)

#14	MeSH descriptor: [Medical Records] this term only	729
#15	MeSH descriptor: [Registries] this term only	894
#16	MeSH descriptor: [Electronic Health Records] this term only	318
#17	MeSH descriptor: [Health Records, Personal] this term only	46
#18	MeSH descriptor: [Health Smart Cards] this term only	0
#19	MeSH descriptor: [Medical Order Entry Systems] this term only	63
#20	MeSH descriptor: [Medical Records Systems, Computerized] this term only	198
#21	MeSH descriptor: [Forms and Records Control] this term only	54
#22	MeSH descriptor: [Clinical Coding] this term only	11
#23	MeSH descriptor: [Medical Record Linkage] this term only	29
#24	MeSH descriptor: [Health Information Management] this term only	6
#25	MeSH descriptor: [Health Information Exchange] this term only	5
#26	MeSH descriptor: [Management Information Systems] this term only	9
#27	MeSH descriptor: [Decision Support Systems, Management] this term only	8
#28	MeSH descriptor: [Decision Support Systems, Clinical] this term only	342
#29	MeSH descriptor: [Decision Making] this term only	2129
#30	MeSH descriptor: [Decision Support Techniques] this term only	767
#31	MeSH descriptor: [Checklist] this term only	248
#32	MeSH descriptor: [Health Information Systems] this term only	11
#33	MeSH descriptor: [Ambulatory Care Information Systems] this term only	25
#34	MeSH descriptor: [Hospital Information Systems] this term only	42
#35	(register or registers or registration or registry or registries or ((tracking or monitor*) near/2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) near/2 (record or records)) or (health next smart next card*) or hmis or ((information or decision* or case*) near (management or system* or support))):ti,ab,kw	99768
#36	((decision* near/3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or (expert next system*) or (job next aid*)):ti,ab,kw	24166
#37	("district health information" or dhis2 or motech or "mobile technology for health" or "service record" or logbook or "log book" or eregistr* or e-registr* or ((vital next event*) near/3 track*)):ti,ab,kw	317

(Continued)

#38	{or #14-#37}	117105
#39	MeSH descriptor: [Cell Phone] this term only	626
#40	MeSH descriptor: [Smartphone] this term only	267
#41	MeSH descriptor: [MP3-Player] this term only	21
#42	MeSH descriptor: [Computers, Handheld] this term only	242
#43	((cell* or mobile*) near/1 (phone* or telephone* or technolog* or device*)):ti,ab,kw	3655
#44	(handheld or (hand next held)):ti,ab,kw	2060
#45	(smartphone* or (smart next phone*) or cellphone* or mobiles):ti,ab,kw	3135
#46	((personal near/1 digital) or (pda near/3 (device* or assistant*)) or ((mp3 or mp4) next player*)):ti,ab,kw	286
#47	(samsung or nokia):ti,ab,kw	128
#48	(windows near/3 (mobile* or phone*)):ti,ab,kw	6
#49	android:ti,ab,kw	524
#50	(ipad* or (i next pad*) or ipod* or (i next pod*) or iphone* or (i next phone*)):ti,ab,kw	987
#51	(tablet* near/3 (device* or computer*)):ti,ab,kw	676
#52	MeSH descriptor: [Text Messaging] this term only	689
#53	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health):ti,ab,kw	4004
#54	(((text* or short or voice or multimedia or (multi next media) or electronic or instant) near/1 messag*) or "instant messenger"):ti,ab,kw	3469
#55	(texting or texted or texter* or ((sms or mms) near (service* or messag*)) or (interactive next voice next response*) or ivr or (voice next call*) or callback* or "voice over internet" or voip):ti,ab,kw	2170
#56	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or (google next hangout*)):ti,ab,kw	840
#57	MeSH descriptor: [Mobile Applications] this term only	451
#58	(mobile next app*):ti,ab,kw	1640
#59	MeSH descriptor: [Reminder Systems] this term only	864
#60	(remind* near/3 (text* or system* or messag*)):ti,ab,kw	1864
#61	MeSH descriptor: [Medical Informatics] this term only	72

(Continued)

#62	MeSH descriptor: [Medical Informatics Applications] this term only	23
#63	MeSH descriptor: [Nursing Informatics] this term only	10
#64	MeSH descriptor: [Public Health Informatics] this term only	1
#65	((medical or clinical or health or healthcare or nurs*) near/3 informatic-s):ti,ab,kw	314
#66	MeSH descriptor: [Computer-Assisted Instruction] this term only	1187
#67	((interactive or (computer next assisted)) near/1 (tutor* or technolog* or learn* or instruct* or software or communication)):ti,ab,kw	1453
#68	{or #39-#67}	19346
#69	#13 and #38 and #68	3513
#70	#13 and #38 and #68 with Publication Year from 2018 to 2019, in Trials	877
#71	#13 and #38 and #68 with Cochrane Library publication date Between Sep 2018 and Oct 2019, in Trials	865
#72	#70 or #71	1130

Rerun October 2020

Database	**Issue/year (e.g. 3/2013)**
CDSR	10/2020
CENTRAL	10/2020

No.	**Search terms**	**Results**
#1	MeSH descriptor: [Health Personnel] explode all trees	8776
#2	MeSH descriptor: [Volunteers] this term only	285
#3	MeSH descriptor: [Delivery of Health Care] this term only	725
#4	MeSH descriptor: [Delivery of Health Care, Integrated] this term only	376
#5	MeSH descriptor: [Workforce] this term only	398
#6	MeSH descriptor: [Health Workforce] this term only	21
#7	(#3 or #4) and (#5 or #6)	9
#8	(((health or medical or healthcare or frontline or front-line) near (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or (general next practitioner?)or nurse* or mid-wi* or "clinical officer*" or pharmacist* or dentist* or vaccinator* or supervi-	105691

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	sor* or ((birth or childbirth or labor or labour) near (attendant? or assistant?))):ti,ab,kw	
#9	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or (non next professional?) or support or link or outreach or "out reach") near/5 (worker? or visitor? or attendant? or aide or aides or support$ or person$ or helper? or carer? or caregiver? or (care next giver?) or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or (lay next advocate*) or (lay next health) or "lay advisors" or "lay educators" or (lay next counselor*) or (lay next counsellor*) or (lay next facilitator*) or "natural helpers" or linkworker? or monitrice* or consejeras):ti,ab,kw	87143
#10	(paraprofessional? or paramedic or paramedics or (paramedical next worker?) or "paramedical personnel" or "allied health personnel" or (allied next health next worker?) or (support next worker?) or (home next health next aide?)):ti,ab,kw	1479
#11	((community or village? or peer or indigenous or treatment) near/3 ("health worker?" or "health care worker?" or "healthcare worker?" or "health advisor*" or volunteer* or educator* or facilitator* or distributor* or "extension worker*" or supporter* or counselor* or counsellor*)):ti,ab,kw	2671
#12	(doula? or douladural? or (barefoot next doctor?)):ti,ab,kw	64
#13	[**Error**]==> {or #1-#2, #7-#12}	
#14	MeSH descriptor: [Medical Records] this term only	727
#15	MeSH descriptor: [Registries] this term only	869
#16	MeSH descriptor: [Electronic Health Records] this term only	337
#17	MeSH descriptor: [Health Records, Personal] this term only	48
#18	MeSH descriptor: [Health Smart Cards] this term only	1
#19	MeSH descriptor: [Medical Order Entry Systems] this term only	66
#20	MeSH descriptor: [Medical Records Systems, Computerized] this term only	196
#21	MeSH descriptor: [Forms and Records Control] this term only	54
#22	MeSH descriptor: [Clinical Coding] this term only	9
#23	MeSH descriptor: [Medical Record Linkage] this term only	29
#24	MeSH descriptor: [Health Information Management] this term only	5
#25	MeSH descriptor: [Health Information Exchange] this term only	6
#26	MeSH descriptor: [Management Information Systems] this term only	9
#27	MeSH descriptor: [Decision Support Systems, Management] this term only	8
#28	MeSH descriptor: [Decision Support Systems, Clinical] this term only	370

(Continued)

#29	MeSH descriptor: [Decision Making] this term only	2085
#30	MeSH descriptor: [Decision Support Techniques] this term only	800
#31	MeSH descriptor: [Checklist] this term only	265
#32	MeSH descriptor: [Health Information Systems] this term only	10
#33	MeSH descriptor: [Ambulatory Care Information Systems] this term only	25
#34	MeSH descriptor: [Hospital Information Systems] this term only	44
#35	(register or registers or registration or registry or registries or ((tracking or monitor*) near/2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) near/2 (record or records)) or (health next smart next card*) or hmis or ((information or decision* or case*) near (management or system* or support))):ti,ab,kw	104831
#36	((decision* near/3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or (expert next system*) or (job next aid*)):ti,ab,kw	25766
#37	("district health information" or dhis2 or motech or "mobile technology for health" or "service record" or logbook or "log book" or eregistr* or e-registr* or ((vital next event*) near/3 track*)):ti,ab,kw	383
#38	{or #14-#37}	123228
#39	MeSH descriptor: [Cell Phone] this term only	674
#40	MeSH descriptor: [Smartphone] this term only	384
#41	MeSH descriptor: [MP3-Player] this term only	21
#42	MeSH descriptor: [Computers, Handheld] this term only	270
#43	((cell* or mobile*) near/1 (phone* or telephone* or technolog* or device*)):ti,ab,kw	4321
#44	(handheld or (hand next held)):ti,ab,kw	2297
#45	(smartphone* or (smart next phone*) or cellphone* or mobiles):ti,ab,kw	4090
#46	((personal near/1 digital) or (pda near/3 (device* or assistant*)) or ((mp3 or mp4) next player*)):ti,ab,kw	316
#47	(samsung or nokia):ti,ab,kw	161
#48	(windows near/3 (mobile* or phone*)):ti,ab,kw	6
#49	android:ti,ab,kw	633
#50	(ipad* or (i next pad*) or ipod* or (i next pod*) or iphone* or (i next phone*)):ti,ab,kw	1104
#51	(tablet* near/3 (device* or computer*)):ti,ab,kw	854

(Continued)

#52	MeSH descriptor: [Text Messaging] this term only	848
#53	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health):ti,ab,kw	4477
#54	(((text* or short or voice or multimedia or (multi next media) or electronic or instant) near/1 messag*) or "instant messenger"):ti,ab,kw	4275
#55	(texting or texted or texter* or ((sms or mms) near (service* or messag*)) or (interactive next voice next response*) or ivr or (voice next call*) or callback* or "voice over internet" or voip):ti,ab,kw	2522
#56	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or (google next hangout*)):ti,ab,kw	1069
#57	MeSH descriptor: [Mobile Applications] this term only	628
#58	(mobile next app*):ti,ab,kw	2280
#59	MeSH descriptor: [Reminder Systems] this term only	933
#60	(remind* near/3 (text* or system* or messag*)):ti,ab,kw	2143
#61	MeSH descriptor: [Medical Informatics] this term only	74
#62	MeSH descriptor: [Medical Informatics Applications] this term only	23
#63	MeSH descriptor: [Nursing Informatics] this term only	7
#64	MeSH descriptor: [Public Health Informatics] this term only	1
#65	((medical or clinical or health or healthcare or nurs*) near/3 informatics):ti,ab,kw	325
#66	MeSH descriptor: [Computer-Assisted Instruction] this term only	1214
#67	((interactive or (computer next assisted)) near/1 (tutor* or technolog* or learn* or instruct* or software or communication)):ti,ab,kw	1605
#68	{or #39-#67}	22823
#69	#13 and #38 and #68	3977
#70	#13 and #38 and #68 with Publication Year from 2019 to 2020, in Trials	977
#71	#13 and #38 and #68 with Cochrane Library publication date Between Oct 2019 and Oct 2020, in Trials	843
#72	#70 or #71	1199

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(Continued)

CENTRAL, Cochrane Library (searched 08 November 2022)

ID	Search	Hits
#1	MeSH descriptor: [Health Personnel] explode all trees	10571
#2	MeSH descriptor: [Volunteers] this term only	333
#3	MeSH descriptor: [Delivery of Health Care] this term only	950
#4	MeSH descriptor: [Delivery of Health Care, Integrated] this term only	432
#5	MeSH descriptor: [Workforce] this term only	403
#6	MeSH descriptor: [Health Workforce] this term only	25
#7	(#3 or #4) and (#5 or #6)	10
#8	(((health or medical or healthcare or frontline or front-line) near (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or (general next practitioner?)or nurse* or midwi* or "clinical officer*" or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) near (attendant? or assistant?))):ti,ab,kw	129220
#9	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or (non next professional?) or support or link or outreach or "out reach") near/5 (worker? or visitor? or attendant? or aide or aides or support$ or person$ or helper? or carer? or caregiver? or (care next giver?) or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or (lay next advocate*) or (lay next health) or "lay advisors" or "lay educators" or (lay next counselor*) or (lay next counsellor*) or (lay next facilitator*) or "natural helpers" or linkworker? or monitrice* or consejeras):ti,ab,kw	107522
#10	(paraprofessional? or paramedic or paramedics or (paramedical next worker?) or "paramedical personnel" or "allied health personnel" or (allied next health next worker?) or (support next worker?) or (home next health next aide?)):ti,ab,kw	1745
#11	((community or village? or peer or indigenous or treatment) near/3 ("health worker?" or "health care worker?" or "healthcare worker?" or "health advisor*" or volunteer* or educator* or facilitator* or distributor* or "extension worker*" or supporter* or counselor* or counsellor*)):ti,ab,kw	3200
#12	(doula? or douladural? or (barefoot next doctor?)):ti,ab,kw	83
#13	#1 or #2 or #7 or #8 or #9 or #10 or #11 or #12	221842
#14	MeSH descriptor: [Medical Records] this term only	735
#15	MeSH descriptor: [Registries] this term only	997
#16	MeSH descriptor: [Electronic Health Records] this term only	453
#17	MeSH descriptor: [Health Records, Personal] this term only	50

(Continued)

#18	MeSH descriptor: [Health Smart Cards] this term only	1
#19	MeSH descriptor: [Medical Order Entry Systems] this term only	71
#20	MeSH descriptor: [Medical Records Systems, Computerized] this term only	200
#21	MeSH descriptor: [Forms and Records Control] this term only	55
#22	MeSH descriptor: [Clinical Coding] this term only	9
#23	MeSH descriptor: [Medical Record Linkage] this term only	30
#24	MeSH descriptor: [Health Information Management] this term only	5
#25	MeSH descriptor: [Health Information Exchange] this term only	9
#26	MeSH descriptor: [Management Information Systems] this term only	9
#27	MeSH descriptor: [Decision Support Systems, Management] this term only	8
#28	MeSH descriptor: [Decision Support Systems, Clinical] this term only	454
#29	MeSH descriptor: [Decision Making] this term only	2343
#30	MeSH descriptor: [Decision Support Techniques] this term only	911
#31	MeSH descriptor: [Checklist] this term only	313
#32	MeSH descriptor: [Health Information Systems] this term only	14
#33	MeSH descriptor: [Ambulatory Care Information Systems] this term only	25
#34	MeSH descriptor: [Hospital Information Systems] this term only	48
#35	(register or registers or registration or registry or registries or ((tracking or monitor*) near/2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) near/2 (record or records)) or (health next smart next card*) or hmis or ((information or decision* or case*) near (management or system* or support))):ti,ab,kw	133914
#36	((decision* near/3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or (expert next system*) or (job next aid*)):ti,ab,kw	32464
#37	("district health information" or dhis2 or motech or "mobile technology for health" or "service record" or logbook or "log book" or eregistr* or e-registr* or ((vital next event*) near/3 track*)):ti,ab,kw	538
#38	{or #14-#37}	157075
#39	MeSH descriptor: [Cell Phone] this term only	806
#40	MeSH descriptor: [Smartphone] this term only	688
#41	MeSH descriptor: [MP3-Player] this term only	21

(Continued)

#42	MeSH descriptor: [Computers, Handheld] this term only	313
#43	((cell* or mobile*) near/1 (phone* or telephone* or technolog* or device*)):ti,ab,kw	6001
#44	(handheld or (hand next held)):ti,ab,kw	3023
#45	(smartphone* or (smart next phone*) or cellphone* or mobiles):ti,ab,kw	7039
#46	((personal near/1 digital) or (pda near/3 (device* or assistant*)) or ((mp3 or mp4) next player*)):ti,ab,kw	362
#47	(samsung or nokia):ti,ab,kw	340
#48	(windows near/3 (mobile* or phone*)):ti,ab,kw	7
#49	android:ti,ab,kw	979
#50	(ipad* or (i next pad*) or ipod* or (i next pod*) or iphone* or (i next phone*)):ti,ab,kw	1488
#51	(tablet* near/3 (device* or computer*)):ti,ab,kw	1256
#52	MeSH descriptor: [Text Messaging] this term only	1158
#53	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health):ti,ab,kw	7126
#54	(((text* or short or voice or multimedia or (multi next media) or electronic or instant) near/1 messag*) or "instant messenger"):ti,ab,kw	5865
#55	(texting or texted or texter* or ((sms or mms) near (service* or messag*)) or (interactive next voice next response*) or ivr or (voice next call*) or callback* or "voice over internet" or voip):ti,ab,kw	3069
#56	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or (google next hangout*)):ti,ab,kw	1944
#57	MeSH descriptor: [Mobile Applications] this term only	1144
#58	(mobile next app*):ti,ab,kw	4113
#59	MeSH descriptor: [Reminder Systems] this term only	1020
#60	(remind* near/3 (text* or system* or messag*)):ti,ab,kw	2648
#61	MeSH descriptor: [Medical Informatics] this term only	83
#62	MeSH descriptor: [Medical Informatics Applications] this term only	24
#63	MeSH descriptor: [Nursing Informatics] this term only	8
#64	MeSH descriptor: [Public Health Informatics] this term only	2
#65	((medical or clinical or health or healthcare or nurs*) near/3 informatics):ti,ab,kw	412

(Continued)

#66	MeSH descriptor: [Computer-Assisted Instruction] this term only	1267
#67	((interactive or (computer next assisted)) near/1 (tutor* or technolog* or learn* or instruct* or software or communication)):ti,ab,kw	1801
#68	{or #39-#67}	33261
#69	#13 and #38 and #68 in Trials	5588
#70	#13 and #38 and #68 with Publication Year from 2020 to 2022, in Trials	2008
#71	#13 and #38 and #68 with Cochrane Library publication date Between Oct 2020 and Nov 2022, in Trials	1820
#72	#70 or #71	2173

Embase (OVID)

Embase database used: Embase 1974 to present

No.	Search terms	Results
1	mobile phone/ or smartphone/	20022
2	mp3 player/	176
3	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kw.	19245
4	(handheld or hand-held).ti,ab,kw.	14586
5	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kw.	10824
6	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kw.	1765
7	(samsung or nokia).ti,ab,kw.	1728
8	(windows adj3 (mobile* or phone*)).ti,ab,kw.	72
9	android.ti,ab,kw.	2959
10	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kw.	4264
11	(tablet* adj3 (device* or computer*)).ti,ab,kw.	1922
12	text messaging/	3556
13	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kw.	25924

(Continued)

14	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kw.	5398
15	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kw.	4061
16	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or "google hangout*").ti,ab,kw.	7788
17	mobile application/	6646
18	"mobile app*".ti,ab,kw.	3219
19	reminder system/	2314
20	(remind* adj3 (text* or system* or messag*)).ti,ab,kw.	2208
21	medical informatics/	18860
22	nursing informatics/	1414
23	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kw.	7803
24	teaching/	81202
25	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kw.	3307
26	or/1-25	197609
27	exp health care personnel/	1327563
28	volunteer/ or hospital volunteer/	52482
29	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kw.	1179504
30	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lady health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or conse-jeras).ti,ab,kw.	1104854
31	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kw.	10496

(Continued)

32	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kw.	12174
33	(doula? or douladural? or barefoot doctor?).ti,ab,kw.	400
34	or/27-33	2958307
35	medical record/	155581
36	"medical record review"/	104258
37	electronic health record/ or electronic health record certification/	8398
38	electronic medical record/ or electronic medical record system/	46368
39	electronic patient record/	1234
40	register/ or registration/	134215
41	smart card/	202
42	physician order entry system/	187
43	coding/ or patient coding/	26878
44	information system/ or clinical data repository/ or hospital information system/ or medical information system/ or nursing information system/ or exp performance measurement system/ or "point of care system"/	81358
45	decision support system/ or clinical decision support system/ or expert system/ or checklist/	44163
46	monitoring/ or ambulatory monitoring/ or patient monitoring/	246698
47	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kw.	645576
48	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or expert system* or checklist* or job-aid* or "job aid*").ti,ab,kw.	263962
49	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kw.	1617
50	or/35-49	1336159
51	randomized controlled trial/	512971
52	controlled clinical trial/	457947
53	quasi experimental study/	4882

(Continued)

54	pretest posttest control group design/	351
55	time series analysis/	21218
56	experimental design/	15789
57	multicenter study/	193671
58	(randomis* or randomiz* or randomly or random allocat*).ti,ab,kw.	1093175
59	groups.ab.	2492437
60	(trial or multicentre or multicenter or multi centre or multi center).ti.	303851
61	(intervention* or controlled or control group or compare or compared or (before adj5 after) or (pre adj5 post) or pretest or pre test or posttest or post test or quasiexperiment* or quasi experiment* or evaluat* or effect or impact or time series or time point? or repeated measur*).ti,ab.	11419685
62	or/51-61	12399930
63	(systematic review or literature review).ti.	138696
64	"cochrane database of systematic reviews".jn.	12661
65	editorial.pt.	576108
66	nonhuman/	5529484
67	or/63-66	6204705
68	62 not 67	9866319
69	26 and 34 and 50 and 68	13929
70	limit 69 to embase	4954
71	(201707* or 201708* or 201709* or 20171* or 2018*).dd.	1087649
72	"2018".yr.	895799
73	71 or 72	1653747
74	70 and 73	570
75	70 and ("2017" or "2018").yr.	1153
76	74 or 75	1156

Rerun October 2019

No.	Search terms	Results

(Continued)

1	mobile phone/ or smartphone/	25066
2	mp3 player/	191
3	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kw.	22570
4	(handheld or hand-held).ti,ab,kw.	16346
5	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kw.	14821
6	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kw.	1845
7	(samsung or nokia).ti,ab,kw.	2029
8	(windows adj3 (mobile* or phone*)).ti,ab,kw.	75
9	android.ti,ab,kw.	3614
10	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kw.	4918
11	(tablet* adj3 (device* or computer*)).ti,ab,kw.	2346
12	text messaging/	4387
13	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kw.	33898
14	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kw.	6584
15	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kw.	4634
16	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or "google hangout*").ti,ab,kw.	10236
17	mobile application/	9091
18	"mobile app*".ti,ab,kw.	4709
19	reminder system/	2497
20	(remind* adj3 (text* or system* or messag*)).ti,ab,kw.	2515
21	medical informatics/	19880
22	nursing informatics/	1496
23	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kw.	8653
24	teaching/	87219

(Continued)

25	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kw.	3574
26	or/1-25	226670
27	exp health care personnel/	1473256
28	volunteer/ or hospital volunteer/	59430
29	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kw.	1283471
30	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lady health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kw.	1219112
31	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kw.	11548
32	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kw.	13856
33	(doula? or douladural? or barefoot doctor?).ti,ab,kw.	447
34	or/27-33	3244490
35	medical record/	168865
36	"medical record review"/	119106
37	electronic health record/ or electronic health record certification/	13542
38	electronic medical record/ or electronic medical record system/	52525
39	electronic patient record/	1917
40	register/ or registration/	140567
41	smart card/	220
42	physician order entry system/	222
43	coding/ or patient coding/	29656

(Continued)

44	information system/ or clinical data repository/ or hospital information system/ or medical information system/ or nursing information system/ or exp performance measurement system/ or "point of care system"/	85922
45	decision support system/ or clinical decision support system/ or expert system/ or checklist/	50491
46	monitoring/ or ambulatory monitoring/ or patient monitoring/	268654
47	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kw.	733894
48	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or expert system* or checklist* or job-aid* or "job aid*").ti,ab,kw.	300773
49	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kw.	1857
50	or/35-49	1495104
51	randomized controlled trial/	574764
52	controlled clinical trial/	465629
53	quasi experimental study/	6056
54	pretest posttest control group design/	418
55	time series analysis/	24192
56	experimental design/	17640
57	multicenter study/	231930
58	(randomis* or randomiz* or randomly or random allocat*).ti,ab,kw.	1206296
59	groups.ab.	2729939
60	(trial or multicentre or multicenter or multi centre or multi center).ti.	344421
61	(intervention* or controlled or control group or compare or compared or (before adj5 after) or (pre adj5 post) or pretest or pre test or posttest or post test or quasiexperiment* or quasi experiment* or evaluat* or effect or impact or time series or time point? or repeated measur*).ti,ab.	12484569
62	or/51-61	13537555
63	(systematic review or literature review).ti.	170937
64	"cochrane database of systematic reviews".jn.	13684
65	editorial.pt.	633743

(Continued)

66	nonhuman/	5973468
67	or/63-66	6732789
68	62 not 67	10734818
69	26 and 34 and 50 and 68	17003
70	limit 69 to embase	5951
71	70 and ("2018" or "2019").yr.	1447
72	(201809* or 20181* or 2019*).dd.	838025
73	"2019".yr.	1210397
74	72 or 73	1640259
75	70 and 74	790
76	71 or 75	1452

Rerun October 2020

No.	Search terms	Results
1	mobile phone/ or smartphone/	30402
2	mp3 player/	203
3	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kw.	26105
4	(handheld or hand-held).ti,ab,kw.	17874
5	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kw.	19372
6	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kw.	1904
7	(samsung or nokia).ti,ab,kw.	2384
8	(windows adj3 (mobile* or phone*)).ti,ab,kw.	82
9	android.ti,ab,kw.	4252
10	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kw.	5518
11	(tablet* adj3 (device* or computer*)).ti,ab,kw.	2711
12	text messaging/	5279
13	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kw.	43179

(Continued)

14	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kw.	7726
15	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kw.	5195
16	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or "google hangout*").ti,ab,kw.	12864
17	mobile application/	12229
18	"mobile app*".ti,ab,kw.	6613
19	reminder system/	2674
20	(remind* adj3 (text* or system* or messag*)).ti,ab,kw.	2797
21	medical informatics/	20819
22	nursing informatics/	1568
23	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kw.	9508
24	teaching/	92508
25	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kw.	3826
26	or/1-25	256640
27	exp health care personnel/	1590287
28	volunteer/ or hospital volunteer/	59002
29	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kw.	1379799
30	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lady health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kw.	1328726
31	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kw.	12483

(Continued)

32	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kw.	15421
33	(doula? or douladural? or barefoot doctor?).ti,ab,kw.	498
34	or/27-33	3492964
35	medical record/	178827
36	"medical record review"/	131495
37	electronic health record/ or electronic health record certification/	18824
38	electronic medical record/ or electronic medical record system/	58511
39	electronic patient record/	2518
40	register/ or registration/	142233
41	smart card/	236
42	physician order entry system/	272
43	coding/ or patient coding/	31792
44	information system/ or clinical data repository/ or hospital information system/ or medical information system/ or nursing information system/ or exp performance measurement system/ or "point of care system"/	89744
45	decision support system/ or clinical decision support system/ or expert system/ or checklist/	56587
46	monitoring/ or ambulatory monitoring/ or patient monitoring/	269813
47	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kw.	819043
48	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or expert system* or checklist* or job-aid* or "job aid*").ti,ab,kw.	338373
49	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kw.	2056
50	or/35-49	1628923
51	randomized controlled trial/	628767
52	controlled clinical trial/	465461
53	quasi experimental study/	7374

(Continued)

54	pretest posttest control group design/	499
55	time series analysis/	27411
56	experimental design/	19640
57	multicenter study/	266980
58	(randomis* or randomiz* or randomly or random allocat*).ti,ab,kw.	1309058
59	groups.ab.	2946998
60	(trial or multicentre or multicenter or multi centre or multi center).ti.	382068
61	(intervention* or controlled or control group or compare or compared or (before adj5 after) or (pre adj5 post) or pretest or pre test or posttest or post test or quasiexperiment* or quasi experiment* or evaluat* or effect or impact or time series or time point? or repeated measur*).ti,ab.	13481116
62	or/51-61	14601247
63	(systematic review or literature review).ti.	206334
64	"cochrane database of systematic reviews".jn.	14681
65	editorial.pt.	671216
66	nonhuman/	6364826
67	or/63-66	7192554
68	62 not 67	11554035
69	26 and 34 and 50 and 68	19801
70	limit 69 to embase	7076
71	(201909* or 20191* or 2020*).dd.	1006385
72	("2019" or "2020").yr.	3121490
73	70 and (71 or 72)	1895

RERUN NOVEMBER 2022

Embase <1974 to 2022 Week 44>, Ovid (searched 09 November 2022)

1	mobile phone/ or smartphone/	42475
2	mp3 player/	233

(Continued)

3	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kf.	32983
4	(handheld or hand-held).ti,ab,kf.	20823
5	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kf.	29192
6	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kf.	2041
7	(samsung or nokia).ti,ab,kf.	3078
8	(windows adj3 (mobile* or phone*)).ti,ab,kf.	85
9	android.ti,ab,kf.	5383
10	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kf.	6496
11	(tablet* adj3 (device* or computer*)).ti,ab,kf.	3322
12	text messaging/	7030
13	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kf.	65500
14	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kf.	10011
15	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kf.	6246
16	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or "google hangout*").ti,ab,kf.	19382
17	mobile application/	19311
18	mobile app*.ti,ab,kf.	10742
19	reminder system/	2976
20	(remind* adj3 (text* or system* or messag*)).ti,ab,kf.	3350
21	medical informatics/	22511
22	nursing informatics/	1677
23	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kf.	11308
24	teaching/	102612
25	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kf.	4391
26	or/1-25	323935

(Continued)

27	exp health care personnel/	1852370
28	volunteer/ or hospital volunteer/	59916
29	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kf.	1579366
30	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lady health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kf.	1561559
31	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kf.	14609
32	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kf.	18840
33	(doula? or douladural? or barefoot doctor?).ti,ab,kf.	611
34	or/27-33	4026391
35	medical record/	199698
36	medical record review/	158566
37	electronic health record/ or electronic health record certification/	32496
38	electronic medical record/ or electronic medical record system/	74414
39	electronic patient record/	4156
40	register/ or registration/	147616
41	smart card/	277
42	physician order entry system/	338
43	coding/ or patient coding/	37255
44	information system/ or clinical data repository/ or hospital information system/ or medical information system/ or nursing information system/ or exp performance measurement system/ or "point of care system"/	98058

(Continued)

45	decision support system/ or clinical decision support system/ or expert system/ or checklist/	67373
46	monitoring/ or ambulatory monitoring/ or patient monitoring/	281336
47	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kf.	1006500
48	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or expert system* or checklist* or job-aid* or "job aid*").ti,ab,kf.	419454
49	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kf.	2536
50	or/35-49	1933740
51	randomized controlled trial/	734856
52	controlled clinical trial/	467435
53	quasi experimental study/	10156
54	pretest posttest control group design/	620
55	time series analysis/	34336
56	experimental design/	23049
57	multicenter study/	341257
58	(randomis* or randomiz* or randomly or random allocat*).ti,ab,kf.	1514632
59	groups.ab.	3385925
60	(trial or multicentre or multicenter or multi centre or multi center).ti.	461430
61	(intervention* or controlled or control group or compare or compared or (before adj5 after) or (pre adj5 post) or pretest or pre test or posttest or post test or quasiexperiment* or quasi experiment* or evaluat* or effect or impact or time series or time point? or repeated measur*).ti,ab.	15430469
62	or/51-61	16677352
63	(systematic review or literature review).ti.	290998
64	cochrane database of systematic reviews.jn.	16444
65	editorial.pt.	741912
66	nonhuman/	7080492
67	or/63-66	8052059

(Continued)

68	62 not 67	13167287
69	26 and 34 and 50 and 68	26507
70	limit 69 to embase	10131
71	(20201* or 2021* or 2022*).dd.	1295201
72	("2020" or "2021" or "2022").yr.	5179119
73	70 and (71 or 72)	4025

WHO Global Health Library

limited to Regional Indexes only

excluded the Medline records from the results

Operator	Search terms	Field
	("cell phones" OR smartphone OR mp3-player OR "Computers, Handheld" OR telemedicine OR videoconferencing OR "Text Messaging" OR telenursing OR "Mobile Applications" OR "Reminder Systems" OR "Electronic Mail" OR "Medical Informatics" OR "Nursing Informatics" OR "Public Health Informatics" OR multimedia OR hypermedia OR blogging OR "cell phone" OR "cellular phone" OR "cellular phones" OR "mobile phone" OR "mobile phones" OR "mobile devices" OR "mobile devices" OR smartphones OR smart-phone OR smartphones OR cellphone OR cellphones)	Title, abstract, subject
AND	(register OR registers OR registration OR registry OR registries OR ((track* OR monitor*) AND (client* OR patient*)) OR record OR records OR "smart card*" OR HMIS OR ((information OR decision* OR case*) AND (management OR system* OR support)) OR "district health information" OR DHIS2 OR Motech OR "mobile technology for health" OR logbook* OR "log book*" OR eregistr* OR e-registr* OR ("vital event*" AND track*) OR (decision* AND (make OR makes OR making OR made OR support* OR algorithm* OR aid OR aids OR app OR apps OR application* OR technique*)) OR "expert system*" OR job-aid* OR "job aid*")	Title, abstract, subject
AND	(randomised OR randomized OR "randomly allocated" OR "random allocation" OR "controlled trial" OR "control group" OR "control groups" OR trial OR multicenter OR multicentre OR multi-center OR multi-centre OR "multi center" OR "multi centre" OR quasiexperiment* OR quasi-experiment* OR nonrandom* OR nonrandom* OR "time series" OR "controlled before" OR pretest OR "pre test" OR posttest OR "post test" OR "time point*" OR "time trend*" OR "repeated measur*")	Title, abstract, subject
AND	2017 or 2018	Publication year
	Total =	10

(Continued)

Rerun October 2019

Operator	Search terms	Field
	("cell phones" OR smartphone OR mp3-player OR "Computers, Handheld" OR telemedicine OR videoconferencing OR "Text Messaging" OR telenursing OR "Mobile Applications" OR "Reminder Systems" OR "Electronic Mail" OR "Medical Informatics" OR "Nursing Informatics" OR "Public Health Informatics" OR multimedia OR hypermedia OR blogging OR "cell phone" OR "cellular phone" OR "cellular phones" OR "mobile phone" OR "mobile phones" OR "mobile devices" OR "mobile devices" OR smartphones OR smart-phone OR smartphones OR cellphone OR cellphones)	Title, abstract, subject
AND	(register OR registers OR registration OR registry OR registries OR ((track* OR monitor*) AND (client* OR patient*)) OR record OR records OR "smart card*" OR HMIS OR ((information OR decision* OR case*) AND (management OR system* OR support)) OR "district health information" OR DHIS2 OR Motech OR "mobile technology for health" OR logbook* OR "log book*" OR eregistr* OR e-registr* OR ("vital event*" AND track*) OR (decision* AND (make OR makes OR making OR made OR support* OR algorithm* OR aid OR aids OR app OR apps OR application* OR technique*)) OR "expert system*" OR job-aid* OR "job aid*")	Title, abstract, subject
AND	(randomised OR randomized OR "randomly allocated" OR "random allocation" OR "controlled trial" OR "control group" OR "control groups" OR trial OR multicenter OR multicentre OR multi-center OR multi-centre OR "multi center" OR "multi centre" OR quasiexperiment* OR quasi-experiment* OR nonrandom* OR nonrandom* OR "time series" OR "controlled before" OR pretest OR "pre test" OR posttest OR "post test" OR "time point*" OR "time trend*" OR "repeated measur*")	Title, abstract, subject
	Year range: 2018-2019	19 hits

Rerun October 2020

Operator	Search terms	Field
	("cell phones" OR smartphone OR mp3-player OR "Computers, Handheld" OR telemedicine OR videoconferencing OR "Text Messaging" OR telenursing OR "Mobile Applications" OR "Reminder Systems" OR "Electronic Mail" OR "Medical Informatics" OR "Nursing Informatics" OR "Public Health Informatics" OR multimedia OR hypermedia OR blogging OR "cell phone" OR "cellular phone" OR "cellular phones" OR "mobile phone" OR "mobile phones" OR "mobile devices" OR "mobile devices" OR smartphones OR smart-phone OR smartphones OR cellphone OR cellphones)	Title, abstract, subject
AND	(register OR registers OR registration OR registry OR registries OR ((track* OR monitor*) AND (client* OR patient*)) OR record OR records OR "smart card*" OR HMIS OR ((information OR decision* OR case*) AND (management OR system* OR support)) OR "district health information" OR DHIS2 OR Motech OR "mobile technology for health" OR logbook* OR "log book*" OR eregistr* OR e-registr* OR ("vital event*" AND track*) OR (decision* AND (make OR makes OR making OR made OR support* OR algorithm* OR aid OR aids OR app OR apps OR application* OR technique*)) OR "expert system*" OR job-aid* OR "job aid*")	Title, abstract, subject

(Continued)

AND	(randomised OR randomized OR "randomly allocated" OR "random allocation" OR "controlled trial" OR "control group" OR "control groups" OR trial OR multicenter OR multicentre OR multi-center OR multi-centre OR "multi center" OR "multi centre" OR quasiexperiment* OR quasi-experiment* OR non-random* OR nonrandom* OR "time series" OR "controlled before" OR pretest OR "pre test" OR posttest OR "post test" OR "time point*" OR "time trend*" OR "repeated measur*")	Title, abstract, subject
	Year range: 2019-2020	37 hits

RERUN NOVEMBER 2022

Global Index Medicus, WHO (https://www.globalindexmedicus.net/) (searched 09.11.2022)

	("cell phones" OR smartphone OR mp3-player OR "Computers, Handheld" OR telemedicine OR videoconferencing OR "Text Messaging" OR telenursing OR "Mobile Applications" OR "Reminder Systems" OR "Electronic Mail" OR "Medical Informatics" OR "Nursing Informatics" OR "Public Health Informatics" OR multimedia OR hypermedia OR blogging OR "cell phone" OR "cellular phone" OR "cellular phones" OR "mobile phone" OR "mobile phones" OR "mobile devices" OR "mobile devices" OR smartphones OR smart-phone OR smartphones OR cellphone OR cellphones)	Title, abstract, subject
AND	(register OR registers OR registration OR registry OR registries OR ((track* OR monitor*) AND (client* OR patient*)) OR record OR records OR "smart card*" OR HMIS OR ((information OR decision* OR case*) AND (management OR system* OR support)) OR "district health information" OR DHIS2 OR Motech OR "mobile technology for health" OR logbook* OR "log book*" OR eregistr* OR e-registr* OR ("vital event*" AND track*) OR (decision* AND (make OR makes OR making OR made OR support* OR algorithm* OR aid OR aids OR app OR apps OR application* OR technique*)) OR "expert system*" OR job-aid* OR "job aid*")	Title, abstract, subject
AND	(randomised OR randomized OR "randomly allocated" OR "random allocation" OR "controlled trial" OR "control group" OR "control groups" OR trial OR multicenter OR multicentre OR multi-center OR multi-centre OR "multi center" OR "multi centre" OR quasiexperiment* OR quasi-experiment* OR non-random* OR nonrandom* OR "time series" OR "controlled before" OR pretest OR "pre test" OR posttest OR "post test" OR "time point*" OR "time trend*" OR "repeated measur*")	Title, abstract, subject
	Year range: 2020-2022	68 hits

Medline (OVID)

Medline database used:

Medline (Ovid MEDLINE® Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE®) 1946 to present

(Continued)

No.	Search terms	Results
1	exp health personnel/	466943
2	volunteers/	9047
3	"delivery of health care"/ma or "delivery of health care, integrated"/ma	1118
4	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kf.	937669
5	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lay health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kf.	880142
6	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kf.	7989
7	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kf.	9967
8	(doula? or douladural? or barefoot doctor?).ti,ab,kf.	432
9	or/1-8	1980094
10	medical records/	64439
11	registries/	76185
12	electronic health records/	15169
13	health records, personal/	1329
14	health smart cards/	41
15	medical order entry systems/	2053
16	medical records systems, computerized/	18841
17	"forms and records control"/ or clinical coding/ or medical record linkage/	13838
18	health information management/ or health information exchange/	1337

(Continued)

19	management information systems/ or decision support systems, management/	4459
20	decision support systems, clinical/ or decision making/ or decision support techniques/ or checklist/	112441
21	health information systems/	1004
22	ambulatory care information systems/	1166
23	hospital information systems/	10746
24	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kf.	448243
25	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or expert system* or job-aid* or "job aid*").ti,ab,kf.	196650
26	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kf.	902
27	or/10-26	791133
28	cell phones/	7457
29	smartphone/	2220
30	mp3-player/	172
31	computers, handheld/	3250
32	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kf.	15518
33	(handheld or hand-held).ti,ab,kf.	10889
34	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kf.	7982
35	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kf.	1309
36	(samsung or nokia).ti,ab,kf.	963
37	(windows adj3 (mobile* or phone*)).ti,ab,kf.	49
38	android.ti,ab,kf.	1878
39	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kf.	2296
40	(tablet* adj3 (device* or computer*)).ti,ab,kf.	1238
41	text messaging/	2017

(Continued)

42	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kf.	21064
43	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kf.	4137
44	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kf.	2888
45	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or google hangout*).ti,ab,kf.	5516
46	mobile applications/	3362
47	"mobile app*".ti,ab,kf.	2756
48	reminder systems/	3125
49	(remind* adj3 (text* or system* or messag*)).ti,ab,kf.	1575
50	medical informatics/ or medical informatics applications/	12992
51	nursing informatics/ or public health informatics/	2529
52	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kf.	6120
53	computer-assisted instruction/	11255
54	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kf.	2423
55	or/28-54	100223
56	randomized controlled trial.pt.	468469
57	controlled clinical trial.pt.	92646
58	multicenter study.pt.	239226
59	pragmatic clinical trial.pt.	868
60	(randomis* or randomiz* or randomly).ti,ab.	790772
61	groups.ab.	1835458
62	(trial or multicenter or multi center or multicentre or multi centre).ti.	222133
63	(intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or time series or time point? or repeated measur*).ti,ab.	8622691
64	non-randomized controlled trials as topic/	401
65	interrupted time series analysis/	474

(Continued)

66	controlled before-after studies/	353
67	or/56-66	9622021
68	exp animals/	21787133
69	humans/	17290000
70	68 not (68 and 69)	4497133
71	review.pt.	2430825
72	meta analysis.pt.	92396
73	news.pt.	191574
74	comment.pt.	733437
75	editorial.pt.	468641
76	cochrane database of systematic reviews.jn.	13834
77	comment on.cm.	733432
78	(systematic review or literature review).ti.	118242
79	or/70-78	8013767
80	67 not 79	6743532
81	9 and 27 and 55 and 80	6453
82	81 and (201707* or 201708* or 201709* or 20171* or 2018*).dt,dp,ed,ep,yr.	1919

Rerun October 2019

No.	Search terms	Results
1	exp health personnel/	492035
2	volunteers/	9371
3	(delivery of health care/ or delivery of health care, integrated/) and (workforce/ or health workforce/)	3582
4	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kf.	993409
5	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or	945436

(Continued)

	helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lay health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kf.	
6	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kf.	8475
7	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kf.	11019
8	(doula? or douladural? or barefoot doctor?).ti,ab,kf.	484
9	or/1-8	2105355
10	medical records/	64972
11	registries/	83032
12	electronic health records/	17475
13	health records, personal/	1435
14	health smart cards/	46
15	medical order entry systems/	2148
16	medical records systems, computerized/	18953
17	"forms and records control"/ or clinical coding/ or medical record linkage/	14133
18	health information management/ or health information exchange/	1527
19	management information systems/ or decision support systems, management/	4486
20	decision support systems, clinical/ or decision making/ or decision support techniques/ or checklist/	120375
21	health information systems/	1177
22	ambulatory care information systems/	1166
23	hospital information systems/	10863
24	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kf.	496206

(Continued)

25	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or expert system* or job-aid* or "job aid*").ti,ab,kf.	218249
26	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kf.	1035
27	or/10-26	862999
28	cell phones/	8002
29	smartphone/	3339
30	mp3-player/	180
31	computers, handheld/	3422
32	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kf.	17981
33	(handheld or hand-held).ti,ab,kf.	11866
34	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kf.	10608
35	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kf.	1357
36	(samsung or nokia).ti,ab,kf.	1091
37	(windows adj3 (mobile* or phone*)).ti,ab,kf.	51
38	android.ti,ab,kf.	2280
39	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kf.	2605
40	(tablet* adj3 (device* or computer*)).ti,ab,kf.	1483
41	text messaging/	2413
42	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kf.	26445
43	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kf.	4978
44	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kf.	3210
45	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or google hangout*).ti,ab,kf.	6943
46	mobile applications/	4604
47	"mobile app*".ti,ab,kf.	3869

(Continued)

48	reminder systems/	3266
49	(remind* adj3 (text* or system* or messag*)).ti,ab,kf.	1750
50	medical informatics/ or medical informatics applications/	13669
51	nursing informatics/ or public health informatics/	2615
52	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kf.	6773
53	computer-assisted instruction/	11584
54	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kf.	2600
55	or/28-54	115106
56	randomized controlled trial.pt.	490570
57	controlled clinical trial.pt.	93277
58	multicenter study.pt.	257666
59	pragmatic clinical trial.pt.	1165
60	(randomis* or randomiz* or randomly).ti,ab.	851682
61	groups.ab.	1959472
62	(trial or multicenter or multi center or multicentre or multi centre).ti.	243807
63	(intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or time series or time point? or repeated measur*).ti,ab.	9183567
64	non-randomized controlled trials as topic/	535
65	interrupted time series analysis/	666
66	controlled before-after studies/	427
67	or/56-66	10238275
68	exp animals/	22632526
69	humans/	18011314
70	68 not (68 and 69)	4621212
71	review.pt.	2561356
72	meta analysis.pt.	105139
73	news.pt.	197328

(Continued)

74	comment.pt.	807340
75	editorial.pt.	504082
76	cochrane database of systematic reviews.jn.	14103
77	comment on.cm.	807286
78	(systematic review or literature review).ti.	141024
79	or/70-78	8380017
80	67 not 79	7210874
81	9 and 27 and 55 and 80	7768
82	81 and (201809* or 20181* or 2019*).dt,dp,ed,ep,yr.	1842

Rerun October 2020

No.	Search terms	Results
1	exp health personnel/	521193
2	volunteers/	9757
3	(delivery of health care/ or delivery of health care, integrated/) and (workforce/ or health workforce/)	3690
4	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kf.	1057024
5	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lay health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kf.	1022592
6	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kf.	9058
7	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kf.	12216

(Continued)

8	(doula? or douladural? or barefoot doctor?).ti,ab,kf.	512
9	or/1-8	2249248
10	medical records/	65546
11	registries/	91150
12	electronic health records/	20349
13	health records, personal/	1538
14	health smart cards/	49
15	medical order entry systems/	2274
16	medical records systems, computerized/	19065
17	"forms and records control"/ or clinical coding/ or medical record linkage/	14426
18	health information management/ or health information exchange/	1710
19	management information systems/ or decision support systems, management/	4513
20	decision support systems, clinical/ or decision making/ or decision support techniques/ or checklist/	128464
21	health information systems/	1319
22	ambulatory care information systems/	1168
23	hospital information systems/	10945
24	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kf.	554054
25	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or expert system* or job-aid* or "job aid*").ti,ab,kf.	244059
26	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kf.	1170
27	or/10-26	948398
28	cell phones/	8645
29	smartphone/	4767
30	mp3-player/	186
31	computers, handheld/	3647

(Continued)

32	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kf.	20602
33	(handheld or hand-held).ti,ab,kf.	12913
34	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kf.	13866
35	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kf.	1396
36	(samsung or nokia).ti,ab,kf.	1227
37	(windows adj3 (mobile* or phone*)).ti,ab,kf.	54
38	android.ti,ab,kf.	2666
39	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kf.	2914
40	(tablet* adj3 (device* or computer*)).ti,ab,kf.	1728
41	text messaging/	3039
42	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kf.	33370
43	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kf.	5836
44	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kf.	3586
45	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or google hangout*).ti,ab,kf.	8867
46	mobile applications/	6392
47	"mobile app*".ti,ab,kf.	5251
48	reminder systems/	3506
49	(remind* adj3 (text* or system* or messag*)).ti,ab,kf.	1947
50	medical informatics/ or medical informatics applications/	14369
51	nursing informatics/ or public health informatics/	2681
52	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kf.	7478
53	computer-assisted instruction/	11913
54	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kf.	2753
55	or/28-54	132821

(Continued)

56	randomized controlled trial.pt.	515341
57	controlled clinical trial.pt.	93888
58	multicenter study.pt.	281091
59	pragmatic clinical trial.pt.	1531
60	(randomis* or randomiz* or randomly).ti,ab.	920888
61	groups.ab.	2102194
62	(trial or multicenter or multi center or multicentre or multi centre).ti.	269746
63	(intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or time series or time point? or repeated measur*).ti,ab.	9835074
64	non-randomized controlled trials as topic/	778
65	interrupted time series analysis/	1000
66	controlled before-after studies/	559
67	or/56-66	10953515
68	exp animals/	23516525
69	humans/	18771945
70	68 not (68 and 69)	4744580
71	review.pt.	2705325
72	meta analysis.pt.	121037
73	news.pt.	203271
74	comment.pt.	872950
75	editorial.pt.	543835
76	cochrane database of systematic reviews.jn.	15033
77	comment on.cm.	872896
78	(systematic review or literature review).ti.	170016
79	or/70-78	8764707
80	67 not 79	7765730
81	9 and 27 and 55 and 80	9307

(Continued)

82	81 and (201909* or 20191* or 2020*).dt,dp,ed,ep,yr.	2521

RERUN November 2022		
Ovid MEDLINE(R) ALL <1946 to November 08, 2022> (searched 09 November 2022)		
1	exp health personnel/	595322
2	volunteers/	10684
3	(delivery of health care/ or delivery of health care, integrated/) and (workforce/ or health workforce/)	4009
4	(((health or medical or healthcare or frontline or front-line) adj (personnel or worker* or auxiliar* or staff or professional* or assistant* or provider*)) or doctor* or physician* or gp or general practitioner? or family doctor or nurse* or midwi* or clinical officer* or pharmacist* or dentist* or vaccinator* or supervisor* or ((birth or childbirth or labor or labour) adj (attendant? or assistant?))).ti,ab,kf.	1206213
5	(((lay or voluntary or volunteer? or untrained or unlicensed or nonprofessional? or non professional? or support or link or outreach or out reach) adj5 (worker? or visitor? or attendant? or aide or aides or support* or person* or helper? or carer? or caregiver? or care giver? or consultant? or assistant? or staff)) or promotores or promotora or promotoras or embajadoras or comodrones or abuela or "lay advocate*" or "lay health" or "lay advisors" or "lay educators" or "lay counselor*" or "lay counsellor*" or "lay health worker*" or "lay facilitator*" or "natural helpers" or linkworker? or monitrice* or consejeras).ti,ab,kf.	1211167
6	(paraprofessional? or paramedic or paramedics or paramedical worker? or paramedical personnel or allied health personnel or allied health worker? or support worker? or home health aide?).ti,ab,kf.	10605
7	((community or village? or peer or indigenous or treatment) adj3 (health worker? or health care worker? or healthcare worker? or health advisor* or volunteer* or educator* or facilitator* or distributor* or extension worker* or supporter* or counselor* or counsellor*)).ti,ab,kf.	15115
8	(doula? or douladural? or barefoot doctor?).ti,ab,kf.	641
9	or/1-8	2589039
10	medical records/	66188
11	registries/	106392
12	electronic health records/	25996
13	health records, personal/	1716
14	health smart cards/	63
15	medical order entry systems/	2436

(Continued)

16	medical records systems, computerized/	19143
17	forms and records control/ or clinical coding/ or medical record linkage/	14757
18	health information management/ or health information exchange/	1955
19	management information systems/ or decision support systems, management/	4562
20	decision support systems, clinical/ or decision making/ or decision support techniques/ or checklist/	139882
21	health information systems/	1581
22	ambulatory care information systems/	1171
23	hospital information systems/	11055
24	(register or registers or registration or registry or registries or ((tracking or monitor*) adj2 (client* or patient*)) or ((digital or digiti?ed or electronic or computeri?ed or medical or clinical or patient* or health) adj2 (record or records)) or health smart card* or hmis or ((information or decision* or case*) adj (management or system* or support))).ti,ab,kf.	691217
25	((decision* adj3 (make or makes or making or made or support* or algorithm* or aid or aids or app or apps or application* or technique*)) or checklist* or expert system* or job-aid* or "job aid*").ti,ab,kf.	307778
26	(district health information or dhis2 or motech or mobile technology for health or service record or logbook or log book or eregistr* or e-registr* or (vital event* adj3 track*)).ti,ab,kf.	1540
27	or/10-26	1145228
28	cell phones/	9800
29	smartphone/	8364
30	mp3-player/	196
31	computers, handheld/	4018
32	((cell* or mobile*) adj1 (phone* or telephone* or technolog* or device*)).ti,ab,kf.	27418
33	(handheld or hand-held).ti,ab,kf.	15289
34	(smartphone* or smart-phone* or cellphone* or mobiles).ti,ab,kf.	22617
35	((personal adj1 digital) or (pda adj3 (device* or assistant*)) or mp3 player* or mp4 player*).ti,ab,kf.	1502
36	(samsung or nokia).ti,ab,kf.	1542
37	(windows adj3 (mobile* or phone*)).ti,ab,kf.	57
38	android.ti,ab,kf.	3547

(Continued)

39	(ipad* or i-pad* or ipod* or i-pod* or iphone* or i-phone*).ti,ab,kf.	3536
40	(tablet* adj3 (device* or computer*)).ti,ab,kf.	2224
41	text messaging/	4293
42	(mhealth or m-health or "mobile health" or ehealth or e-health or "electronic health" or "digital health" or uhealth or u-health).ti,ab,kf.	51831
43	(((text* or short or voice or multimedia or multi-media or electronic or instant) adj1 messag*) or instant messenger).ti,ab,kf.	7760
44	(texting or texted or texter* or ((sms or mms) adj (service* or messag*)) or interactive voice response* or ivr or voice call* or callback* or voice over internet or voip).ti,ab,kf.	4431
45	(facebook or twitter or whatsapp* or skyp* or youtube or "you tube" or google hangout*).ti,ab,kf.	14648
46	mobile applications/	10684
47	mobile app*.ti,ab,kf.	8919
48	reminder systems/	3765
49	(remind* adj3 (text* or system* or messag*)).ti,ab,kf.	2341
50	medical informatics/ or medical informatics applications/	15228
51	nursing informatics/ or public health informatics/	2823
52	((medical or clinical or health or healthcare or nurs*) adj3 informatics).ti,ab,kf.	9288
53	computer-assisted instruction/	12466
54	((interactive or computer-assisted) adj1 (tutor* or technolog* or learn* or instruct* or software or communication)).ti,ab,kf.	3209
55	or/28-54	178529
56	randomized controlled trial.pt.	580418
57	controlled clinical trial.pt.	95089
58	multicenter study.pt.	327324
59	pragmatic clinical trial.pt.	2155
60	(randomis* or randomiz* or randomly).ti,ab.	1074787
61	groups.ab.	2431173
62	(trial or multicenter or multi center or multicentre or multi centre).ti.	329693
63	(intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or pseudo experiment* or	11339202

(Continued)

	pseudoexperiment* or evaluat* or time series or time point? or repeated measur*).ti,ab.	
64	non-randomized controlled trials as topic/	1049
65	interrupted time series analysis/	1711
66	controlled before-after studies/	705
67	or/56-66	12597858
68	exp animals/	25921449
69	humans/	20858817
70	68 not (68 and 69)	5062632
71	review.pt.	3069539
72	meta analysis.pt.	170411
73	news.pt.	214991
74	comment.pt.	985473
75	editorial.pt.	625506
76	cochrane database of systematic reviews.jn.	16040
77	comment on.cm.	985420
78	(systematic review or literature review).ti.	247865
79	or/70-78	9668111
80	67 not 79	8994248
81	9 and 27 and 55 and 80	13118
82	81 and (20201* or 2021* or 2022*).dt,dp,ed,ep,yr.	4792

POPLINE

Field	Search terms	Operator
Keyword	TEXT MESSAGING OR MOBILE DEVICES OR INFORMATION COMMUNICATION TECHNOLOGY OR CELLULAR PHONE	OR
All Fields	((cell OR cellular OR mobile) AND (phone OR phones OR telephone OR telephones OR technology OR technologies OR device OR devices)) OR smartphone OR smartphones OR smart-phone OR smart-phones OR cellphone OR cellphones OR mobiles OR mhealth OR m-health OR "mobile health" OR ehealth OR e-health OR "electronic health" OR telemedicine OR tele-medicine	

(Continued)

	OR telehealth OR tele-health OR telecare OR tele-care OR telenursing OR tele-nursing OR telepsychiatry OR tele-psychiatry OR telemonitor OR telemonitoring OR tele-monitor OR tele-monitoring OR teleconsult OR teleconsulting OR tele-consult OR tele-consulting OR telecounsel OR telecounseling OR tele-counsel OR tele-counseling OR telecoach OR telecoaching OR tele-coach OR tele-coaching OR videoconference OR videoconferences OR videoconferencing OR video-conference OR video-conferences OR video-conferencing OR webcast OR webcasts OR webcasting OR web-cast OR web-casts OR web-casting OR ((text OR texts OR texting OR short OR voice OR multimedia OR multi-media OR electronic OR instant) AND (message OR messages OR messaging)) OR "instant messenger" OR texting OR texted OR texter OR texters OR ((sms OR mms) AND (service OR services OR message OR messages OR messaging)) OR "interactive voice response" OR "interactive voice responses" OR ivr OR "voice call" OR "voice calls" OR callback OR "voice over internet" OR voip OR "mobile app" OR "mobile apps" OR "mobile application" OR "mobile applications" OR "social media" OR ((medical OR clinical OR health OR healthcare OR nurse OR nurses OR nursing) AND informatics)	
		AND
Keyword	DECISION MAKING OR MONITORING OR RECORDS	OR
	(register OR registers OR registration OR registry OR registries OR ((track* OR monitor*) AND (client* OR patient*)) OR record OR records OR "smart card*" OR HMIS OR ((information OR decision* OR case*) AND (management OR system* OR support)) OR "district health information" OR DHIS2 OR Motech OR "mobile technology for health" OR logbook* OR "log book*" OR eregistr* OR e-registr* OR ("vital event*" AND track*) OR (decision* AND (make OR makes OR making OR made OR support* OR algorithm* OR aid OR aids OR app OR apps OR application* OR technique*)) OR "expert system*" OR job-aid* OR "job aid*")	
		AND
Keyword	QUANTITATIVE RESEARCH OR RESEARCH METHODOLOGY OR CLINICAL TRIALS OR CONTROL GROUPS	OR
All Fields	(randomised OR randomized OR "randomly allocated" OR "random allocation" OR "controlled trial" OR "control group" OR "control groups" OR trial OR multicenter OR multicentre OR multi-center OR multi-centre OR "multi center" OR "multi centre" OR quasiexperiment* OR quasi-experiment* OR nonrandom* OR nonrandom* OR "time series" OR "controlled before" OR pretest OR "pre test" OR posttest OR "post test" OR "time point*" OR "time trend*" OR "repeated measur*")	
Limits	Added to POPLINE: 2017-07-01 to 2018-09-25	
		126 hits

Rerun October 2019
POPLINE retired on 1 Sept 2019 so no further reruns
Date searched: 7 August 2019

Field	Search terms	Operator

(Continued)

Keyword	TEXT MESSAGING OR MOBILE DEVICES OR INFORMATION COMMUNICATION TECHNOLOGY OR CELLULAR PHONE	OR
All Fields	((cell OR cellular OR mobile) AND (phone OR phones OR telephone OR telephones OR technology OR technologies OR device OR devices)) OR smartphone OR smartphones OR smart-phone OR smart-phones OR cellphone OR cellphones OR mobiles OR mhealth OR m-health OR "mobile health" OR ehealth OR e-health OR "electronic health" OR telemedicine OR tele-medicine OR telehealth OR tele-health OR telecare OR tele-care OR telenursing OR tele-nursing OR telepsychiatry OR tele-psychiatry OR telemonitor OR telemonitoring OR tele-monitor OR tele-monitoring OR teleconsult OR teleconsulting OR tele-consult OR tele-consulting OR telecounsel OR telecounseling OR tele-counsel OR tele-counseling OR telecoach OR telecoaching OR tele-coach OR tele-coaching OR videoconference OR videoconferences OR videoconferencing OR video-conference OR video-conferences OR video-conferencing OR webcast OR webcasts OR webcasting OR web-cast OR web-casts OR web-casting OR ((text OR texts OR texting OR short OR voice OR multimedia OR multi-media OR electronic OR instant) AND (message OR messages OR messaging)) OR "instant messenger" OR texting OR texted OR texter OR texters OR ((sms OR mms) AND (service OR services OR message OR messages OR messaging)) OR "interactive voice response" OR "interactive voice responses" OR ivr OR "voice call" OR "voice calls" OR callback OR "voice over internet" OR voip OR "mobile app" OR "mobile apps" OR "mobile application" OR "mobile applications" OR "social media" OR ((medical OR clinical OR health OR healthcare OR nurse OR nurses OR nursing) AND informatics)	
		AND
Keyword	DECISION MAKING OR MONITORING OR RECORDS	OR
	(register OR registers OR registration OR registry OR registries OR ((track* OR monitor*) AND (client* OR patient*)) OR record OR records OR "smart card*" OR HMIS OR ((information OR decision* OR case*) AND (management OR system* OR support)) OR "district health information" OR DHIS2 OR Motech OR "mobile technology for health" OR logbook* OR "log book*" OR eregistr* OR e-registr* OR ("vital event*" AND track*) OR (decision* AND (make OR makes OR making OR made OR support* OR algorithm* OR aid OR aids OR app OR apps OR application* OR technique*)) OR "expert system*" OR job-aid* OR "job aid*")	
		AND
Keyword	QUANTITATIVE RESEARCH OR RESEARCH METHODOLOGY OR CLINICAL TRIALS OR CONTROL GROUPS	OR
All Fields	(randomised OR randomized OR "randomly allocated" OR "random allocation" OR "controlled trial" OR "control group" OR "control groups" OR trial OR multicenter OR multicentre OR multi-center OR multi-centre OR "multi center" OR "multi centre" OR quasiexperiment* OR quasi-experiment* OR nonrandom* OR nonrandom* OR "time series" OR "controlled before" OR pretest OR "pre test" OR posttest OR "post test" OR "time point*" OR "time trend*" OR "repeated measur*")	
Limits	Added to POPLINE: 2018-09-01 to 2019-08-07	
		0 hits

TRIAL REGISTRIES

ClinicalTrials.gov

No.	Search terms	2017 Results	2019 Results	2020 Results	2022 Results
Field search: Other Terms:	(register OR registration OR registries OR logbook OR records OR eregistry OR tracking OR monitoring OR linkage) AND ("mobile phone" OR "mobile phones" OR "mobile devices" OR mobiles OR smartphone OR smartphones) | First posted from 08/01/2017 to 09/25/2018 | Last update posted from 08/01/2017 to 09/25/2018	379			
Field search: Other Terms:	(register OR registration OR registries OR logbook OR records OR eregistry OR tracking OR monitoring OR linkage) AND ("mobile phone" OR "mobile phones" OR "mobile devices" OR mobiles OR smartphone OR smartphones) | Last update posted from 09/25/2018 TO 10/02/2019		1016		
Field search: Other Terms:	(register OR registration OR registries OR logbook OR records OR eregistry OR tracking OR monitoring OR linkage) AND ("mobile phone" OR "mobile phones" OR "mobile devices" OR mobiles OR smartphone OR smartphones) | Last update posted from 10/02/2019 TO 10/19/2020			1205	
Field search: Other Terms:	(register OR registration OR registries OR logbook OR records OR eregistry OR tracking OR monitoring OR linkage) AND ("mobile phone" OR "mobile phones" OR "mobile devices" OR mobiles OR smartphone OR smartphones) | Interventional Studies | Last update posted from 10/19/2020 to 11/09/2022				1778

WHO International Clinical Trials Registry Platform (ICTRP)

No.	Search terms	2017 Results	2019 Results	2020 Results	2022 Results
Title:	mobile device OR mobiles OR smartphone OR phone OR cellphone				
	AND				
Intervention:	register OR registration OR registries OR logbook OR records OR eregistry OR tracking OR monitoring OR linkage				

(Continued)

	Date of registration is between 01/08/2017 AND 25/09/2018	17			
	Date of registration is between 25/09/2018 AND 02/10/2019		13		
	Date of registration is between 02/10/2020 AND 19/10/2020			0	
	Date of registration is between 19/10/2020 AND 09/11/2022				33
Title:	register OR registration OR registries OR log-book OR records OR eregistry OR tracking OR monitoring OR linkage				
	AND				
Intervention:	mobile device OR mobiles OR smartphone OR phone OR cellphone				
	Date of registration is between 01/08/2017 AND 25/09/2018	20			
	Date of registration is between 25/09/2018 AND 02/10/2019		22		
	Date of registration is between 02/10/2020 AND 19/10/2020			0	
	Date of registration is between 19/10/2020 AND 09/11/2022				47
	Total =	37	35	0	80

Appendix 5. Full list of excluded studies

Full list of excluded studies

We excluded a total of 122 studies from the review following full-text screening for the following reasons.

Ineligible intervention (N = 87): Many trials did not contain a mobile tracking element. Some were trials of standalone CDSS or TCC interventions, and some used paper records or desktop computers to track patients.

Ineligible study design (N = 16): We excluded small feasibility/pilot studies, trials with no control or comparison groups, and cross-sectional studies

Ineligible comparator (N = 5): We excluded studies where mobile tracking was used in both arms of the trial

Ineligible outcome (N = 3): We excluded studies with process outcomes or those that only assessed change in knowledge, attitude and practise

Ineligible setting (N = 11): We excluded population-based public health studies and those set in secondary or tertiary settings

Study ID	Citation	Reason for exclusion	Notes
Abdel-Kader 2011	Abdel-Kader K, Fischer GS, Li J, Moore CG, Hess R, Unruh ML. Automated clinical reminders for primary care providers in the care of CKD: a small cluster-randomized controlled trial. Am J Kidney Dis. 2011 Dec;58(6):894-902. doi: 10.1053/j.ajkd.2011.08.028. Epub 2011 Oct 7. PMID: 21982456; PMCID: PMC3221894.	Ineligible intervention	Not accessible by or primarily used via mobile device
Abidi 2018	Abidi S, Vallis M, Piccinini-Vallis H, Imran SA, Abidi SSR. Diabetes-related behavior change knowledge transfer to primary care practitioners and patients: implementation and evaluation of a digital health platform. JMIR Med Inform. 2018 Apr 18;6(2):e25. doi: 10.2196/medinform.9629. PMID: 29669705; PMCID: PMC5932333.	Ineligible intervention	No digital tracking by provider
Adams 2014	Adams WG, Phillips BD, Bacic JD, Walsh KE, Shanahan CW, Paasche-Orlow MK. Automated conversation system before pediatric primary care visits: a randomized trial. Pediatrics. 2014 Sep;134(3):e691-9. doi: 10.1542/peds.2013-3759. Epub 2014 Aug 4. PMID: 25092938.	Ineligible intervention	No direct face-to-face provider-client service delivery interaction
Adams 2016	Adams AS, Bayliss EA, Schmittdiel JA, Altschuler A, Dyer W, Neugebauer R, Jaffe M, Young JD, Kim E, Grant RW; Diabetes Telephone Study Team. The Diabetes Telephone Study: Design and challenges of a pragmatic cluster randomized trial to improve diabetic peripheral neuropathy treatment. Clin Trials. 2016 Jun;13(3):286-93. doi: 10.1177/1740774516631530. Epub 2016 Mar 31. PMID: 27034455; PMCID: PMC7261503.	Ineligible intervention	Not a tracking intervention
Adjei 2015	Adjei DN, Agyemang C, Dasah JB, Kuranchie P, Amoah AG. The effect of electronic reminders on risk management among diabetic patients in low resourced settings. J Diabetes Complications. 2015 Aug;29(6):818-21. doi: 10.1016/j.jdiacomp.2015.05.008. Epub 2015 May 18. PMID: 26025699.	Ineligible setting	Not delivered in primary care settings
Agarwal 2016	Agarwal S, Lasway C, L'Engle K, Homan R, Layer E, Ollis S, Braun R, Silas L, Mwakibete A, Kudrati M. Family Planning Counseling in Your Pocket: A Mobile Job Aid for Community Health Workers in Tanzania. Glob Health Sci Pract. 2016 Jun 27;4(2):300-10. doi: 10.9745/GHSP-D-15-00393. PMID: 27353622; PMCID: PMC4982253.	Ineligible study design	Pilot/ feasibility study
Amoakoh 2019	Amoakoh HB, Klipstein-Grobusch K, Agyepong IA, Zuithoff NPA, Amoakoh-Coleman M, Kayode GA, Sarpong C, Reitsma JB, Grobbee DE, Ansah EK. The effect of an mHealth clinical decision-making support system on neonatal mortality in a low resource setting: A cluster-randomized controlled trial. EClinicalMedicine. 2019 Jul 4;12:31-42. doi: 10.1016/j.eclinm.2019.05.010. PMID: 31388661; PMCID: PMC6677648.	Ineligible intervention	No mobile tracking
	Amoakoh HB, Klipstein-Grobusch K, Agyepong IA, Amoakoh-Coleman M, Kayode GA, Reitsma JB, Grobbee DE, Ansah EK. Can an mhealth clinical decision-making support system improve adherence to neonatal healthcare protocols in a low-resource setting? BMC Pediatr. 2020 Nov 27;20(1):534. doi: 10.1186/s12887-020-02378-1. PMID: 33243172; PMCID: PMC7694934.		

(Continued)

Andersson 2013	Andersson ML, Böttiger Y, Lindh JD, Wettermark B, Eiermann B. Impact of the drug-drug interaction database SFINX on prevalence of potentially serious drug-drug interactions in primary health care. Eur J Clin Pharmacol. 2013 Mar;69(3):565-71. doi: 10.1007/s00228-012-1338-y. Epub 2012 Jul 1. PMID: 22752671.	Ineligible intervention	Not accessible by or primarily used via mobile device
Arbogast 2017	Arbogast KB, Curry AE, Metzger KB, Kessler RS, Bell JM, Haarbauer-Krupa J, Zonfrillo MR, Breiding MJ, Master CL. Improving Primary Care Provider Practices in Youth Concussion Management. Clin Pediatr (Phila). 2017 Aug;56(9):854-865. doi: 10.1177/0009922817709555. Epub 2017 May 19. PMID: 28521519; PMCID: PMC6082149.	Ineligible study design	Not a relevant study design
Atlas 2011	Atlas SJ, Grant RW, Lester WT, Ashburner JM, Chang Y, Barry MJ, Chueh HC. A cluster-randomized trial of a primary care informatics-based system for breast cancer screening. J Gen Intern Med. 2011 Feb;26(2):154-61. doi: 10.1007/s11606-010-1500-0. Epub 2010 Sep 15. PMID: 20872083; PMCID: PMC3019316.	Ineligible intervention	Not accessible by or primarily used via mobile device
Atlas 2014	Atlas SJ, Zai AH, Ashburner JM, Chang Y, Percac-Lima S, Levy DE, Chueh HC, Grant RW. Non-visit-based cancer screening using a novel population management system. J Am Board Fam Med. 2014 Jul-Aug;27(4):474-85. doi: 10.3122/jabfm.2014.04.130319. PMID: 25002002.	Ineligible intervention	Not accessible by or primarily used via mobile device
Atreja 2016	Atreja A, Szigethy E, Colombel J F, Otobo E, Ullman T, Marion J, et al. P-063 Psychosocial Burden Among Patients with IBD: Prospectively Collected Data from 2 Academic Institutions, *Inflammatory Bowel Diseases*, Volume 22, Issue suppl_1, March 2016, Page S29, https://doi.org/10.1097/01.MIB.0000480167.23793.3b	Ineligible study design	Not a relevant study design
Bakibinga 2017	Bakibinga P, Kamande E, Omuya M, Ziraba AK, Kyobutungi C. The role of a decision support smartphone application in enhancing community health volunteers' effectiveness to improve maternal and newborn outcomes in Nairobi, Kenya: quasi-experimental research protocol. BMJ Open. 2017 Jul 20;7(7):e014896. doi: 10.1136/bmjopen-2016-014896. PMID: 28729309; PMCID: PMC5642658.	Ineligible intervention	No digital tracking on a mobile device
Badamana 2021	Badamana S. Efficacy of electronic mobile phone application compared with mother and child health booklet in improving quality of antenatal care from first visit through third trimester at Kenyatta National Hospital, a randomized controlled trial. 2021. Research dissertation submitted to the University of Nairobi for the award of Master of Medicine in Obstetrics and Gynaecology.	Ineligible setting	A hospital-based trial (hospital antenatal clinic run by O&G registars and consultants) at Kenyatta National Hospital - a major teaching and teaching hospital affiliated with Nairobi University
Baer 2015	Baer HJ, Wee CC, DeVito K, Orav EJ, Frolkis JP, Williams DH, Wright A, Bates DW. Design of a cluster-randomized trial of electronic health record-based tools to address overweight and obesity in primary care. Clin Trials. 2015 Aug;12(4):374-83. doi: 10.1177/1740774515578132. Epub 2015 Mar 25. PMID: 25810449; PMCID: PMC4863225.	Ineligible intervention	Not accessible by or primarily used via mobile device

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Bailey 2016	Bailey SC, Paasche-Orlow MK, Adams WG, Brokenshire SA, Hedlund LA, Hickson RP, Oramasionwu CU, Moore AL, McCarthy DM, Curtis LM, Kwasny MJ, Wolf MS. The electronic medication complete communication (EMC^2) study: Rationale and methods for a randomized controlled trial of a strategy to promote medication safety in ambulatory care. Contemp Clin Trials. 2016 Nov;51:72-77. doi: 10.1016/j.cct.2016.10.005. Epub 2016 Oct 22. Erratum in: Contemp Clin Trials. 2017 Jun;57:99. PMID: 27777127; PMCID: PMC5108675.	Ineligible intervention	Not accessible by or primarily used via mobile device
Bajaj 2016	Bajaj JS, Frederick RT, Bass NM, Ghabril M, Coyne K, Margolis MK, Santoro M, Coakley DF, Mokhtarani M, Jurek M, Scharschmidt BF. Overt hepatic encephalopathy: development of a novel clinician reported outcome tool and electronic caregiver diary. Metab Brain Dis. 2016 Oct;31(5):1081-93. doi: 10.1007/s11011-016-9851-9. Epub 2016 Jun 9. PMID: 27278222.	Ineligible intervention	Tracking (e-diary) by caregivers (not by health workers)
Bell 2010	Bell LM, Grundmeier R, Localio R, Zorc J, Fiks AG, Zhang X, Stephens TB, Swietlik M, Guevara JP. Electronic health record-based decision support to improve asthma care: a cluster-randomized trial. Pediatrics. 2010 Apr;125(4):e770-7. doi: 10.1542/peds.2009-1385. Epub 2010 Mar 15. PMID: 20231191.	Ineligible intervention	Not accessible by or primarily used via mobile device
Beratarrechea 2019	Beratarrechea A, Abrahams-Gessel S, Irazola V, Gutierrez L, Moyano D, Gaziano TA. Using mH ealth Tools to Improve Access and Coverage of People With Public Health Insurance and High Cardiovascular Disease Risk in Argentina: A Pragmatic Cluster Randomized Trial. J Am Heart Assoc. 2019 Apr 16;8(8):e011799. doi: 10.1161/JAHA.118.011799. PMID: 30943824; PMCID: PMC6507203.. Beratarrechea A, Abrahams-Gessel S, Irazola V, Gutierrez L, Moyano D, Rubinstein A, Gaziano T. Use of mhealth tools by community health workers (CHWS) in a pragmatic cluster randomized trial improves access, coverage, and treatment of uninsured people with high cardiovascular disease (CVD) risk in two provinces in Argentina. Circulation 2018;138.	Ineligible intervention	No digital tracking of client information, only appointment scheduling
Bertoni 2009	Bertoni AG, Bonds DE, Chen H, Hogan P, Crago L, Rosenberger E, Barham AH, Clinch CR, Goff DC Jr. Impact of a multifaceted intervention on cholesterol management in primary care practices: guideline adherence for heart health randomized trial. Arch Intern Med. 2009 Apr 13;169(7):678-86. doi: 10.1001/archinternmed.2009.44. PMID: 19364997; PMCID: PMC2937279.	Ineligible intervention	Hand-held computerised decision support tool but tracking was not mobile
Bhavnani 2017	Bhavnani SP, Sola S, Adams D, Venkateshvaran A, Dash PK, Sengupta PP; ASEF-VALUES Investigators. A Randomized Trial of Pocket-Echocardiography Integrated Mobile Health Device Assessments in Modern Structural Heart Disease Clinics. JACC Cardiovasc Imaging. 2018 Apr;11(4):546-557. doi: 10.1016/j.jcmg.2017.06.019. Epub 2017 Oct 5. PMID: 28917688.	Ineligible setting	Not a primary care intervention
Biemba 2020	Biemba G, Chiluba B, Yeboah-Antwi K, Silavwe V, Lunze K, Mwale RK, Hamer DH, MacLeod WB. Impact of mobile health-enhanced supportive supervision and supply chain management on appropriate integrated community case management of malaria, diarrhoea, and pneumonia in children 2-59 months: A cluster randomised trial in Eastern Province, Zambia. J Glob Health. 2020 Jun;10(1):010425. doi: 10.7189/jogh.10.010425. PMID: 32509293; PMCID: PMC7243069.	Ineligible outcomes	Outcomes not relevant for this review

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Billah 2022	Billah SM, Ferdous TE, Kelly P, Raynes-Greenow C, Siddique AB, Choudhury N, Ahmed T, Gillespie S, Hoddinott J, Menon P, Dibley MJ, Arifeen SE. Effect of nutrition counselling with a digital job aid on child dietary diversity: Analysis of secondary outcomes from a cluster randomised controlled trial in rural Bangladesh. Matern Child Nutr. 2022 Jan;18(1):e13267. doi: 10.1111/mcn.13267. Epub 2021 Aug 31. PMID: 34467669; PMCID: PMC8710107. Billah SM, Ferdous TE, Siddique AB, et al. The effect of electronic job aid assisted one-to-one counselling to support exclusive breastfeeding among 0-5-month-old infants in rural Bangladesh. Matern Child Nutr 2022;18(3):e133777	Ineligible comparator	The effectiveness of digital tracking was not evaluated as both arms of the trial had digital tracking
Bloomfield 2005	Bloomfield HE, Nelson DB, van Ryn M, Neil BJ, Koets NJ, Basile JN, Samaha FF, Kaul R, Mehta JL, Bouland D. A trial of education, prompts, and opinion leaders to improve prescription of lipid modifying therapy by primary care physicians for patients with ischemic heart disease. Qual Saf Health Care. 2005 Aug;14(4):258-63. doi: 10.1136/qshc.2004.012617. PMID: 16076789; PMCID: PMC1744060.	Ineligible intervention	Not accessible by or primarily used via mobile device
Bobrow 2016	Bobrow K, Farmer AJ, Springer D, et al. Mobile Phone Text Messages to Support Treatment Adherence in Adults With High Blood Pressure (SMS-Text Adherence Support [StAR]): A Single-Blind, Randomized Trial. Circulation 2016;133(6):592-600. [DOI: 10.1161/CIRCULATIONAHA.115.017530] Bobrow K, Brennan T, Springer D, Levitt NS, Rayner B, Namane M, Yu LM, Tarassenko L, Farmer A. Efficacy of a text messaging (SMS) based intervention for adults with hypertension: protocol for the StAR (SMS Text-message Adherence suppoRt trial) randomised controlled trial. BMC Public Health. 2014 Jan 11;14:28. doi: 10.1186/1471-2458-14-28. PMID: 24410738; PMCID: PMC3909351.	Ineligible intervention	SMS without mobile tracking
Borbolla 2007	Borbolla D, Giunta D, Figar S, Soriano M, Dawidowski A, de Quiros FG. Effectiveness of a chronic disease surveillance systems for blood pressure monitoring. Stud Health Technol Inform. 2007;129(Pt 1):223-7. PMID: 17911711.	Ineligible intervention	Not accessible by or primarily used via mobile device
Bourgeois 2010	Bourgeois FC, Linder J, Johnson SA, Co JP, Fiskio J, Ferris TG. Impact of a computerized template on antibiotic prescribing for acute respiratory infections in children and adolescents. Clin Pediatr (Phila). 2010 Oct;49(10):976-83. doi: 10.1177/0009922810373649. Epub 2010 Aug 19. PMID: 20724348.	Ineligible intervention	Not accessible by or primarily used via mobile device
Bowman 2015	Bowman S, Butz A, Rothman R, Anders J, Johnson B, Trent M. Unmet need for HIV screening among adolescents with pelvic inflammatory disease. Journal of adolescent health 2015;56:S23-s24.	Ineligible intervention	Not delivered by health provider
Byonanebye 2021	Byonanebye DM, Nabaggala MS, Naggirinya AB, Lamorde M, Oseku E, King R, Owarwo N, Laker E, Orama R, Castelnuovo B, Kiragga A, Parkes-Ratanshi R. An Interactive Voice Response Software to Improve the Quality of Life of People Living With HIV in Uganda: Randomized Controlled Trial. JMIR Mhealth Uhealth. 2021 Feb 11;9(2):e22229. doi: 10.2196/22229. PMID: 33570497; PMCID: PMC7906832.	Ineligible intervention	TCC intervention without mobile tracking

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Campbell 2018	Campbell AR, Kinvig K, Côté HC, Lester RT, Qiu AQ, Maan EJ, Alimenti A, Pick N, Murray MC. Health Care Provider Utilization and Cost of an mHealth Intervention in Vulnerable People Living With HIV in Vancouver, Canada: Prospective Study. JMIR Mhealth Uhealth. 2018 Jul 9;6(7):e152. doi: 10.2196/mhealth.9493. PMID: 29986845; PMCID: PMC6056738.	Ineligible setting	Not delivered in primary care settings
Castillo 2023	Castillo M, Alexander N, Rubiano L, Rojas C, Navarro A, Rincon D, Bernal LV, Lerma YO, Saravia NG, Aronoff-Spencer E. Randomized trial evaluating an mHealth intervention for the early community-based detection and follow-up of cutaneous leishmaniasis in rural Colombia. PLoS Negl Trop Dis. 2023 Mar 27;17(3):e0011180. doi: 10.1371/journal.pntd.0011180. PMID: 36972285; PMCID: PMC10079216.	Ineligible intervention	Digital tracking + telemonitoring intervention
Catho 2018	Catho G, De Kraker M, Waldispühl Suter B, Valotti R, Harbarth S, Kaiser L, Elzi L, Meyer R, Bernasconi E, Huttner BD. Study protocol for a multicentre, cluster randomised, superiority trial evaluating the impact of computerised decision support, audit and feedback on antibiotic use: the COMPuterized Antibiotic Stewardship Study (COMPASS). BMJ Open. 2018 Jun 27;8(6):e022666. doi: 10.1136/bmjopen-2018-022666. PMID: 29950480; PMCID: PMC6042555.	Ineligible setting	Not delivered in primary care settings
Chatzakis 2018	Chatzakis I, Vassilakis K, Lionis C, Germanakis I. Electronic health record with computerized decision support tools for the purposes of a pediatric cardiovascular heart disease screening program in Crete. Comput Methods Programs Biomed. 2018 Jun;159:159-166. doi: 10.1016/j.cmpb.2018.03.009. Epub 2018 Mar 15. PMID: 29650310.	Ineligible study design	Pilot/ feasibility study
Chawla 2021	Chawla D, Thukral A, Kumar P, Deorari A. Harnessing mobile technology to deliver evidence-based maternal-infant care. Semin Fetal Neonatal Med. 2021 Feb;26(1):101206. doi: 10.1016/j.siny.2021.101206. Epub 2021 Feb 13. PMID: 33612418.	Ineligible study design	Review article
Chen 2018	Chen S, Gong E, Kazi DS, Gates AB, Bai R, Fu H, Peng W, De La Cruz G, Chen L, Liu X, Su Q, Girerd N, Karaye KM, Alhabib KF, Yan LL, Schwalm JD. Using Mobile Health Intervention to Improve Secondary Prevention of Coronary Heart Diseases in China: Mixed-Methods Feasibility Study. JMIR Mhealth Uhealth. 2018 Jan 25;6(1):e9. doi: 10.2196/mhealth.7849. PMID: 29371178; PMCID: PMC5806005.	Ineligible study design	Pilot/ feasibility study
Chernick 2017	Chernick LS, Stockwell MS, Wu M, Castaño PM, Schnall R, Westhoff CL, Santelli J, Dayan PS. Texting to Increase Contraceptive Initiation Among Adolescents in the Emergency Department. J Adolesc Health. 2017 Dec;61(6):786-790. doi: 10.1016/j.jadohealth.2017.07.021. Epub 2017 Oct 19. PMID: 29056437; PMCID: PMC5701840.	Ineligible intervention	Texting only with no tracking; pilot study
Chirambo 2021	Chirambo GB, Thompson M, Hardy V, Ide N, Hwang PH, Dharmayat K, Mastellos N, Heavin C, O'Connor Y, Muula AS, Andersson B, Carlsson S, Tran T, Hsieh JC, Lee HY, Fitzpatrick A, Joseph Wu TS, O'Donoghue J. Effectiveness of Smartphone-Based Community Case Management on the Urgent Referral, Reconsultation, and Hospitalization of Children Aged Under 5 Years in Malawi: Cluster-Randomized, Stepped-Wedge Trial. J Med	Ineligible intervention	CDSS without mobile tracking

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	Internet Res. 2021 Oct 20;23(10):e25777. doi: 10.2196/25777. PMID: 34668872; PMCID: PMC8567152.		
Coppock 2017	Coppock D, Zambo D, Moyo D, Tanthuma G, Chapman J, Re VL 3rd, Graziani A, Lowenthal E, Hanrahan N, Littman-Quinn R, Kovarik C, Albarracin D, Holmes JH, Gross R. Development and Usability of a Smartphone Application for Tracking Antiretroviral Medication Refill Data for Human Immunodeficiency Virus. Methods Inf Med. 2017;56(5):351-359. doi: 10.3414/ME17-01-0045. Epub 2018 Jan 24. PMID: 29582932; PMCID: PMC9868897.	Ineligible study design	Pilot/ feasibility study
Dregan 2014	Dregan A, Van Staa TP, McDermott L, McCann G, Ashworth M, Charlton J, Wolfe CD, Rudd A, Yardley L, Gulliford MC; Data Monitoring Committee; Trial Steering Committee. Point-of-care cluster randomized trial in stroke secondary prevention using electronic health records. Stroke. 2014 Jul;45(7):2066-71. doi: 10.1161/STROKEAHA.114.005713. Epub 2014 Jun 5. PMID: 24903985.	Ineligible intervention	Not accessible by or primarily used via mobile device
Duffy 2020	Duffy S, Norton D, Kelly M, Chavez A, Tun R, Ramírez MNG, Chen G, Wise P, Svenson J. Using Community Health Workers and a Smartphone Application to Improve Diabetes Control in Rural Guatemala. Glob Health Sci Pract. 2020 Dec 23;8(4):699-720. doi: 10.9745/GHSP-D-20-00076. PMID: 33361237; PMCID: PMC7784066.	Ineligible study design	Program evaluation using a single-group, pre-post design
Feldstein 2006	Feldstein A, Elmer P J, Smith D H, Herson M, Orwoll E, Chen C, et al. Electronic medical record reminder improves osteoporosis management after a fracture: a randomized, controlled trial. Journal of the american geriatrics society 2006;54:450-7.	Ineligible intervention	Not accessible by or primarily used via mobile device
Feldstein 2006a	Feldstein A, Elmer PJ, Smith DH, Herson M, Orwoll E, Chen C, Aickin M, Swain MC. Electronic medical record reminder improves osteoporosis management after a fracture: a randomized, controlled trial. J Am Geriatr Soc. 2006 Mar;54(3):450-7. doi: 10.1111/j.1532-5415.2005.00618.x. PMID: 16551312..	Ineligible intervention	Not accessible by or primarily used via mobile device
Fiks 2009	Fiks AG, Hunter KF, Localio AR, Grundmeier RW, Bryant-Stephens T, Luberti AA, Bell LM, Alessandrini EA. Impact of electronic health record-based alerts on influenza vaccination for children with asthma. Pediatrics. 2009 Jul;124(1):159-69. doi: 10.1542/peds.2008-2823. PMID: 19564296.	Ineligible intervention	Not accessible by or primarily used via mobile device
Fiks 2013	Fiks AG, Grundmeier RW, Mayne S, Song L, Feemster K, Karavite D, Hughes CC, Massey J, Keren R, Bell LM, Wasserman R, Localio AR. Effectiveness of decision support for families, clinicians, or both on HPV vaccine receipt. Pediatrics. 2013 Jun;131(6):1114-24. doi: 10.1542/peds.2012-3122. Epub 2013 May 6. PMID: 23650297; PMCID: PMC3666111..	Ineligible intervention	Not accessible by or primarily used via mobile device
Forrest 2013	Forrest C B, Fiks A G, Bailey L C, Localio R, Grundmeier R W, Richards T, et al. Improving adherence to otitis media guidelines with clinical decision support and physician feedback. Pediatrics 2013;131:e1071-81.	Ineligible intervention	Not accessible by or primarily used via mobile device
Fricton 2011	Forrest CB, Fiks AG, Bailey LC, Localio R, Grundmeier RW, Richards T, Karavite DJ, Elden L, Alessandrini EA. Improving adherence to otitis media guidelines with clinical decision support and physician feedback. Pediatrics. 2013	Ineligible intervention	Not accessible by or primarily used via mobile device

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	Apr;131(4):e1071-81. doi: 10.1542/peds.2012-1988. Epub 2013 Mar 11. PMID: 23478860.		
Gill 2011	Gill JM, Mainous AG 3rd, Koopman RJ, Player MS, Everett CJ, Chen YX, Diamond JJ, Lieberman MI. Impact of EHR-based clinical decision support on adherence to guidelines for patients on NSAIDs: a randomized controlled trial. Ann Fam Med. 2011 Jan-Feb;9(1):22-30. doi: 10.1370/afm.1172. PMID: 21242557; PMCID: PMC3022041.	Ineligible intervention	Not accessible by or primarily used via mobile device
Gill 2012	Gill JM, Chen YX, Grimes A, Klinkman MS. Using electronic health record-based tools to screen for bipolar disorder in primary care patients with depression. J Am Board Fam Med. 2012 May-Jun;25(3):283-90. doi: 10.3122/jabfm.2012.03.110217. PMID: 22570391.	Ineligible intervention	Not accessible by or primarily used via mobile device
Grant 2015	Grant RW, Ashburner JM, Jernigan MC, Chang J, Borowsky LH, Chang Y, Atlas SJ. Randomized trial of a health IT tool to support between-visit-based laboratory monitoring for chronic disease medication prescriptions. J Gen Intern Med. 2015 May;30(5):619-25. doi: 10.1007/s11606-014-3152-y. Epub 2015 Jan 6. PMID: 25560319; PMCID: PMC4395618.	Ineligible intervention	Not accessible by or primarily used via mobile device
Gupta 2014	Gupta A, Gholami P, Turakhia MP, Friday K, Heidenreich PA. Clinical reminders to providers of patients with reduced left ventricular ejection fraction increase defibrillator referral: a randomized trial. Circ Heart Fail. 2014 Jan;7(1):140-5. doi: 10.1161/CIRCHEARTFAILURE.113.000753. Epub 2013 Dec 6. PMID: 24319096.	Ineligible intervention	Not accessible by or primarily used via mobile device
Hardy 2017	Hardy V, O'Connor Y, Heavin C, Mastellos N, Tran T, O'Donoghue J, Fitzpatrick AL, Ide N, Wu TJ, Chirambo GB, Muula AS, Nyirenda M, Carlsson S, Andersson B, Thompson M. The added value of a mobile application of Community Case Management on referral, re-consultation and hospitalization rates of children aged under 5 years in two districts in Northern Malawi: study protocol for a pragmatic, stepped-wedge cluster-randomized controlled trial. Trials. 2017 Oct 11;18(1):475. doi: 10.1186/s13063-017-2213-z. PMID: 29020976; PMCID: PMC5637321.	Ineligible intervention	CDSS without mobile tracking
Holbrook 2011	Holbrook A, Pullenayegum E, Thabane L, Troyan S, Foster G, Keshavjee K, Chan D, Dolovich L, Gerstein H, Demers C, Curnew G. Shared electronic vascular risk decision support in primary care: Computerization of Medical Practices for the Enhancement of Therapeutic Effectiveness (COMPETE III) randomized trial. Arch Intern Med. 2011 Oct 24;171(19):1736-44. doi: 10.1001/archinternmed.2011.471. PMID: 22025430..	Ineligible intervention	Not accessible by or primarily used via mobile device
Hsu 2013	Hsu L, Bowlus CL, Stewart SL, Nguyen TT, Dang J, Chan B, Chen MS Jr. Electronic messages increase hepatitis B screening in at-risk Asian American patients: a randomized, controlled trial. Dig Dis Sci. 2013 Mar;58(3):807-14. doi: 10.1007/s10620-012-2396-9. Epub 2012 Oct 17. PMID: 23073671; PMCID: PMC3578075.	Ineligible intervention	Not accessible by or primarily used via mobile device
Karlyn 2020	Karlyn A, Odindo S, Onyango R, Mbindyo C, Mberi T, Too G, Dalley J, Holeman I, Wasunna B. Testing mHealth solutions at the last mile: insights from a study of technology-assisted community health referrals in rural Kenya. Mhealth. 2020 Oct	Ineligible outcomes	

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	5;6:43. doi: 10.21037/mhealth-19-261. PMID: 33437839; PMCID: PMC7793019.		
Kart 2017	Kart Ö, Mevsim V, Kut A, Yürek İ, Altın AÖ, Yılmaz O. A mobile and web-based clinical decision support and monitoring system for diabetes mellitus patients in primary care: a study protocol for a randomized controlled trial. BMC Med Inform Decis Mak. 2017 Nov 29;17(1):154. doi: 10.1186/s12911-017-0558-6. PMID: 29187186; PMCID: PMC5707797.	Ineligible intervention	Clinican CDSS and patient monitoring system without tracking
Kateera 2022	Kateera F, Riviello R, Goodman A, Nkurunziza T, Cherian T, Bikorimana L, Nkurunziza J, Nahimana E, Habiyakare C, Ntakiyiruta G, Matousek A, Gaju E, Gruendl M, Powell B, Sonderman K, Koch R, Hedt-Gauthier B. The Effect and Feasibility of mHealth-Supported Surgical Site Infection Diagnosis by Community Health Workers After Cesarean Section in Rural Rwanda: Randomized Controlled Trial. JMIR Mhealth Uhealth. 2022 Jun 8;10(6):e35155. doi: 10.2196/35155. PMID: 35675108; PMCID: PMC9218905.	Ineligible intervention	Digital tracking, as client health records are not accessible via the digital device
Kitsao-Wekulo 2021	Kitsao-Wekulo P, Kipkoech Langat N, Nampijja M, Mwaniki E, Okelo K, Kimani-Murage E. Development and feasibility testing of a mobile phone application to track children's developmental progression. PLoS One. 2021 Jul 15;16(7):e0254621. doi: 10.1371/journal.pone.0254621. PMID: 34265009; PMCID: PMC8282085.	Ineligible intervention	Mobile phone app is on the participant's phone and data input by participants (not the health worker)
Laktabai 2018	Laktabai J, Platt A, Menya D, Turner EL, Aswa D, Kinoti S, O'Meara WP. A mobile health technology platform for quality assurance and quality improvement of malaria diagnosis by community health workers. PLoS One. 2018 Feb 1;13(2):e0191968. doi: 10.1371/journal.pone.0191968. PMID: 29389958; PMCID: PMC5794091.	Ineligible intervention	Mobile device to diagnose malaria without any digital tracking of patients
Lee 2022	Lee YJ, Lee S, Kim S, Choi W, Jeong Y, Rhim NJJ, Seo I, Kim SY. An mHealth-Based Health Management Information System Among Health Workers in Volta and Eastern Regions of Ghana: Pre-Post Comparison Analysis. JMIR Med Inform. 2022 Aug 31;10(8):e29431. doi: 10.2196/29431. PMID: 36044256; PMCID: PMC9475412.	Ineligible outcomes	Irrelevant outcomes and design: pre-post crossectional survey on KAP
Leight 2022	Leight J, Hensly C, Chissano M, Safran E, Ali L, Dustan D, Jamison J. The effects of text reminders on the use of family planning services: evidence from a randomised controlled trial in urban Mozambique. BMJ Glob Health. 2022 Apr;7(4):e007862. doi: 10.1136/bmjgh-2021-007862. PMID: 35428679; PMCID: PMC9014002.	Ineligible intervention	Only TCC was evaluated; both arms had digital record keeping but only for research outcome measurements
Levine 2021	Levine G, Salifu A, Mohammed I, Fink G. Mobile nudges and financial incentives to improve coverage of timely neonatal vaccination in rural areas (GEVaP trial): A 3-armed cluster randomized controlled trial in Northern Ghana. PLoS One. 2021 May 19;16(5):e0247485. doi: 10.1371/journal.pone.0247485. PMID: 34010312; PMCID: PMC8133473.	Ineligible intervention	Impact of financial incentives on neonatal vaccine uptake. No digital tracking occurs
Lim 2011	Lim S, Kang SM, Shin H, Lee HJ, Won Yoon J, Yu SH, Kim SY, Yoo SY, Jung HS, Park KS, Ryu JO, Jang HC. Improved glycemic control without hypoglycemia in elderly diabetic patients using the ubiquitous healthcare service, a new medical information	Ineligible intervention	No direct face-to-face provider-client service delivery interaction

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	system. Diabetes Care. 2011 Feb;34(2):308-13. doi: 10.2337/dc10-1447. PMID: 21270188; PMCID: PMC3024339.		
Lim 2016	Lim S, Kang SM, Kim KM, Moon JH, Choi SH, Hwang H, Jung HS, Park KS, Ryu JO, Jang HC. Multifactorial intervention in diabetes care using real-time monitoring and tailored feedback in type 2 diabetes. Acta Diabetol. 2016 Apr;53(2):189-98. doi: 10.1007/s00592-015-0754-8. Epub 2015 May 5. PMID: 25936739.	Ineligible intervention	No direct face-to-face provider-client service delivery interaction
Lim 2019	Lim S, Wyatt LC, Mammen S, Zanowiak JM, Mohaimin S, Goldfeld KS, Shelley D, Gold HT, Islam NS. The DREAM Initiative: study protocol for a randomized controlled trial testing an integrated electronic health record and community health worker intervention to promote weight loss among South Asian patients at risk for diabetes. Trials. 2019 Nov 21;20(1):635. doi: 10.1186/s13063-019-3711-y. PMID: 31752964; PMCID: PMC6868710.	Ineligible intervention	Not accessible by or primarily used via mobile device
Lo 2007	Lo HG, Matheny ME, Seger DL, Bates DW, Gandhi TK. Non-interruptive drug-lab alerts in ambulatory care. AMIA Annu Symp Proc. 2007 Oct 11:1038. PMID: 18694136.	Ineligible intervention	Not accessible by or primarily used via mobile device
Lokman 2015	Lokman S, Volker D, Zijlstra-Vlasveld MC, Brouwers EP, Boon B, Beekman AT, Smit F, Van der Feltz-Cornelis CM. Return-to-work intervention versus usual care for sick-listed employees: health-economic investment appraisal alongside a cluster randomised trial. BMJ Open. 2017 Oct 5;7(10):e016348. doi: 10.1136/bmjopen-2017-016348. PMID: 28982815; PMCID: PMC5640022.	Ineligible intervention	Not a health provider intervention
Luo 2019	Luo Y, Zhu Y, Chen J, Gao X, Yang W, Zou X, Zhou X, Ji L. A Decision Support Software to Improve the Standard Care in Chinese Type 2 Diabetes. J Diabetes Res. 2019 Nov 11;2019:5491743. doi: 10.1155/2019/5491743. PMID: 31828162; PMCID: PMC6881560.	Ineligible setting	Not primary care setting
Mann 2012	Mann D, Kannry J, Wisnivesky J P, Stulman J, McCullagh L, Sofianou A, et al. Electronic health record tool reduces antibiotic use: The integrated clinical prediction rules (ICPR) trial. Journal of general internal medicine 2012;27:S181.	Ineligible intervention	Not accessible by or primarily used via mobile device
Martins 2017	Martins CM, da Costa Teixeira AS, de Azevedo LF, Sá LM, Santos PA, do Couto ML, da Costa Pereira AM, Hespanhol AA, da Costa Santos CM. The effect of a test ordering software intervention on the prescription of unnecessary laboratory tests - a randomized controlled trial. BMC Med Inform Decis Mak. 2017 Feb 20;17(1):20. doi: 10.1186/s12911-017-0416-6. PMID: 28219437; PMCID: PMC5319139.	Ineligible intervention	Not accessible by or primarily used via mobile device
Mayberry 2022	Mayberry LS, El-Rifai M, Nelson LA, Parks M, Greevy RA Jr, LeStourgeon L, Molli S, Bergner E, Spieker A, Aikens JE, Wolever RQ. Rationale, design, and recruitment outcomes for the Family/Friend Activation to Motivate Self-care (FAMS) 2.0 randomized controlled trial among adults with type 2 diabetes and their support persons. Contemp Clin Trials. 2022 Nov;122:106956. doi: 10.1016/j.cct.2022.106956. Epub 2022 Oct 5. PMID: 36208719; PMCID: PMC10364455.	Ineligible intervention	No digital tracking: monthly phone coaching and text message support for goals and medication adherence

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McGinn 2013	McGinn TG, McCullagh L, Kannry J, Knaus M, Sofianou A, Wisnivesky JP, Mann DM. Efficacy of an evidence-based clinical decision support in primary care practices: a randomized clinical trial. JAMA Intern Med. 2013 Sep 23;173(17):1584-91. doi: 10.1001/jamainternmed.2013.8980. PMID: 23896675.	Ineligible intervention	Not accessible by or primarily used via mobile device
McKinstry 2013	McKinstry B, Hanley J, Wild S, Pagliari C, Paterson M, Lewis S, Sheikh A, Krishan A, Stoddart A, Padfield P. Telemonitoring based service redesign for the management of uncontrolled hypertension: multicentre randomised controlled trial. BMJ. 2013 May 24;346:f3030. doi: 10.1136/bmj.f3030. PMID: 23709583; PMCID: PMC3663293.	Ineligible intervention	Not a health provider intervention
McNabb 2015	McNabb M, Chukwu E, Ojo O, Shekhar N, Gill CJ, Salami H, Jega F. Assessment of the quality of antenatal care services provided by health workers using a mobile phone decision support application in northern Nigeria: a pre/post-intervention study. PLoS One. 2015 May 5;10(5):e0123940. doi: 10.1371/journal.pone.0123940. PMID: 25942018; PMCID: PMC4420494.	Ineligible study design	Not a relevant study design
Mekonnen 2019	Mekonnen ZA, Tilahun B, Alemu K, Were M. Effect of mobile phone text message reminders on improving completeness and timeliness of routine childhood vaccinations in North-West, Ethiopia: a study protocol for randomised controlled trial. BMJ Open. 2019 Nov 5;9(11):e031254. doi: 10.1136/bmjopen-2019-031254. PMID: 31694849; PMCID: PMC6858152.	Ineligible intervention	Mobile text reminders only with no digital tracking
Miloh 2017	Miloh T, Shub M, Montes R, Ingebo K, Silber G, Pasternak B. Text Messaging Effect on Adherence in Children With Inflammatory Bowel Disease. J Pediatr Gastroenterol Nutr. 2017 Jun;64(6):939-942. doi: 10.1097/MPG.0000000000001399. PMID: 27602705.	Ineligible intervention	Not a health provider intervention
Nigussie 2021	Nigussie ZY, Zemicheal NF, Tiruneh GT, Bayou YT, Teklu GA, Kibret ES, Eifler K, Hodsdon SE, Altaye DE, Rosenblum L, Getu YA, Nebi Z, Lemango ET, Kebede E, Betemariam WA. Using mHealth to Improve Timeliness and Quality of Maternal and Newborn Health in the Primary Health Care System in Ethiopia. Glob Health Sci Pract. 2021 Sep 30;9(3):668-681. doi: 10.9745/GHSP-D-20-00685. PMID: 34593589; PMCID: PMC8514022.	Ineligible study design	Process evaluation and user experience exploration only - no control group
O'Connor 2011	O'Connor PJ, Sperl-Hillen JM, Rush WA, Johnson PE, Amundson GH, Asche SE, Ekstrom HL, Gilmer TP. Impact of electronic health record clinical decision support on diabetes care: a randomized trial. Ann Fam Med. 2011 Jan-Feb;9(1):12-21. doi: 10.1370/afm.1196. PMID: 21242556; PMCID: PMC3022040.	Ineligible intervention	Not accessible by or primarily used via mobile device
Orchard 2018	Orchard JJ, Neubeck L, Freedman B, Webster R, Patel A, Gallagher R, Li J, Hespe CM, Ferguson C, Zwar N, Lowres N. Atrial Fibrillation Screen, Management And Guideline Recommended Therapy (AF SMART II) in the rural primary care setting: an implementation study protocol. BMJ Open. 2018 Oct 31;8(10):e023130. doi: 10.1136/bmjopen-2018-023130. PMID: 30385444; PMCID: PMC6252758.	Ineligible study design	Cross-sectional study design
Orrell 2015	Orrell C, Cohen K, Mauff K, Bangsberg DR, Maartens G, Wood R. A Randomized Controlled Trial of Real-Time Electronic Adherence Monitoring With Text Message Dosing Reminders in People Starting First-Line Antiretroviral Therapy. J Acquir Im-	Ineligible intervention	No direct face-to-face provider-client service delivery interaction

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	mune Defic Syndr. 2015 Dec 15;70(5):495-502. doi: 10.1097/QAI.0000000000000770. PMID: 26218411.		
Park 2012	Park MJ, Kim HS. Evaluation of mobile phone and Internet intervention on waist circumference and blood pressure in postmenopausal women with abdominal obesity. Int J Med Inform. 2012 Jun;81(6):388-94. doi: 10.1016/j.ijmedinf.2011.12.011. Epub 2012 Jan 21. PMID: 22265810.	Ineligible setting	Not a primary care intervention
Peiris 2012	Peiris D, Usherwood T, Panaretto K, Harris M, Hunt J, Patel B, Zwar N, Redfern J, Macmahon S, Colagiuri S, Hayman N, Patel A. The Treatment of cardiovascular Risk in Primary care using Electronic Decision supOrt (TORPEDO) study-intervention development and protocol for a cluster randomised, controlled trial of an electronic decision support and quality improvement intervention in Australian primary health care. BMJ Open. 2012 Nov 19;2(6):e002177. doi: 10.1136/bmjopen-2012-002177. PMID: 23166140; PMCID: PMC3533097.	Ineligible intervention	No mobile tracking
Quanbeck 2018	Quanbeck A, Gustafson DH, Marsch LA, Chih MY, Kornfield R, McTavish F, Johnson R, Brown RT, Mares ML, Shah DV. Implementing a Mobile Health System to Integrate the Treatment of Addiction Into Primary Care: A Hybrid Implementation-Effectiveness Study. J Med Internet Res. 2018 Jan 30;20(1):e37. doi: 10.2196/jmir.8928. PMID: 29382624; PMCID: PMC5811649.	Ineligible intervention	Mobile app for patients (not for service providers)
Quinn 2009	Quinn CC, Gruber-Baldini AL, Shardell M, Weed K, Clough SS, Peeples M, Terrin M, Bronich-Hall L, Barr E, Lender D. Mobile diabetes intervention study: testing a personalized treatment/behavioral communication intervention for blood glucose control. Contemp Clin Trials. 2009 Jul;30(4):334-46. doi: 10.1016/j.cct.2009.02.004. Epub 2009 Feb 27. PMID: 19250979.	Ineligible intervention	No direct face-to-face provider-client service delivery interaction
Quinn 2012	Quinn CC, Shardell MD, Terrin ML, Barr EA, Ballew SH, Gruber-Baldini AL. Cluster-randomized trial of a mobile phone personalized behavioral intervention for blood glucose control. Diabetes Care. 2011 Sep;34(9):1934-42. doi: 10.2337/dc11-0366. Epub 2011 Jul 25. Erratum in: Diabetes Care. 2013 Nov;36(11):3850. PMID: 21788632; PMCID: PMC3161305.	Ineligible intervention	No direct face-to-face provider-client service delivery interaction
Quinn 2014	Quinn CC, Sareh PL, Shardell ML, Terrin ML, Barr EA, Gruber-Baldini AL. Mobile Diabetes Intervention for Glycemic Control: Impact on Physician Prescribing. J Diabetes Sci Technol. 2014 Mar;8(2):362-370. doi: 10.1177/1932296813514503. Epub 2014 Feb 5. PMID: 24876589; PMCID: PMC4455407.	Ineligible intervention	No direct face-to-face provider-client service delivery interaction
Rahman 2021	Rahman A, Friberg IK, Dolphyne A, Fjeldheim I, Khatun F, O'Donnell B, Pervin J, Rahman M, Rahman AMQ, Nu UT, Sarker BK, Venkateswaran M, Frøen JF. An Electronic Registry for Improving the Quality of Antenatal Care in Rural Bangladesh (eRegMat): Protocol for a Cluster Randomized Controlled Trial. JMIR Res Protoc. 2021 Jul 6;10(7):e26918. doi: 10.2196/26918. PMID: 34255723; PMCID: PMC8292932.	Ineligible comparator	Both arms had mobile tracking
Rambaud-Althaus 2017	Rambaud-Althaus C, Shao A, Samaka J, Swai N, Perri S, Kahama-Maro J, Mitchell M, D'Acremont V, Genton B. Performance of Health Workers Using an Electronic Algorithm for the Management of Childhood Illness in Tanzania: A Pilot Implementation Study. Am J Trop Med Hyg. 2017 Jan 11;96(1):249-257. doi:	Ineligible intervention	CDSS without mobile tracking

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	10.4269/ajtmh.15-0395. Epub 2016 Nov 14. PMID: 28077751; PMCID: PMC5239703.		
Redfern 2020	Redfern J, Coorey G, Mulley J, Scaria A, Neubeck L, Hafiz N, Pitt C, Weir K, Forbes J, Parker S, Bampi F, Coenen A, Enright G, Wong A, Nguyen T, Harris M, Zwar N, Chow CK, Rodgers A, Heeley E, Panaretto K, Lau A, Hayman N, Usherwood T, Peiris D. A digital health intervention for cardiovascular disease management in primary care (CONNECT) randomized controlled trial. NPJ Digit Med. 2020 Sep 10;3:117. doi: 10.1038/s41746-020-00325-z. PMID: 32964140; PMCID: PMC7484809.	Ineligible intervention	No mobile tracking
Robbins 2012	Robbins GK, Lester W, Johnson KL, Chang Y, Estey G, Surrao D, Zachary K, Lammert SM, Chueh HC, Meigs JB, Freedberg KA. Efficacy of a clinical decision support system in an HIV practice: a randomized trial. Ann Intern Med. 2012 Dec 4;157(11):757-66. doi: 10.7326/0003-4819-157-11-201212040-00003. PMID: 23208165; PMCID: PMC3829692.	Ineligible intervention	Not accessible by or primarily used via mobile device
Rono 2021	Rono H, Bastawrous A, Macleod D, Mamboleo R, Bunywera C, Wanjala E, Gichuhi S, Burton MJ. Effectiveness of an mHealth system on access to eye health services in Kenya: a cluster-randomised controlled trial. Lancet Digit Health. 2021 Jul;3(7):e414-e424. doi: 10.1016/S2589-7500(21)00083-2. PMID: 34167763; PMCID: PMC8239618.	Ineligible intervention	Screening, clinical decision tool for detecting visual problems, linked to the clinic with cloud based technology, and targeted SMS reminders but without a digital tracking component
Saha 2022	Saha S, Quazi ZS. Does Digitally Enabling Frontline Health Workers Improve Coverage and Quality of Maternal and Child Health Services? Findings From a Mixed Methods Evaluation of TECHO+ in Gujarat. Front Public Health. 2022 Jul 22;10:856561. doi: 10.3389/fpubh.2022.856561. PMID: 35958841; PMCID: PMC9363132.	Ineligible comparator	TECHO+ software (new software) vs e-Mamta software (pre-comparator old software) - both have tracking capability
Santero 2018	Santero M, Morelli D, Nejamis A, Gibbons L, Irazola V, Beratarrechea A. Using mHealth strategies in a Diabetes Management Program to improve the quality of care in Argentina: Study design and baseline data. Prim Care Diabetes. 2018 Dec;12(6):510-516. doi: 10.1016/j.pcd.2018.07.014. Epub 2018 Aug 27. PMID: 30166114.	Ineligible study design	Uncontrolled Pre-Post study
Sarrasst 2021	Sarrassat S, Lewis JJ, Some AS, Somda S, Cousens S, Blanchet K. An Integrated eDiagnosis Approach (IeDA) versus standard IMCI for assessing and managing childhood illness in Burkina Faso: a stepped-wedge cluster randomised trial. BMC Health Serv Res. 2021 Apr 16;21(1):354. doi: 10.1186/s12913-021-06317-3. PMID: 33863326; PMCID: PMC8052659.	Ineligible intervention	No digital tracking on a mobile device
Schmitz 2022	Schmitz T, Beynon F, Musard C, Kwiatkowski M, Landi M, Ishaya D, Zira J, Muazu M, Renner C, Emmanuel E, Bulus SG, Rossi R. Effectiveness of an electronic clinical decision support system in improving the management of childhood illness in primary care in rural Nigeria: an observational study. BMJ Open. 2022 Jul 21;12(7):e055315. doi: 10.1136/bmjopen-2021-055315. PMID: 35863838; PMCID: PMC9310162.	Ineligible intervention	Only the CDSS is being evaluated

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Sequist 2005	Sequist T D, Gandhi T K, Karson A S, Fiskio J M, Bugbee D, Sperling M, et al. A randomized trial of electronic clinical reminders to improve quality of care for diabetes and coronary artery disease. Journal of the american medical informatics association: JAMIA 2005;12:431-7.	Ineligible intervention	Not accessible by or primarily used via mobile device
Sequist 2012	Sequist TD, Gandhi TK, Karson AS, Fiskio JM, Bugbee D, Sperling M, Cook EF, Orav EJ, Fairchild DG, Bates DW. A randomized trial of electronic clinical reminders to improve quality of care for diabetes and coronary artery disease. J Am Med Inform Assoc. 2005 Jul-Aug;12(4):431-7. doi: 10.1197/jamia.M1788. Epub 2005 Mar 31. PMID: 15802479; PMCID: PMC1174888.	Ineligible intervention	Not accessible by or primarily used via mobile device
Shah 2012	CARRS Trial Writing Group; Shah S, Singh K, Ali MK, Mohan V, Kadir MM, Unnikrishnan AG, Sahay RK, Varthakavi P, Dharmalingam M, Viswanathan V, Masood Q, Bantwal G, Khadgawat R, Desai A, Sethi BK, Shivashankar R, Ajay VS, Reddy KS, Narayan KM, Prabhakaran D, Tandon N. Improving diabetes care: multi-component cardiovascular disease risk reduction strategies for people with diabetes in South Asia--the CARRS multi-center translation trial. Diabetes Res Clin Pract. 2012 Nov;98(2):285-94. doi: 10.1016/j.diabres.2012.09.023. Epub 2012 Oct 22. PMID: 23084280; PMCID: PMC3544938.	Ineligible intervention	Not a digital tracking intervention
Shaikh 2015	Shaikh U, Berrong J, Nettiksimmons J, Byrd RS. Impact of electronic health record clinical decision support on the management of pediatric obesity. Am J Med Qual. 2015 Jan-Feb;30(1):72-80. doi: 10.1177/1062860613517926. Epub 2014 Jan 13. PMID: 24418755.0.	Ineligible intervention	Not accessible by or primarily used via mobile device
Shelley 2011	Shelley D, Tseng TY, Matthews AG, Wu D, Ferrari P, Cohen A, Millery M, Ogedegbe O, Farrell L, Kopal H. Technology-driven intervention to improve hypertension outcomes in community health centers. Am J Manag Care. 2011 Dec;17(12 Spec No.):SP103-10. PMID: 22216768.	Ineligible intervention	Not accessible by or primarily used via mobile device
Shrestha 2019	Shrestha, SS; Bhavnani, S; Casaclang-Verzosa, G; Khalil, M; Thamman, R; Patel, J; Desai, A; Shah, R; Hu, L; Piccirilli, M; et al. Improving the Efficiency of Healthcare Delivery with Digital Health Technologies in the ASE Foundation Community Health Outreach Imaging and Cardiovascular Examinations (CHOICE) Program: a Cluster Randomized Trial. Journal of the American Society of Echocardiography 2019;32(6):B111-2019. DOI: 10.1016/j.echo.2019.04.414	Ineligible intervention	Not accessible by or primarily used via mobile device
Silveira 2019	Silveira DV, Marcolino MS, Machado EL, Ferreira CG, Alkmim MBM, Resende ES, Carvalho BC, Antunes AP, Ribeiro ALP. Development and Evaluation of a Mobile Decision Support System for Hypertension Management in the Primary Care Setting in Brazil: Mixed-Methods Field Study on Usability, Feasibility, and Utility. JMIR Mhealth Uhealth. 2019 Mar 25;7(3):e9869. doi: 10.2196/mhealth.9869. PMID: 30907740; PMCID: PMC6452279.	Ineligible study design	Irrelevant study design: App development and field study, no comparison group
Singh 2020	Singh JK, Acharya D, Paudel R, Gautam S, Adhikari M, Kushwaha SP, Park JH, Yoo SJ, Lee K. Effects of Female Community Health Volunteer Capacity Building and Text Messaging Intervention on Gestational Weight Gain and Hemoglobin Change Among Pregnant Women in Southern Nepal: A Cluster Randomized Controlled Trial. Front Public Health. 2020 Jul	Ineligible intervention	No digital tracking: female community health volunteer capacity building followed by regular supervision and

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	17;8:312. doi: 10.3389/fpubh.2020.00312. PMID: 32766199; PMCID: PMC7379845.		monitoring and mobile phone text messaging to expectant mothers
Sonderman 2018	Sonderman KA, Nkurunziza T, Kateera F, Gruendl M, Koch R, Gaju E, Habiyakare C, Matousek A, Nahimana E, Ntakiyiruta G, Riviello R, Hedt-Gauthier BL. Using mobile health technology and community health workers to identify and refer caesarean-related surgical site infections in rural Rwanda: a randomised controlled trial protocol. BMJ Open. 2018 May 8;8(5):e022214. doi: 10.1136/bmjopen-2018-022214. PMID: 29739786; PMCID: PMC5942430.	Ineligible intervention	Not a digital tracking intervention
Soni 2017	Soni A, Karna S, Patel H, Fahey N, Raithatha S, Handorf A, Bostrom J, Bashar S, Talati K, Shah R, Goldberg RJ, Thanvi S, Phatak AG, Allison JJ, Chon K, Nimbalkar SM, McManus DD. Study protocol for Smartphone Monitoring for Atrial fibrillation in Real-Time in India (SMART-India): a community-based screening and referral programme. BMJ Open. 2017 Dec 14;7(12):e017668. doi: 10.1136/bmjopen-2017-017668. PMID: 29247089; PMCID: PMC5736031.	Ineligible setting	Community screening, not primary care
Srinivasapura Venkateshmurthy 2018	Srinivasapura Venkateshmurthy N, Ajay VS, Mohan S, Jindal D, Anand S, Kondal D, Tandon N, Rao MB, Prabhakaran D. m-Power Heart Project - a nurse care coordinator led, mHealth enabled intervention to improve the management of hypertension in India: study protocol for a cluster randomized trial. Trials. 2018 Aug 7;19(1):429. doi: 10.1186/s13063-018-2813-2. PMID: 30086778; PMCID: PMC6081824.	Ineligible setting	Not a primary care setting.Methods state clinics are secondary level referral clinics
Szilagyi 2015	Szilagyi PG, Serwint JR, Humiston SG, Rand CM, Schaffer S, Vincelli P, Dhepyasuwan N, Blumkin A, Albertin C, Curtis CR. Effect of provider prompts on adolescent immunization rates: a randomized trial. Acad Pediatr. 2015 Mar-Apr;15(2):149-57. doi: 10.1016/j.acap.2014.10.006. PMID: 25748976; PMCID: PMC8340134.	Ineligible intervention	Not accessible by or primarily used via mobile device
Tajmir 2017	Tajmir S, Raja AS, Ip IK, Andruchow J, Silveira P, Smith S, Khorasani R. Impact of Clinical Decision Support on Radiography for Acute Ankle Injuries: A Randomized Trial. West J Emerg Med. 2017 Apr;18(3):487-495. doi: 10.5811/westjem.2017.1.33053. Epub 2017 Mar 7. PMID: 28435501; PMCID: PMC5391900.	Ineligible setting	Not a primary care intervention
Tamblyn 2010	Tamblyn R, Reidel K, Huang A, Taylor L, Winslade N, Bartlett G, Grad R, Jacques A, Dawes M, Larochelle P, Pinsonneault A. Increasing the detection and response to adherence problems with cardiovascular medication in primary care through computerized drug management systems: a randomized controlled trial. Med Decis Making. 2010 Mar-Apr;30(2):176-88. doi: 10.1177/0272989X09342752. Epub 2009 Aug 12. PMID: 19675319.	Ineligible intervention	Not accessible by or primarily used via mobile device
Tan 2023	Tan R, Cobuccio L, Beynon F, Levine GA, Vaezipour N, Luwanda LB, Mangu C, Vonlanthen A, De Santis O, Salim N, Manji K, Naburi H, Chirande L, Matata L, Bulongeleje M, Moshiro R, Miheso A, Arimi P, Ndiaye O, Faye M, Thiongane A, Awasthi S, Sharma K, Kumar G, Van De Maat J, Kulinkina A, Rwandarwacu V, Dusengumuremyi T, Nkuranga JB, Rusingiza E, Tuyisenge L, Hartley MA, Faivre V, Thabard J, Keitel K, D'Acremont V. ePOCT+ and the	Ineligible comparator	Both arms of the study use digital tracking on a tablet

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	medAL-suite: Development of an electronic clinical decision support algorithm and digital platform for pediatric outpatients in low- and middle-income countries. PLOS Digit Health. 2023 Jan 19;2(1):e0000170. doi: 10.1371/journal.pdig.0000170. PMID: 36812607; PMCID: PMC9931356.		
Tang 2012	Tang JW, Kushner RF, Cameron KA, Hicks B, Cooper AJ, Baker DW. Electronic tools to assist with identification and counseling for overweight patients: a randomized controlled trial. J Gen Intern Med. 2012 Aug;27(8):933-9. doi: 10.1007/s11606-012-2022-8. Epub 2012 Mar 9. PMID: 22402982; PMCID: PMC3403149.	Ineligible intervention	Not accessible by or primarily used via mobile device
Taveras 2013	Taveras EM, Marshall R, Horan CM, Gillman MW, Hacker K, Kleinman KP, Koziol R, Price S, Simon SR. Rationale and design of the STAR randomized controlled trial to accelerate adoption of childhood obesity comparative effectiveness research. Contemp Clin Trials. 2013 Jan;34(1):101-8. doi: 10.1016/j.cct.2012.10.005. Epub 2012 Oct 22. PMID: 23099100.	Ineligible intervention	Not accessible by or primarily used via mobile device
Taveras 2017	Taveras EM, Perkins M, Anand S, Woo Baidal JA, Nelson CC, Kamdar N, Kwass JA, Gortmaker SL, Barrett JL, Davison KK, Land T. Clinical effectiveness of the massachusetts childhood obesity research demonstration initiative among low-income children. Obesity (Silver Spring). 2017 Jul;25(7):1159-1166. doi: 10.1002/oby.21866. PMID: 28653504; PMCID: PMC5506684.	Ineligible intervention	Not accessible by or primarily used via mobile device
Tian 2015	Tian M, Ajay VS, Dunzhu D, Hameed SS, Li X, Liu Z, Li C, Chen H, Cho K, Li R, Zhao X, Jindal D, Rawal I, Ali MK, Peterson ED, Ji J, Amarchand R, Krishnan A, Tandon N, Xu LQ, Wu Y, Prabhakaran D, Yan LL. A Cluster-Randomized, Controlled Trial of a Simplified Multifaceted Management Program for Individuals at High Cardiovascular Risk (SimCard Trial) in Rural Tibet, China, and Haryana, India. Circulation. 2015 Sep 1;132(9):815-24. doi: 10.1161/CIRCULATIONAHA.115.015373. Epub 2015 Jul 17. PMID: 26187183; PMCID: PMC4558306.	Ineligible intervention	Not a digital tracking intervention
Vollmer 2014	Vollmer WM, Owen-Smith AA, Tom JO, Laws R, Ditmer DG, Smith DH, Waterbury AC, Schneider JL, Yonehara CH, Williams A, Vupputuri S, Rand CS. Improving adherence to cardiovascular disease medications with information technology. Am J Manag Care. 2014 Nov;20(11 Spec No. 17):SP502-10. PMID: 25811824; PMCID: PMC6358176.	Ineligible intervention	Not accessible by or primarily used via mobile device
Weingart 2013	Weingart SN, Carbo A, Tess A, Chiappetta L, Tutkus S, Morway L, Toth M, Davis RB, Phillips RS, Bates DW. Using a patient internet portal to prevent adverse drug events: a randomized, controlled trial. J Patient Saf. 2013 Sep;9(3):169-75. doi: 10.1097/PTS.0b013e31829e4b95. PMID: 23965840.	Ineligible intervention	No direct face-to-face provider-client service delivery interaction
Westgard 2019	Westgard CM, Rivadeneyra N, Mechael P. mHealth tool to improve community health agent performance for child development: study protocol for a cluster-randomised controlled trial in Peru. BMJ Open. 2019 Nov 6;9(11):e028361. doi: 10.1136/bmjopen-2018-028361. PMID: 31699716; PMCID: PMC6858115.	Ineligible study design	Pilot/ feasibility study
Wu 2015	Wu RR, Myers RA, McCarty CA, Dimmock D, Farrell M, Cross D, Chinevere TD, Ginsburg GS, Orlando LA; Family Health History Network. Protocol for the "Implementation, adoption, and utility of family history in diverse care settings" study. Implement	Ineligible intervention	No direct face-to-face provider-client service delivery interaction

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	Sci. 2015 Nov 24;10:163. doi: 10.1186/s13012-015-0352-8. PMID: 26597091; PMCID: PMC4657284.		
Yang 2021	Yang JE, Lassala D, Liu JX, Whidden C, Holeman I, Keita Y, Djiguiba Y, N'Diaye SI, Fall F, Kayentao K, Johnson AD. Effect of mobile application user interface improvements on minimum expected home visit coverage by community health workers in Mali: a randomised controlled trial. BMJ Glob Health. 2021 Nov;6(11):e007205. doi: 10.1136/bmjgh-2021-007205. PMID: 34815242; PMCID: PMC8609935.	Ineligible comparator	Mobile tracking in both arms
Zaman 2021	Zaman SB, Evans RG, Singh R, Singh A, Singh P, Singh R, Thrift AG. Feasibility of community health workers using a clinical decision support system to screen and monitor non-communicable diseases in resource-poor settings: study protocol. Mhealth. 2021 Jan 20;7:15. doi: 10.21037/mhealth-19-258. PMID: 33634198; PMCID: PMC7882273.	Ineligible study design	Protocol for a feasibility study only - no control group
Zhuo 2022	Zhuo Y, Pan Y, Lin K, Yin G, Wu Y, Xu J, Cai D, Xu L. Effectiveness of clinical pharmacist-led smartphone application on medication adherence, insulin injection technique and glycemic control for women with gestational diabetes receiving multiple daily insulin injection: A randomized clinical trial. Prim Care Diabetes. 2022 Apr;16(2):264-270. doi: 10.1016/j.pcd.2022.02.003. Epub 2022 Feb 12. PMID: 35168915.	Ineligible setting	Tertiary hospital-based trial on pregnant women receiving insulin
Zurovac 2011	Zurovac Dejan, Sudoi Raymond K, Akhwale Willis S, Ndiritu Moses, Hamer Davidson H, Rowe Alexander K, et al. The effect of mobile phone text-message reminders on Kenyan health workers' adherence to malaria treatment guidelines: a cluster randomised trial. Lancet 2011;378:795-803.	Ineligible intervention	No digital tracking intervention
Zurovac 2012	Zurovac D, Larson BA, Sudoi RK, Snow RW. Costs and cost-effectiveness of a mobile phone text-message reminder programmes to improve health workers' adherence to malaria guidelines in Kenya. PLoS One. 2012;7(12):e52045. doi: 10.1371/journal.pone.0052045. Epub 2012 Dec 18. PMID: 23272206; PMCID: PMC3525566.	Ineligible intervention	No digital tracking intervention

HISTORY

Protocol first published: Issue 1, 2018

CONTRIBUTIONS OF AUTHORS

Conceiving the review: CG, TT, SL, SA, GM, MF
Designing the review: CG, TT, SL, SA, LV, NH, MF, GM
Co-ordinating the review: SA, TT, CG, SL, WYC, HB
Designing search strategies: SA, SL, TT
Writing the review: WYC, NH, HF, SA, TT, SL, CG, HB
Providing general advice on the review: CG, SL, MF, TT, GM, NR, SP
Securing funding for the review: GM
Performing previous work that was the foundation of the current study: SL, SA, CG, TT, LV

DECLARATIONS OF INTEREST

Smisha Agarwal: Bill and Melinda Gates Foundation (Grant / Contract), Digital Health Consulting (Independent Contractor - Consultant), REACH (Fiduciary Officer).

Hanna Bergman: none known.

Weng Yee Chin: World Health Organization (Independent Contractor - Other).

Marita Fønhus: none known. Former editorial staff at EPOC. MF was not involved in the editorial process of the review.

Hakan Safaralilo Foss: none known.

Tigest Tamrat: none known.

Claire Glenton: Norges Forskningsråd (Grant / Contract). Former editorial staff at EPOC. CG was not involved in the editorial process of the review.

Nicholas Henschke: none known.

Simon Lewin: World Health Organization (Norwegian Institute of Public Health: Grant / Contract), Cochrane Person-Centred Care, Health Systems and Public Health Thematic Group (Fiduciary Officer). SL was previously a Co-Coordinating Editor for Cochrane Effective Practice and Organisation of Care (EPOC) but was not involved in the editorial process of the review.

Garrett L Mehl: owns stock in Apple Computer.

Shivani Pandya: none known.

Natschja Ratanaprayul: none known.

Lavanya Vasudevan: World Health Organization (Independent Contractor—Consultant); LV is a co-author of one of the included studies (Uddin 2016). The study was funded by a non-profit organization, Grand Challenges Canada. LV was not involved in data extraction, assessment of the risk of bias, or certainty of the evidence for this study.

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Internal sources

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  Help with the MEDLINE search and editorial support
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External sources

- UNDP-UNFPA-UNICEF-WHO-World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP), a cosponsored program executed by the World Health Organization (WHO), Switzerland

  Provided funding for the review
- World Health Organization, Switzerland

  Funding to undertake the review
- Norwegian Institute of Public Health, Norway

  Provided funding for the review

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

There were no changes from the published protocol (Argawal 2018) regarding the eligibility criteria for study design, types of participants, and types of interventions.

We identified specific interventions which were not considered as eligible for this review and excluded the following.

- Studies that performed digital tracking of client healthcare services on a laptop alone or in which the client health record is not accessible via a mobile device;
- Studies that provided decision support on stationary computers or laptops alone;
- Studies in which the CDSS or TCC was provided as a standalone intervention or was not linked to client health records;
- Studies in which untargeted client communication was provided (e.g. mass communicated public health messages);

- Studies that included interventions targeted at notification of new births measuring only postnatal outcomes attributable to timely birth notification;
- Studies that did not include a direct face-to-face provider-client service delivery interaction;
- Studies of remote patient monitoring (telemonitoring) on its own or with telemedicine or telehealth interventions;
- Studies of the use of mHealth tools mainly to support patient self-management;
- Studies in which digital tracking is used only to support audit and management in a health facility and not related to CDSS tools or TCC;
- Studies that provided digital tacking + telemonitoring (e.g. Castillo 2019);
- Studies that provided CHW screening (using a mobile device) and electronic appointment scheduling without any ongoing digital tracking (e.g. Beratarrechea 2019).

We excluded pilot and feasibility studies (pilot study defined as "a version of the main study that is run in miniature to test whether the components of the main study can all work together", and feasibility study defined as "pieces of research done before a main study" (Arain 2010)), and design or usability studies of eligible interventions.

We modified our list of outcomes to align with a parallel Cochrane review of clinical decision support tools (Agarwal 2021) with the addition of the following outcomes across all three interventions:

- clients' health behaviour;
- clients' health status and well-being.

We could not implement the following aspects of the protocol due to insufficient data or lack of studies.

- **Intervention 1** Digital tracking with clinical decision support systems vs usual care: no studies examined time between presentation and appropriate management, quality of data about services provided, provider or client acceptability or satisfaction with the intervention, resource use and unintended consequences.
- **Intervention 2** Digital tracking with targeted client communication: no studies examined clients' timeliness of receiving and accessing healthcare services and information, quality of data about services provided, provider or client acceptability or satisfaction with the intervention, resource use and unintended consequences.
- **Intervention 3** Digital tracking with clinical decision support systems and targeted client communication: time between presentation and appropriate management, clients' timeliness of receiving and accessing healthcare services and information, resource use and unintended consequences.

NOTES

The published protocol is based on standard text and guidance provided by Cochrane Effective Practice and Organisation of Care (Argawal 2018).

INDEX TERMS

Medical Subject Headings (MeSH)

Bangladesh; Bias; *Cell Phone; China; *Communication; *Decision Support Systems, Clinical; *Primary Health Care [standards]; Randomized Controlled Trials as Topic

MeSH check words

Female; Humans