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Review of health and non-health sector indicators for monitoring service provision along the continuum of care for maternal health

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Abstract

Objective: This study uses health and non-health sector data sources to select and assess available indicators for service provision along the continuum of care for maternal health at subnational levels in South Africa. It applies the adequacy approach established in another study to assess the multi-dimensionality of available indicators. Using adequacy and the process of assessment in the study, the comprehensiveness of the continuum of care for improving maternal health outcomes can be assessed.

Results: We found 27 indicators of care utilization and access, linkages of care, and quality of care from the routine district health information system. The General Household Survey contained 11 indicators for the social determinants of health on the continuum of care framework. Indicator gaps include health promotion during and after pregnancy, maternal nutrition, empowerment and quality of care. At present, the available indicators measure about 74% of the interventions on the continuum of care framework. We make recommendations regarding improvements needed to better measure and monitor the continuum of care for maternal health. These involve actions within the health system and include integration of non-health system indicators.

Keywords: Continuum of care for maternal health, Health service indicators, Social determinants of health indicators, Adequacy construct for the continuum of care for maternal health

Introduction

The continuum of care is a strategy for improving the efficiency and effectiveness of service delivery for maternal health [1, 2]. It is the delivery of services from preconception to the postnatal period, including those related to social determinants of health. The continuum of care (CoC) framework, developed by national stakeholders in South Africa, is presented in Fig. 1. It outlines linked intervention packages from the family/community to the district level of care. South Africa (SA) has a strategic goal to deliver and monitor services along the CoC in maternal and related health areas [3, 4]. However, there is a gap in defining the indicator set for monitoring service delivery (mainly inputs, outputs and processes) along the CoC to support these goals.

In a previous study, we described the construct of adequacy, which emerged from a systematic review and critical interpretive synthesis of gaps in measurement of the CoC [5]. The adequacy approach states that the CoC should be measured and monitored in a comprehensive and multidimensional manner. This means all aspects of timely access to care, quality of care, linkages between levels of care, and social determinants of health should be measured. The framework in Fig. 1 guides the essential interventions and highlights their linkages, while the adequacy approach integrates multidimensional quality of care measurement.. In this study we used the framework in Fig. 1 and the adequacy construct to (i) propose

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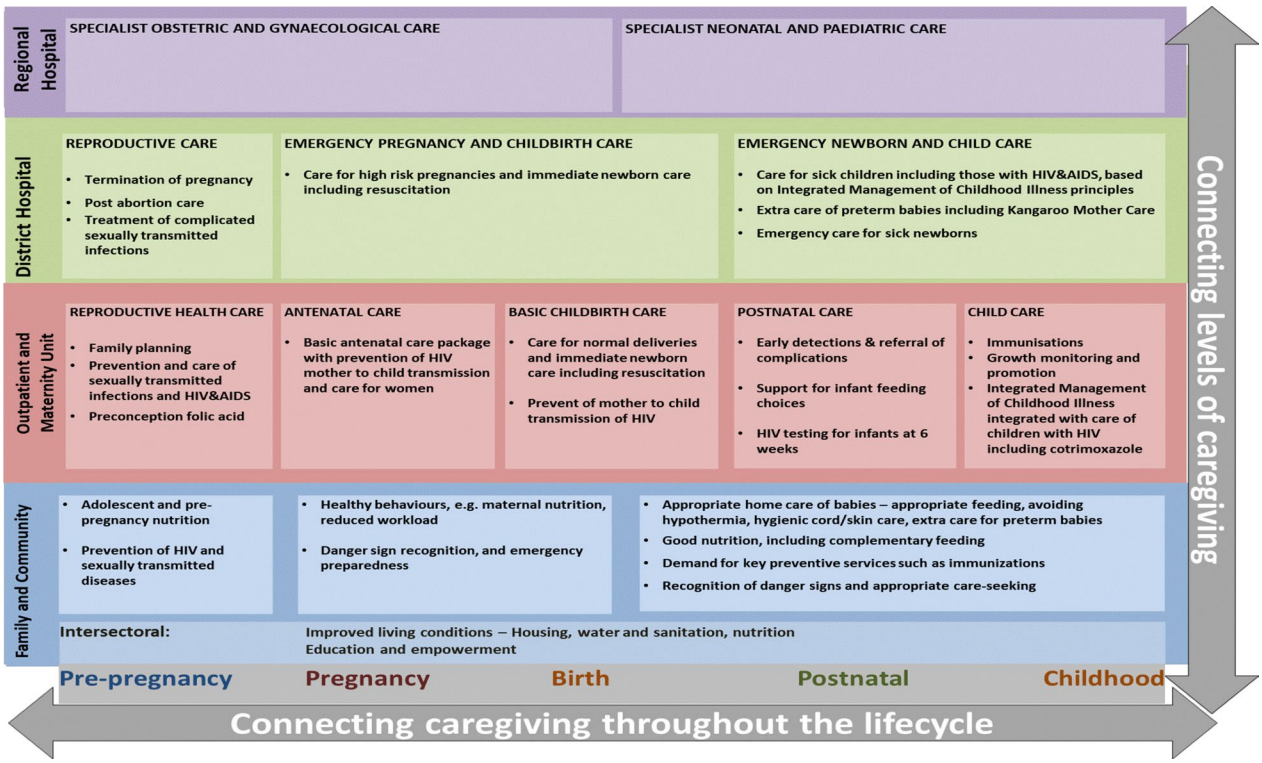

Fig. 1 Continuum of care framework for maternal and newborn health in South Africa, [2]. The continuum of care framework for South Africa was developed by national health system stakeholders and decision makers [2]. It outlines important evidence-based interventions to improve maternal and child health outcomes across the continuum of care. Our study focuses on maternal health aspects. Interventions are implemented across the lifecycle from pre-pregnancy to postnatal period. The levels of care are outlined vertically, and the framework recommends connectedness or linkages between these levels to improve care. In addition, connection between intervention packages (boxed and colour coded) are important. As a primary health care framework, delivery of services on the continuum of care occurs at the district level and below. Besides health system interventions are "intersectoral factors" that represent important social determinants of health for maternal health. These include good living conditions, empowerment and education

an indicator tool for the CoC for maternal health in SA, and (ii) describe current gaps to be addressed in improving monitoring and provision of services.

Main text

Methods

In this study we assess available indicators currently used for health and non-health sector policy and planning in government programs. They thus have a defined monitoring purpose which is re-assessed for suitability to the CoC framework.

Indicator extraction

We used the routine district health information system (DHIS) to extract relevant health system indicators. The DHIS monitors health programmes, track patients and map service availability in the health system in SA [6]. The National Indicator Data Set (NIDS) within the DHIS contains indicators of service inputs, processes, outputs and outcomes (where relevant) extracted for this study, for the reference period April 2017–March 2019 [7]. For social determinants of health/intersectoral factors as outlined in Fig. 1, we assessed datasets on the Statistics SA Nesstar portal and selected the General Household Survey (GHS) (reference year 2017) as the most suitable source. The GHS is annually collected and contains data on all intersectoral factors, which are used in policy and planning in SA [8, 9]. All GHS data can be obtained from the DataFirst Portal of the University of Cape Town in SA [10].

Indicator evaluation

The health service indicators from the DHIS were evaluated for suitability to the framework based on their current monitoring purposes and recommendations from existing guidelines. These guidelines included:

- Annual performance plans of the Department of Health in SA.
- Guidelines for maternity care in South Africa.

- The strategic objectives of the global network to improve Quality, Equity and Dignity in maternal, newborn and child health [11].
- Resources exploring the WHO Quality of Care Framework for maternal and new-born health [12, 13].
- Global Review of Key Interventions related to reproductive, maternal, newborn and child health [14].
- Guidelines for positive birth experience with a focus on monitoring Intrapartum care [15].
- Quality of care at primary (Ideal Clinic Realization and Maintenance Program) and hospital (National Core Standards) level in SA [16, 17].

For social determinants of health, we relied on literature focusing on the relationship between interventions and maternal health outcomes. We also relied on recommendations by the WHO and Commission on Social Determinants of Health [18], conceptual framework of the social determinants of health [19], and frameworks for practice at country level [20]. The evaluation of indicators also revealed outstanding gaps in measuring interventions on the framework, which we describe in this study.

Results

Indicator set

In Fig. 2 we present a set of 38 indicators that were extracted and evaluated from the DHIS and GHS (27 indicators from the health system and 11 for the intersectoral factors). The figure also describes measurement gaps per intervention package of the CoC. As Fig. 2 shows, indicators are available for most of the intervention packages on the CoC framework. The exceptions were danger sign recognition and emergency preparedness, healthy behaviour promotion and indicators for emergency pregnancy care. The lack of indicators demonstrates unavailable services and/or poor monitoring by the health system. Sometimes indicators are available that do not directly measure maternal health outcomes. Figure 2 shows proxies such as food fortification compliance rates (Indicator 3) used by the health system at community level. Other proxies include Ideal Clinic status (Indicator 20) and national core standards (Indicator 21), which are summary measures of quality of care at facility level. Where only proxies are available, we recommend health information system improvements to measure and integrate measures that are more directly related to maternal health outcomes.

Even where indicators are available, measurement improvements can be made in order to monitor each intervention package comprehensively. Each intervention package consists of more than one intervention, as shown in Fig. 1. For example, while Reproductive Care at district hospital may include timely termination of pregnancy indicators, there is a gap in monitoring post-abortion care and treatment of complicated STIs as part of the package. Thus, more research is needed to assess the extent to which the health system provides services within each intervention package of the CoC. New health system interventions, such as Human Papillomavirus (HPV) vaccinations for school going girls and health promotion through mobile phones (MomConnect program), should be monitored through the DHIS. This will improve the comprehensiveness of the data set and ease of monitoring the CoC in the health system.

Quality of care was an under-measured aspect of interventions such as antenatal care visits, normal and Caesarean deliveries, and postnatal visits. There is a need for intervention specific qualities of care indicators, as exemplified by retest rates for HIV positive clients during antenatal care (Indicator 11, Fig. 2). The health system runs parallel quality of care systems for maternal health, particularly the confidential maternal mortality audits [21]. We recommend the establishment of routine measures from these sources for integration into the DHIS. Routine quality of care monitoring should also include reporting of safety incidents and experience of care surveys disaggregated by population groups.

While indicators are available for the intersectoral factors in the framework, we observed gaps in monitoring indoor air pollution, maternal nutrition counselling, and women's empowerment for decision making and demand for healthcare. Like health system interventions, each intersectoral factor could be measured by more than one indicator. For instance, in the water and sanitation intervention package, the GHS had variables that could assess safety of water, infrastructure and basic sanitation (Indicators 28–30). While educational achievement indicators may be straightforward, factors such as empowerment and nutrition are more multifaceted. Thus, a variety of indicators can be isolated for their measurement, depending on data availability.

In summary, Fig. 2 is the indicator tool which provides a description of available indicators and gaps that need to be addressed to monitor the CoC for maternal health. The gaps identified should not preclude use of the tool to assess the nature and extent of provision of services along the CoC for maternal health in future studies. The improvement and validation of indicators in maternal health should be a continuous process, tied to evolving policies and information system improvements [22].

Adequacy assessment

In Fig. 3 indicators are grouped according to adequacy dimensions, and the information in Fig. 2 used to

	Level of care	Intervention package	Indicator(s)	Data Source	Description	Gaps
1-2	Pre-pregnancy/ Community	Reproductive Health	Female and male condom distribution coverage	DHIS	Condoms distributed from a primary distribution site to health facilities or points in the community (e.g. campaigns, non-traditional outlets, etc.)	There is need to monitor screening and vaccination for Human Papilloma Virus (HPV) as per new policy of vaccinations to school going girls.
3		Adolescent/ Preconception nutrition	Mills fortification compliance rate	DHIS	Operational flour and maize milling establishments that were compliant with fortification Regulation under the FCD Act as a proportion of milling establishments that were inspected.	This indicator reflects community level exposure. More indicators can be explored that are directly related to adolescent and preconception nutrition, such as provision of micronutrient supplementation.
4	Pre-pregnancy /Primary health facility	Reproductive Health	Couple year protection rate	DHIS	Women protected against pregnancy by using modern contraceptive methods, including sterilisations, as proportion of female population 15-49 years.	Need to monitor post-partum family planning
5-7	Pre-pregnancy/ District hospital	Reproductive Care	Termination of pregnancy – 0-12 weeks rate, 13-20 weeks rate and under 20 years rate	DHIS	Pregnancies terminated in health facilities in at specified gestation period time, or age of woman, as a proportion of total termination of pregnancies	Need to monitor post abortion care and treatment of complicated STIs.
8	Pregnancy/ Community	Healthy behaviours				Outreach to households through ward based outreach teams could potentially include health promotion to encourage health behaviours. In addition, the MomConnect platform which distributes cellphone messages for pregnant women can promote healthy behaviours. It is important to monitor the promotion of healthy behaviours through these interventions and antenatal care services.
		Danger sign recognition and emergency preparedness				Indicators that monitor interventions such as MomConnect which uses cellphone messages to promote healthy pregnancies need to be integrated into the DHIS as scale up in public health facilities in the country increase.
9	Pregnancy/Primary health facility	Antenatal Care (with PMTCT)	Antenatal 1st visit before 20 weeks rate	DHIS	Women who have a booking visit (first visit) before they are 20 weeks into their pregnancy as proportion of all antenatal 1st visits	Monitoring of content of care during antenatal care as included in clinical management modules of the Ideal Clinic quality improvement assessment tools.
10			Antenatal 1st visit coverage	DHIS	The proportion of potential antenatal clients coming for at least one (booking) antenatal visit. The census number of children under one year factorised by 1.15 is used as a proxy denominator - the extra 0.15 (15%) is a rough estimate to cater for late miscarriages (~10 to 26 w), stillbirths (after 26 weeks gestation) and infant mortality. Pregnant women are regarded as potential antenatal clients from around 10 weeks' gestation, i.e. spontaneous abortions before that as well as ToP cases are excluded	
11			Antenatal client HIV re-test rate: retesting among positive HIV clients	DHIS	Antenatal clients re-tested for HIV as proportion of antenatal clients tested negative for 1st HIV tests done during current pregnancy	Besides HIV, there is need to integrate monitoring indicators for TB diagnosis and treatment.
12			Antenatal client start on ART rate	DHIS	Antenatal clients who started on ART as a proportion of the total number of antenatal clients who are HIV positive and not previously on ART	
13-15			Syphilis positive pregnant female receive Benz-penicillin 1st, 2nd and 3RD dose rate	DHIS	Syphilis positive pregnant females who received Benz-penicillin 1st, 2nd or 3rd dose as a proportion of pregnant females who tested positive for syphilis	
	Pregnancy/ District hospital	Reproductive Care	Emergency pregnancy care	DHIS		Need for indicators of high risk pregnancy care to be integrated into the DHIS
16	Birth/Primary health facility	Care for normal delivery and PMTCT	Delivery in facility rate	DHIS	Deliveries in health facilities as proportion of expected deliveries in the population. Expected deliveries are estimated as population under 1 year multiplied by 1.025 to compensate for still births and infant mortality	Indicators for management of post-partum haemorrhage and other quality of care signal functions during childbirth needed.
17	Birth/ District hospital	Emergency childbirth care	Delivery by caesarean section	DHIS	Delivery by Caesarean section as proportion of total deliveries in health facilities	Need to monitor quality of care during Caesarean deliveries

Fig. 2 Description of indicators and gaps in monitoring interventions along the continuum of care for maternal health in South Africa. The indicator tool was developed to summarize available indicators, their source, and the data gaps that were observed in the study of the continuum of care for maternal health in South Africa. The levels of care and intervention package columns are based on the continuum of care framework developed by health system actors, and presented in Fig. 1 of this study, and indicators are grouped together to make the figure more concise (e.g. indicators 5–7 represents three indicators within the reproductive care package). The detailed definition and numerator and denominators of each indicator can be found in the metadata of the relevant data sources as specified in the Figure. The description of indicators gives a general guidance of the measures involved. Data gaps are also summaries from literature, global and national guidelines as specified in the manuscript

	Level of care	Intervention package	Indicator(s)	Data Source	Description	Gaps
			rate			
18	Post-natal care/ Community	Recognition of danger signs and care-seeking				Outreach to households (OHH) with postnatal care indicators may include recognition of danger signs and care seeking. However, current indicators only monitor visits and not the content of care. This intervention is also not provided to all women who deliver in public facilities.
19	Post-natal care/ Primary health facility	Early detection and referral of complications	Mother postnatal visit within 6 days rate	DHIS	Mothers who received postnatal care within 6 days after delivery as proportion of deliveries in health facilities	Need to monitor the content of care in postnatal visits or obstetric referrals
20	Quality of care/ Primary health facility	Cross-cutting	Ideal Clinic Status rate	DHIS	Score out of 100 based on multidimensional measure of quality environment with some signal functions for maternal health; reflects national priorities at primary care level. The main dimensions include 1. Administration 2. Integrated Clinical Services Management 3. Medicines, Supplies and Laboratory Services 4. Human Resources for Health 5. Support Services 6. Infrastructure 7. Health Information Management 8. Communication 9. District Health System Support 10. Implementing Partners and Stakeholders. All main dimensions have sub-components and specific elements to be measured.	May be supplemented with more detailed signal function data e.g. from the department's maternal death audits and observational data. Reporting specific maternal health safety incidents using newly developed tool for Patient Safety Incident Reporting and Learning to be reported with future Ideal Clinic related data.
21	Quality of care/ District Hospital	Cross-cutting	Hospital achieved 75% and more on National Core Standards (NCS) self-assessment rate	DHIS	Score out of 100 on a multidimensional measure of quality environment, without signal functions for maternal health. Availability of guidelines for clinical management of gynaecological/obstetric conditions assessed via the NCS. 1: Patient Rights 2: Patient Safety, Clinical Governance and Clinical Care 3: Clinical Support Services 4: Public Health 5: Leadership and Governance 6: Operational Management 7: Facilities and Infrastructure.	May be supplemented with more detailed signal function data e.g. from the department's maternal death audits and observational data.
22-23	Linkages of care/ Crosscutting	Cross-cutting	Obstetric emergency inter-facility transfer rates	DHIS	Emergency obstetric inter-facility transfers response times under 60 minutes as a proportion of EMS obstetric rural inter-facility transfers; Emergency obstetric inter-facility transfers response times under 30 minutes as a proportion of EMS obstetric urban inter-facility transfers	Linkages across packages of care can be explored through research and formulation of new indicators
24-26			Obstetric response times and client transport rates	DHIS	Obstetric clients as a proportion of total EMS clients transported	
27	Cross-cutting/Community (Intersectoral Factors)	Water and sanitation	Environmental Health: Domestic water compliance rate	DHIS	Domestic bacteriological and chemical water samples taken from Water Services Authorities and water service intermediaries at a point of use that conform to the standards set out in SANS 241 for drinking water quality and safety as a proportion of water samples collected	Similar sanitation indicators may be collected by the health system as part of their Environmental Health assessment.
28		Water and sanitation	% women 15-49 drinking safe water	GHS	Proportion of women 15-49 in households that perceive their water to be safe	
29			% women 15-49 in households with adequate water infrastructure	GHS	Proportion of women 15-49 in households with adequate water supply infrastructure	
30			% women 15 -49 with basic sanitation facility	GHS	Proportion of women 15-49 in households with basic sanitation facilities.	
31		Housing	% women 15-49 with access to electricity	GHS	Proportion of women 15-49 in households with access to electricity	Exploration of more reliable measures of indoor air pollution; current variables integrate both outdoor and air pollution from the perspective of households.
32			% women 15-49 living in adequate housing	GHS	Proportion of women 15-49 living in households with "good" or "very good" wall, roof, and floor condition of the dwelling.	
33			% women 15-49 living in formal housing	GHS	Proportion of women 15-49 in housing classified as formal housing (by Regional Development Plan (RDP) plan of the country)	
34		Nutrition	% women 15 - 49 who have adequate food access	GHS	The mean proportion of women 15-49 in households that "never" had insufficient food, run out of money for food, cut the size of meals, skip a meal, or small variety of meals.	May be supplemented with other sources of data on macro and micronutrient variety. Intervention/nutrition counselling (health promotion) on lifestyle factors that impact

Fig. 2 continued

	Level of care	Intervention package	Indicator(s)	Data Source	Description	Gaps
						dietary outcomes e.g. alcohol.
35			Household Dietary Diversity Score	GHS	The Household Dietary Diversity Score by consumption of between 0-10 food groups, in households with women 15-49 years of age	Monitoring of interventions to address outcomes such as post-partum weight retention and consideration of a maternal minimum dietary diversity scale for women. Dietary diversity may also not indicate the quantity and quality of food consumed.
36		Education	% women 15-49 who are literate	GHS	Proportion of women 15 - 49 who achieved grade 8 or more	
37		Empowerment	% women 15-49 with medical aid	GHS	Proportion of women 15-49 who have medical aid	Multifaceted domain whose indicators can extend to household income levels and demand for care. In addition, women's decision making power in households and health facilities (across the continuum of their health needs, from reproductive through birth experience and postnatal). Gender based violence as a detrimental influence on empowerment.
38			% women 15-49 with income source	GHS	Proportion of women 15-49 with at least one of social grant, working for wage/commission/salary, or involved in business activities.	

Fig. 2 continued

subjectively assess the level to which intervention packages can be measured by available indicators. We assign "partial" (orange) measurement if indicators are available but there are measurement gaps identified. When assigned "no" (red) if no indicators or proxies were identified from the data sources. And we assigned "yes" (green) if, according to literature and existing guidelines, there are indicators available to measure the intervention package. Availability of indicators for an intervention package does not preclude future rigorous validation processes and iterations; this is a normal process within the health information system that is encouraged.

All dimensions of the CoC can be measured by current indicators, although gaps remain within specific intervention packages. Data gaps were most prevalent in the care access and utilization dimension, where 40% (6/15) of intervention packages had no indicators available. Dimensions of quality and linkages of care can only be partially measured; while only 40% (2/5) of social determinants of health domains have available indicators. In general, the GHS and the DHIS provide indicator data for measurement and monitoring of the majority (74%) of CoC intervention packages (17/23) as defined by the framework in Fig. 1.

Discussion

This study developed and assessed the indicator tool for the continuum of care framework for maternal health in South Africa. This process can be applied to newborn and child health indicators within the framework, using relevant data sources. These processes contribute to the operationalization of the framework, in order to fulfil health system goals in comprehensive monitoring and evaluation of maternal health [23]. Our study also advances the application of the adequacy approach to assess the multi-dimensionality of the available indicators. The adequacy approach complements the framework developed by health system actors by integrating quality of care measures. The CoC has been criticized for under-emphasizing quality of care [24]. For instance, there is still a gap in monitoring quality of care signal functions for maternal health through the DHIS. Data from many programs in the health system are collected separately and only later incorporated into the DHIS [25]. We recommend future research for assessing feasibility of integration of quality of care and service programs data into the routine monitoring and evaluation systems.

Interventions that signify "linkages of care" were also not well defined prior to our study. For that purpose, we proposed the use of indicators for patient transport from community to facility and in-between facilities. Transport facilitates referrals between different levels of care, and an important determinant of maternal mortality in SA [21]. Referrals encompass not only transport but also matching skills to patient needs and managing congestion in facilities [21]. Thus, more research is needed to identify indicators for monitoring human resources and patient management factors in facilities that can contribute to the framework. Our study identified a gap in linkages between one intervention package and another, which is also an important determinant of maternal health outcomes [26, 27]. The CoC framework improves on the country's strategic plan because it includes more social determinants than water and sanitation [23]. Other frameworks propose even more social determinants, such as occupation, social class, race and ethnicity, social environment and psychosocial circumstances, and behavioural factors [19]. In this study we focused on the domains specified by the framework and recommend future research to explore feasibility of additional indicators.

Dimension	*Level of care*	*Intervention package*	*Indicators/proxies available*
Timely access and utilization of care	Family and community/Pre-pregnancy	Adolescence and pre-pregnancy nutrition	Yes
		Prevention of HIV/STIs	Yes
	Family and community/Pregnancy	Healthy Behaviour	No
		Danger Sign Recognition and Emergency Preparedness	No
	Family and Community/Postnatal	Danger sign recognition and appropriate care seeking, nutrition	No
	Primary health facility/ Pre-pregnancy	Family planning	Yes
		Prevention of HIV/STIs	Yes
		Preconception folic acid	No
	Primary health facility/Pregnancy	Basic Antenatal Care with PMTCT	Yes
	Primary health facility/Childbirth	Care for normal deliveries	Yes
	Primary health facility/ Postnatal care	Early detection and referral of complications	Partial
	District Hospital / Pre-pregnancy	Termination of pregnancy	Yes
		Post-abortion care	No
		Treatment of complicated STIs	No
	District Hospital /Emergency Pregnancy and Childbirth Care	Care for high risk pregnancies	Partial
Quality of Care	District Hospital/Crosscutting	Quality of care at secondary level	Partial
	Primary health facility/cross-cutting	Quality of care at primary level	Partial
Linkages of care	All levels/cross-cutting	Linkages of care levels (referrals)	Partial
Intersectoral factors/social determinants of health	Family and community/cross-cutting	Housing	Partial
		Water and Sanitation	Yes
		Nutrition	Partial
		Empowerment	Partial
		Education	Yes

Fig. 3 Assessment of availability of indicators over dimensions and domains of the continuum of care for maternal health in South Africa. The dimensions of the continuum of care are defined according to the adequacy construct developed in a previous study [5]. The level of care and intervention packages contain indicators found in Fig. 2 and are based on the continuum of care framework in Fig. 1. We assign "partial" (orange) measurement if indicators are available but there are measurement gaps identified. When assigned "no" (red) when no indicators or proxies were identified from the data sources. And we assigned "yes" (green) if, according to literature and existing guidelines, the indicators available to measure the intervention package are considered adequate

In conclusion, this study proposed a multidimensional, comprehensive indicator set that can be used to assess the continuum of maternal health care in public health research and practice. The indicator set integrates the under-specified aspects of the framework, such as quality of care and broader social determinants of health, thus improving its potential use from a multisectoral perspective.

Limitations

The indicators used are only applicable to the South African context, but the adequacy model can be used by researchers from other LMICs to guide a multidimensional analysis of information in their context. We identified and assessed indicators only for the intervention packages outlined in the CoC framework and the dimensions proposed through the adequacy model. We

recommend on-going research to refine the framework and indicators suitable for maternal health CoC.

Abbreviations
CoC: Continuum of Care; DHIS: District Health Information Systems; GHS: General Household Survey; HPV: Human Papillomavirus; LMIC: Low- and Middle-Income Countries; NIDS: National Indicator Data Set; SA: South Africa; STIs: Sexually Transmitted Illnesses; WHO: World Health Organization.

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Authors' contributions
MM and LM conceptualized the study. MM conducted data collection and analysis. LM and HM guided additional analysis of data. MM, LM, HT were involved in writing and revision of manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
The datasets generated and/or analysed for the General Household Survey during the current study are available in the DataFirst repository, [https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/central] [10]. The datasets generated and/or analysed for the District Health Information System during the current study are available in the National Department of Health Data Dictionary repository, [https://dd.dhmis.org/] [7].

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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