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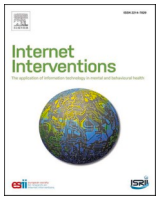

Social media interventions targeting exercise and diet behaviours in people with noncommunicable diseases (NCDs): A systematic review

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ABSTRACT

Background: Noncommunicable diseases (NCDs) are the leading cause of death globally. Promoting physical activity and healthy eating is essential to help manage the NCD burden and reduce mortality. Social media may be a potential platform for delivering and scaling health promotion initiatives. In this systematic review, we aimed to examine i) the feasibility and acceptability of social media interventions targeting physical activity and/or diet for people with NCDs, ii) the effectiveness of improving exercise and diet behaviours, iii) specific design components used to promote user engagement and iv) the effectiveness on other health outcomes.

Methods: We searched MEDLINE, Google Scholar, CINAHL, EMBASE, and SPORTDiscus from inception until June 2021. Social media interventions targeting physical activity and/or diet were included. Participants were any age, with a diagnosis of one of the following categories of NCDs; cardiovascular disease, cancer, chronic respiratory disease, diabetes or mental illness. Interventions using social media alone or as part of an intervention with other modes of delivery were included. Eligible study designs were randomised controlled trials (RCTs), non-randomised controlled trials, feasibility or pilot studies, or quasi-experimental studies.

Results: A total of 2358 publications were identified. After removal of duplicates, 2233 publication titles and abstracts were screened, and 10 publications were eligible, describing 8 individual studies. The study designs included five RCTs and three pilot or feasibility studies, all published between 2016 and 2020. Sample sizes ranged from n = 11 to n = 312. Half of the studies were conducted in the United States of America. Clinical populations included severe mental illness (2 studies), cardiovascular disease (2 studies), chronic obstructive pulmonary disease (2 studies), cancer (1 study) and Type 2 diabetes (1 study). Facebook (three studies) and WeChat (three studies) were the most used social media platforms. The majority utilised social media to deliver health education and facilitate social support and all studies reported >70% retention. Four of the five included RCTS reported significant improvements in exercise behaviours (e.g., step count, exercise capacity) while diet was only assessed in two studies and results were non-significant.

Conclusions: Social media interventions appear to be feasible and acceptable among specific NCD populations and preliminary evidence suggests interventions they may be effective for improving exercise behaviours. The evidence for diet behaviours remains unclear. While overall there is an emerging evidence base, more rigorous evaluation including replication studies are needed to determine the efficacy of social media interventions.

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1. Introduction

Noncommunicable diseases (NCDs) are the leading cause of death globally, and one of the major health challenges of the 21st century (Estimates GH, 2016; Bennett et al., 2018). The World Health Organization estimates that NCDs including cardiovascular diseases, cancers, diabetes and chronic lung diseases are responsible for 41 million (71%) of the world's 57 million deaths each year, and approximately 15 million of these deaths are premature (defined as those occurring in people aged between 30 and 70 years) (World Health Organization, 2014). The increasing impact of NCDs poses significant health and economic consequences for individuals, communities and health systems.

The rising NCD burden disproportionately impacts low- and middle-income countries, where 78% of all global NCD deaths and 85% of premature deaths occur (World Health Organization, 2018). Inequalities in regard to the NCD burden also exist within countries, with higher NCD mortality among people with lower education, income, or social class (Di Cesare et al., 2013). The economic impact is worsening, and macroeconomic simulations suggest that cardiovascular disease, chronic respiratory disease, cancer, diabetes and mental ill-health, will contribute to a cumulative output loss of $47 trillion USD by 2030 (Bloom et al., 2012). This loss represents 75% of global GDP in 2010 (US $ 63 trillion).

Lifestyle behaviours including diet, physical activity and sedentary behaviour are key modifiable risk factors for NCDs. Improving these behaviours is considered essential to reducing the financial and health burden of NCDs (Organization WH, 2019). The Global Burden of Disease Study estimated that in 2015, greater than 13.5 million deaths (24%) were attributable to dietary risk factors (such as excessive salt/sodium intake and low intake of wholegrains and fruits) and physical inactivity (Collaborators GRF, 2016). Evidence-based guidelines to help prevent the progression of NCDs and reduce mortality therefore encourage the adoption of healthy lifestyle behaviours (Beaglehole et al., 2011; Pedersen and Saltin, 2015). The development of strategies to promote physical activity and healthy diet is clearly an important challenge.

Over a third of the world's population (38%) use social media sites such as Facebook, Instagram and WhatsApp (Auxier and Anderson, 2021). High rates of social media use are not confined to the young and/or specific ethnicities, cultures, genders and/or socio-economic groups (Auxier and Anderson, 2021). Unprecedented growth in the use and availability of social media may therefore afford new avenues for supporting public health initiatives, including healthy eating and physical activity promotion (Partridge et al., 2018; Giustini et al., 2018). Social media offers potential given the extensive reach and ability to target large audiences at low cost, as identified in the recent World Health Organization Global Action Plan for Physical Activity (Organization WH, 2019). In contrast to other e-health interventions such as websites and applications, social media is highly interactive, and may help to increase physical activity participation and healthy diet by allowing users to connect with and support each other, and share their experiences or challenges (Fox, 2011). The capacity to build and reinforce social support for improving health outcomes has been identified as one of the benefits of using social media for public health interventions and has been linked to positive health impacts by influencing knowledge, motivation and self-efficacy (Rice et al., 2016; Moorhead et al., 2013).

Social media platforms such as Facebook or Twitter have been increasingly used for health promotion initiatives and to support public health efforts (Capurro et al., 2014; Naslund et al., 2017). Previous systematic reviews on social media interventions for physical activity and diet have focused on the general community or non-clinical populations (Williams et al., 2014; Goodyear et al., 2021; Welch et al., 2018). Our understanding of how best to design social media interventions targeting people with NCDs, how to support engagement and retention and how to tailor interventions to meet the needs of specific disease groups, is currently limited. As social media platforms rapidly evolve and the use of these platforms becomes more prevalent across diverse population groups, it is critical to determine whether social media is feasible, acceptable, and potentially effective for delivering physical activity and dietary interventions.

The objectives of this systematic review were to review the extant evidence base on social media interventions for physical activity and diet among people with NCDs. We limited the review to the five major categories of NCDs, four of which make the largest contribution to morbidity and mortality of NCDs (cardiovascular diseases (CVD), cancers, chronic respiratory diseases, and diabetes) and mental illness given the comorbidities, prevalence and contribution to long term disability (Stein et al., 2019; Momen et al., 2020). The specific research questions we aimed to address were:

1) Are physical activity and diet interventions delivered via social media for people with NCDs feasible, safe and acceptable?
2) What specific intervention components and strategies are employed to promote user engagement and retention?
3) Do physical activity and diet interventions delivered via social media for people with NCDs improve physical activity and diet behaviours?
4) Do physical activity and diet interventions delivered via social media improve health outcomes beyond physical activity and diet?

2. Methods

The protocol for this review was registered with PROSPERO International Prospective Register of Systematic Reviews on the 16th of June 2021 (Registration Code: CRD42021251838). The report follows the PRISMA guidelines and checklist for systematic reviews (Page et al., 2021).

2.1. Eligibility criteria

For inclusion in this review, studies fulfilled the following criteria.

2.1.1. Study design

Studies were included if they were peer-reviewed publications written in English. Study designs that were eligible were randomised controlled trials, non-randomised controlled trials, feasibility or pilot studies, or quasi-experimental studies. We excluded research protocols, review articles, non-intervention studies, and opinion articles or editorials.

2.1.2. Participants

Participants were humans of any age, with a diagnosis of one of the following categories of NCDs; CVD, cancer, chronic respiratory disease, diabetes or mental illness. Within the mental illness category of the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-V) (Edition, 2013), we excluded neurodevelopmental (e.g. intellectual disability) and neurocognitive disorders (e.g. Alzheimer's disease) since people with these conditions may experience cognitive impairments which may impact engagement with a social media intervention. While people with a diagnosis of cancer were included, cancer survivors (i.e., completed cancer treatment prior to enrolment) were excluded. All other illnesses and studies of healthy populations were excluded.

2.1.3. Interventions

Online social media interventions targeting physical activity and/or diet were included. We included interventions using social media alone or as part of an intervention with other modes of delivery (Kaplan and Haenlein, 2010). Social media was defined as web-based applications that allow individuals to interact in a virtual community by exchanging user-generated information (e.g., online discussion boards, online bulletin boards, chat rooms, online community). Social media allows for dynamic interaction and real-time engagement between a virtual network of users. In line with this definition, studies utilising websites

such as Facebook, Twitter, Tumblr, Instagram, WhatsApp as well as other online forums or interactive web-based platforms were eligible. Other m-health/e-health technologies such as text messages or email were excluded as these do not include sharing of user generated content or interactions with other users in a social context (Kaplan and Haenlein, 2010).

2.1.4. Control

Usual care or no-intervention controls were included. Studies without a control group were eligible for inclusion if they reported pre and post intervention data.

2.1.5. Outcomes

For the purpose of this review, the primary outcome was related to physical activity or diet behaviour. For example, minutes of physical activity, sedentary time, step count or changes in overall food consumption, nutrient, mineral and/or supplement intake. Secondary outcomes included feasibility, acceptability, safety defined by adverse events, usability, health-related or disease specific outcomes.

2.1.6. Search strategy

Five electronic databases were searched, including MEDLINE, Google Scholar, Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, and SPORTDiscus from inception until 7 June 2021. Titles, abstracts and key words were searched using the following terms: 'Non-Communicable Disease' OR 'Cancer' OR 'Diabetes' OR 'Chronic Respiratory Disease' OR 'Mental Illness' **AND** 'Diet' OR 'Exercise' OR 'Physical Activity' **AND** 'Social Media' OR 'Social Network'. The search terms were mapped to by subject headings to include all related terms. The total number of papers yielded from this search were collated and exported to EndNote VersionX9 for screening. Reference lists of relevant systematic reviews obtained in this strategy were also manually searched for additional studies.

2.1.7. Data extraction

One researcher independently screened titles and abstracts of the retrieved studies for eligibility. Full text reviews were completed by two reviewers (GM and EP) with conflicts or undecided articles reviewed by a third reviewer (SR) with reasons for exclusion recorded (Fig. 1). Data

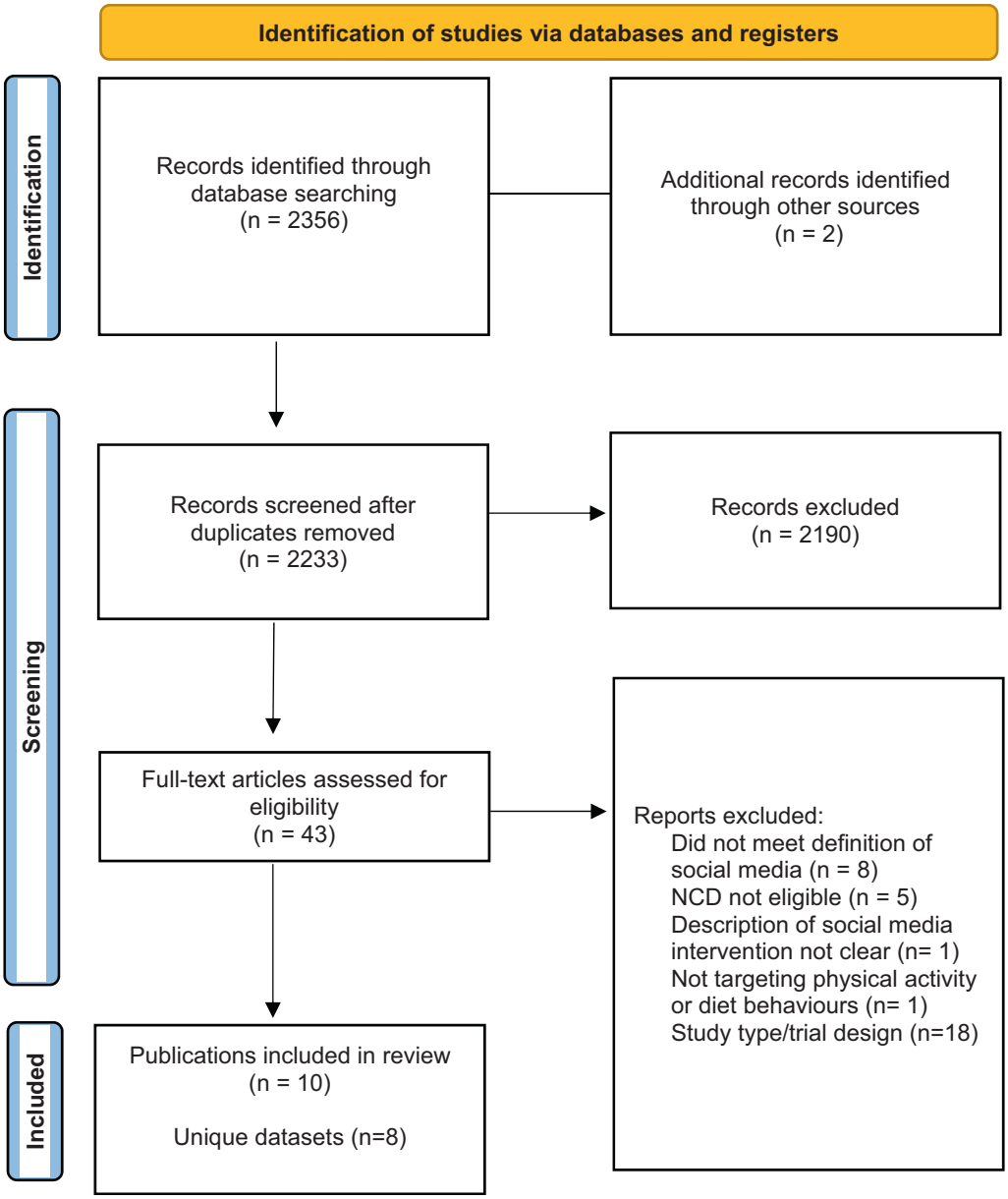

Fig. 1. PRISMA flow diagram.

were extracted by one reviewer (EP) and verified by a second reviewer (GM). Data extracted included the study's setting, population, participant demographics and baseline characteristics, details of the intervention and control condition (if applicable), methodology and outcomes, and times of measure.

2.2. Assessment of quality

To assess the quality of the extracted data and account for the risk of bias, the QualSyst standardised quality checklist was used for non-randomised trials (Kmet et al., 2004). This was selected because of its applicability to different types of study designs. Each study was assessed according to the QualSyst criteria, and a summary score was calculated by summing the items and dividing by the total available score. A summary score (%), ranges from zero (low quality) to 100 (high quality). The RCTs included in the review were assessed for quality using the PEDro scale (Maher et al., 2003). The 11-item checklist yields a maximum score of 10 points if all criteria are satisfied. A score of 0–3 is considered poor, 4–5 fair, 6–8 good and 9–10 excellent. Quality was assessed by two authors (GM and EP) with any discrepancies resolved by a third author (SR).

2.3. Data analysis

Due to the expected heterogeneity in study design and outcomes, no meta-analysis was planned. A narrative synthesis was completed following Cochrane guidelines (Popay et al., 2006). Findings from quantitative and mixed methods studies were described numerically and/or textually to provide a summary of evidence on the: (i) characteristics of the social media interventions; and (ii) effects on physical activity and diet.

3. Results

A flowchart of the study selection process is presented in Fig. 1. A total of 2356 publications were identified from the database search, and two additional publications from other sources. After removal of duplicates, 2232 publication titles and abstracts were screened. Ten full-text articles were considered eligible for inclusion, describing eight interventions. Two articles (Naslund et al., 2018; Naslund et al., 2016a) were secondary analyses of previously published interventions (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b) and detailed the feasibility of the social media component. Therefore, they have been included in the review but will only be referred to as one study each.

3.1. Characteristics

All of the eight eligible studies were published between 2016 and 2020. Four studies were conducted in the USA (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Bender et al., 2017; Wan et al., 2017) and sample sizes ranged from n = 11 to n = 312. In regard to study design, five studies were randomised controlled trials (Wan et al., 2017; Dorje et al., 2019; Jiang et al., 2020; Wang et al., 2020; Gnagnarella et al., 2016) and three were pilot/feasibility studies (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Bender et al., 2017). Studies included participants with various NCDs including severe mental illness (including schizophrenia, major depressive disorder and bipolar disorder) (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b), heart disease (Dorje et al., 2019; Wang et al., 2020), chronic obstructive pulmonary disease (COPD) (Wan et al., 2017; Jiang et al., 2020), cancer (Gnagnarella et al., 2016) and type 2 diabetes (Bender et al., 2017). Facebook (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Bender et al., 2017) and WeChat (Dorje et al., 2019; Jiang et al., 2020; Wang et al., 2020) (three studies each) were the most used social media platforms followed by interactive custom websites comprised of social media features, including discussion forums and blogs (Wan et al., 2017; Gnagnarella et al., 2016).

3.2. Types of interventions

A summary of the intervention studies is presented in Table 1. Three of the included studies were delivered solely online via social media (Wan et al., 2017; Jiang et al., 2020; Gnagnarella et al., 2016), while another three combined social media with occasional in person clinic reviews with clinicians (Bender et al., 2017; Dorje et al., 2019; Wang et al., 2020), and two use social media to supplement a with a face-to-face lifestyle intervention (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b). The duration of interventions ranged from three (Bender et al., 2017; Wan et al., 2017) to 12 months (Wang et al., 2020). Five studies targeted both physical activity and diet behaviours (Aschbrenner et al., 2016a; Bender et al., 2017; Dorje et al., 2019; Jiang et al., 2020; Wang et al., 2020), while two studies targeted solely physical activity (Aschbrenner et al., 2016b; Wan et al., 2017) and one study solely diet (Gnagnarella et al., 2016). All studies utilised social media as a platform to disseminate health education including guidance, education and motivational materials on different topics e.g., goal setting, self-monitoring, healthy eating and recipes. A variety of mediums were used to deliver content including audio, text, reminders, tailored content and graphics.

In addition to providing education, social media was used as a platform for facilitating interaction between peers, participants and health professionals. Most studies used social media to enhance social support among participants, such as through discussion threads or community forums (Wan et al., 2017; Jiang et al., 2020; Gnagnarella et al., 2016), message boards and opportunity for sharing opinions, experiences and peer encouragement (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Bender et al., 2017). Four studies encouraged interaction and support among participants by prompting participants to share content and photos of their journeys with the group (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Bender et al., 2017; Jiang et al., 2020). The two studies delivered via interactive custom-built websites, both encouraged social support through forums, blogs, live discussions (Wan et al., 2017; Gnagnarella et al., 2016). One of the two studies also included a chat room where participants could interact, and 'ask the expert' (health professionals) questions (Gnagnarella et al., 2016). Two studies conducted among cardiac rehabilitation patients (Dorje et al., 2019; Wang et al., 2020) used social media (WeChat) to provide interaction between health care workers and participants through the sharing of test results including physical health monitoring (e.g., blood pressure). One study reported using gamification to help patients with COPD to engage and motivate participants through competition, challenges and awards (Jiang et al., 2020). Participants were encouraged to upload training pictures to share with other patients and health professionals who utilised an incentive system whereby participants could obtain points and exchange prizes based on their participation and postings in the group (Jiang et al., 2020).

The facilitators of the interventions varied between studies. Some were facilitated by specialists of the disease including oncologists (Gnagnarella et al., 2016), cardiologists (Wang et al., 2020) and pulmonary rehabilitation specialists (Jiang et al., 2020), and/or nurses (Wang et al., 2020), exercise professionals (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b), psychologists (Gnagnarella et al., 2016), pharmacists (Gnagnarella et al., 2016), dietitians (Gnagnarella et al., 2016), other health professionals and coaches (Dorje et al., 2019) and peer-facilitators (Aschbrenner et al., 2016a). One study was co-facilitated by fitness trainers and peers with lived experience of mental illness to help people to engage and to promote sharing of experiences in the group (Aschbrenner et al., 2016b). Two studies did not report the qualifications or backgrounds of the research team who facilitated the intervention (Bender et al., 2017; Wan et al., 2017).

Table 1
Summary study characteristics.

Author and year	Location	Study population	NCD/s	Study design	Characteristics of social media intervention and control groups if applicable	Supervision
Aschbrenner et al., 2016a (a)	USA	N = 13 with SMI and obesity (mean BMI of 41.5 kg/m^2). Mean age of 48.8 years, 73% were female, majority were white (91%).	SMI (schizophrenia spectrum disorders, major depressive disorder, bipolar disorder)	Pilot	Social media: Facebook 6-month lifestyle intervention adapted from the Diabetes Prevention Program and modified for weight loss through diet and exercise. Intervention included 1×/week 90-minute group weight management sessions focused on goal setting, self-monitoring, and problem solving, 2×/week optional 1-hour exercise sessions, and mHealth technologies/social media to support the intervention. Participants were given a Fitbit and iPhone to facilitate self-monitoring and PA. After 10-weeks, a private Facebook group was introduced to promote the content of the program, increase participant interest, and provide a platform for communication.	Two lifestyle coaches and a wellness peer led weight management sessions, and a certified fitness trainer led exercise sessions. Texts sent by study staff.
Naslund et al., 2016a (a)	USA	N = 11 participants (same sample as Aschbrenner et al. (a))	SMI (As described above)	Pilot	Social media: Facebook N = 11 participants who participated in the optional Facebook component of the Aschbrenner et al. (a) lifestyle intervention were introduced to a private Facebook group after 10 weeks. Participants were encouraged to post content related to healthy eating and exercise that was encouraging or described their successes/challenges in order to support one another. Study staff posted content related to the weight management sessions, reminders to exercise, and health tips.	Study staff supervised/posted in the private Facebook group.
Aschbrenner et al., 2016b (b)	USA	N = 32 with SMI including major depression (44%), schizophrenia spectrum disorders (22%), and bipolar disorders (34%). All were obese with a mean BMI of 37.7 (±7.9) kg/m^2. Mean age of 48.8 (±11.9) years. 56% female, 97% white.	SMI (schizophrenia spectrum disorders, major depression, bipolar disorder), obese	Pilot	Social media: Facebook 6-month group lifestyle program consisting of a group weight management session 1×/week, an optional group exercise sessions 2×/week, and mHealth technologies/social media to encourage motivation, self-monitoring, and peer support. Weight management sessions were highly interactive and based on the Diabetes Prevention Program. They emphasised principles of healthy eating and exercise through discussions, group problem solving, activities, and group planning. Optional tailored exercise sessions included stretching, resistance, and aerobic exercises. Participants were provided with a Fitbit to track PA, and a smartphone to access a private Facebook group introduced 6-weeks into the intervention. The Facebook group was created to support online peer networking and encourage participants to share experiences. Participants also received 2–3 text messages weekly to provided session reminders and encouraging messages.	Weight management sessions facilitated by two lifestyle coaches, and exercise sessions by a fitness trainer. Study staff moderated the Facebook group and sent text messages.

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Table 1 (*continued*)

Author and year	Location	Study population	NCD/s	Study design	Characteristics of social media intervention and control groups if applicable	Supervision
Naslund et al., 2018 (b)	USA	N = 25 (same sample as Aschbrenner et al. (b)). Participants had SMI including major depression (44%), schizophrenia (20%), and bipolar disorders (36%). All were obese with a mean BMI of 37.3 (±8.1) kg/m^2 Mean age of 49.2 (±11.8) years, 52% female, 96% white.	SMI (schizophrenia, major depression, bipolar disorder), obese	Exploratory study	Social media: Facebook As described above (Aschbrenner et al. (b)). Of the 25 participants, 19 chose to participate in the private Facebook group.	As described above. Additionally, two peer co-facilitators assisted in moderating the Facebook group.
Bender et al., 2017	USA	N = 45 Filipino American adults. Mean age of 58 (±10) years. All had T2DM and were of a BMI >23 kg/m^2 (mean = 30.1 (±4.6) kg/m^2). 62% were women, majority were immigrants (84%).	T2DM	Pilot RCT	Social media: Facebook A 3-month mHealth weight loss lifestyle program. Participants randomised into the intervention (n = 22), or active waitlist group (n = 23). In Phase 1 (baseline to 3-months), participants were trained on Fitbit use to self-monitor PA, and associated app diary use to self-report calorie intake and weight. Participants joined a private Facebook group for support, coaching, and weekly education. Education topics included benefits of exercise, diet/recipes, overcoming barriers, and maintaining glycaemic control. Participants met with staff 1×/month for coaching and feedback. Control group received Fitbit training and met with staff but received hepatitis B and C education. In Phase 2, participants transitioned to a 3-month follow-up and were removed from the Facebook group. Follow-up meetings took place at 4 and 6 months. During Phase 2, the control group transitioned to receive the intervention and returned for 3 office visits at 4, 5, and 6 months.	Office visits and private Facebook group facilitated by research staff.
Dorje et al., 2019	China	N = 312 inpatients with CHD. In the intervention group, mean age = 61.9 (±8.7) years, 126 (81%) were male, 30 (19%) female, and mean BMI = 30 kg/m^2. 42 (27%) had acute coronary syndrome, and 114 (73%) had angina pectoris.	CHD (including myocardial infarction and unstable or stable angina).	Parallel-group, single-blind, RCT	Social media: WeChat Participants randomly allocated to a 2-month intensive program followed by a 4-month step-down phase (n = 156) or to usual care (n = 156). The intervention is a smartphone-based program delivered via WeChat, allowing the use of functions such as communication, education delivery, PA/step tracking through a built in pedometer function, BP and HR monitoring, and wireless transfer of data. The use of multimedia supported a comprehensive delivery, including educational modules on CVD, PA, nutrition, and medication use/adherence. Exercises and remote supervision were provided regularly through reviewing data as BP, HR, and steps were automatically transmitted and reviewed by intervention coaches to provide feedback and recommendations. Support in adherence and risk modification provided to participants by coaches via WeChat based consultations, and additional	Supervised by CR/SP coaches. Remote monitoring of progress via built in self-recording through WeChat.

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Table 1 (*continued*)

Author and year	Location	Study population	NCD/s	Study design	Characteristics of social media intervention and control groups if applicable	Supervision
					alerts were sent to participants when reviewed data was outside of target levels. In the control group, participants received standard care, as provided by their doctors and cardiologists after hospital discharge, and WeChat was only used for sending follow up visit reminders.	
Jiang et al., 2020	China	N = 106 participants diagnosed with COPD. 71% disease duration >10 years. Of the intervention group, 83% were male, mean age = 70.92 (±6.38) years. Mean BMI = 22.21 (±3.52) kg/m^2. Of the control, 81% male, mean age = 71.83 (±7.60) years. Mean BMI = 21.27 (±2.36) kg/m^2.	COPD	RCT	Social media: WeChat 6-month pulmonary rehabilitation intervention involving a 3-month intervention, and 3-month observation period. Participants in the intervention group (n = 53) received Pulmonary Internet Explorer Rehabilitation (PeR) delivered via WeChat. The control group (n = 53) received the same content as the PeR group but delivered in a face-to-face setting. Intervention delivered educational modules on respiratory training, diet, medication, and exercise training (resistance and balance training 3×/week, 20–30 min, adjusted based on participant's reports of home-based pulmonary training). WeChat Moments allowed participants to post about their rehabilitation, and other participants and health professionals could interact on this forum. Both groups received training equipment/aids. Participants completed home-based training and self-assessment reports and uploaded their records to Moments which was reviewed by health professionals.	Baseline measures taken by healthcare and medical professional. Pulmonary rehabilitation training conducted by health professionals.
Wan et al., 2017	USA	N = 109 veteran participants with a diagnosis of COPD, emphysema or chronic bronchitis. 98.5% male, mean age = 68.6 (±8.3) years.	COPD, emphysema, bronchitis.	RCT	Social media: Website 3-month intervention with participants randomised into an intervention (n = 57) or control (n = 52) group. Intervention group received a pedometer and access to a website which contained content including individualized goal setting, step-count feedback for self-monitoring, educational and motivational content for self-management, and an online community forum for social support. Participants were asked to wear their pedometer and to upload their weekly steps. Participants received weekly step goals based on current step counts or previously set goal. Participants in the control group received a pedometer and written materials regarding exercise at study entry, but were not assigned step-count goals. Participants were instructed to wear the pedometer daily and upload step counts at least monthly via the website; the website had no content except a display of the study week.	Research staff provided assistance when needed and completed measures of objectives.
Wang et al., 2020	China	N = 179 participants post coronary artery bypass graft. Mean age = 62 (±12.4) years, and 83% male.	Post-CABG patients	RCT	Social media: WeChat Participants randomised into either the intervention group (n = 89) or to the control (n = 90). The	Cardiologists posted articles/ engaged through WeChat. Cardiologists and a nurse acted as health care managers, and

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Table 1 (*continued*)

Author and year	Location	Study population	NCD/s	Study design	Characteristics of social media intervention and control groups if applicable	Supervision
					control group received 12-month usual care and was provided with instructions on medications and information leaflets about CV risk factors, diet, and smoking cessation. Participants seen by nurse/doctor prior to discharge. Following this, they saw their NTD according to self-assessed CV health. In the intervention group, in addition to usual care participants received a 12-month WeChat based follow-up service including cardiac education, medication reminders, and a cardiologist follow-up service. In WeChat, participants could interact with healthcare, read about medications, treatment goals, and health behaviours (exercises posted weekly), and were encouraged to upload self-monitored data (BP, tests results) to WeChat. Cardiologists/nurses received data and enquiries regularly to provide feedback via WeChat. Online medication reviews were conducted every 4 weeks. Three follow-up visits at outpatient clinics conducted, at 1, 6 and 12-months.	reviewed participants' data/ enquiries. Patients saw their NTDs for their self-assessment.
Gnagnarella et al., 2016	Italy	N = 125. Intervention group was 78.1% female, mean age = 51.5 (±11.4) years. Control group was 88.5% female, mean age = 48.4 (±9.2) years. Breast cancer was most common and most participants were <2 years diagnosed.	Cancer (breast, gastrointestinal, gynaecologic, lung, and other).	RCT	Social media: Website A 6-month intervention with participants randomly allocated to the intervention (N = 35) or control group (N = 39). The intervention group had access to educational content related to nutrition via a website with blogs (live activities, discussions, and examinations). Participants could interact with experts and other participants through a dedicated discussion forum. Education topics included managing nutrition/ eating during cancer symptoms, how to control weight loss/ maintain body weight, and guidelines for healthy eating. The control group only had access to PDF versions of the content by e-mail. At the conclusion of the intervention, participants who were assigned to the control group were invited to access the study website.	An oncologist, patient representative, pharmacist, psychologist, dietician, and oncologist expert in palliative care were available to interact with participants.

Note: BMI: Body Mass Index; BP: Blood Pressure; CHD: Coronary Heart Disease; COPD: Chronic Obstructive Pulmonary Disease; CR/SP: Cardiac Rehabilitation/ Secondary Prevention; CRF: Cardiorespiratory Fitness; CV: Cardiovascular; CVD: Cardiovascular Disease; DBP: Diastolic Blood Pressure; HR: Heart Rate; NTD: Nominated Treating Doctor; PA: Physical Activity; Post-CABG: Post Coronary Artery Bypass Graft; RCT: Randomised Controlled Trial; RHR: Resting Heart Rate; SBP: Systolic Blood Pressure; SMI: Serious Mental Illness; T2DM: Type 2 Diabetes Mellitus; 6-MWT: 6-Minute Walk Test; — represents 2 articles describing 1 intervention.

3.3. Theoretical underpinnings

Four studies reported using a theoretical framework(s) for behaviour change to inform their development; one study used both cognitive theory and transtheoretical theory (Aschbrenner et al., 2016a), one study used social cognitive theory (Jiang et al., 2020), one study used the self-efficacy theory (Dorje et al., 2019), and one study used the theory of self-regulation (Wan et al., 2017).

3.4. Feasibility, engagement, and safety

Feasibility outcomes for each study are listed in the Supplementary material 1. Overall, across all studies retention in the intervention was high, ranging from 72% to 100%, with the majority reporting retention rates >85% (Bender et al., 2017; Wan et al., 2017; Dorje et al., 2019; Jiang et al., 2020; Wang et al., 2020). In two studies, the social media component of the intervention was optional in addition to a face-to-face lifestyle intervention, and among those >75% of participants chose to

join the Facebook group (Naslund et al., 2018; Aschbrenner et al., 2016b; Naslund et al., 2016b). Reasons for not joining included a preference for face-to-face, perceived difficulty, and privacy concerns (Naslund et al., 2018). One of the studies compared attendance rates at the face-to-face sessions between those who joined the optional Facebook group and those who didn't and found that attendance was numerically higher among Facebook users (17.3(SD=7.3)) sessions versus 14.6 (SD = 6.6)), although the difference was not significant (Naslund et al., 2018).

The two articles by Naslund et al. reported on the feasibility and engagement of Facebook, supplementing a face-to-face lifestyle intervention among people with severe mental illness (Naslund et al., 2018; Naslund et al., 2016b). One of these studies found that healthy eating was the most common topic of the Facebook posts (30%), followed by program reminders (19%) and personal sharing (18%) (Naslund et al., 2018). This study found that posts involving personal sharing of stories rather than messages from the facilitators regarding motivational messages or information about healthy eating generated the most interaction (Naslund et al., 2018). The study reported that 19/25 (76%) of participants contributed 208 interactions, totalling 70 posts over 6 months, 81 comments and 57 likes (Naslund et al., 2018). Another study also reported high interaction with a private Facebook group, whereby 79% of total posts in the group were from participants (Naslund et al., 2016a). While engagement appeared high, some discrepancy regarding participant satisfaction with the engagement on the Facebook groups was reported in subsequent qualitative interviews, where some participants reported wanting more group cohesion and interaction (Naslund et al., 2016b). The inclusion of peer-facilitators with lived experience was recommended in one study as a future direction to increase engagement for people living with mental illness, and implemented in another study (Naslund et al., 2018; Naslund et al., 2016b). The third study delivered via Facebook did not report engagement data however retention at 6 months was 100% (N = 45) (Bender et al., 2017).

The three studies which utilised WeChat as the social media platform showed high feasibility (all retention rates >85%) and participant engagement (Dorje et al., 2019; Jiang et al., 2020; Wang et al., 2020). The different aspects of WeChat, mainly communication and online education were frequently utilised by participants with more than 95% of participants using such functions (Wang et al., 2020). Wang et al. presented engagement data on the different components of the WeChat intervention among cardiac patients (post coronary artery bypass graft) and found that 96% of participants read 4 education articles (e.g., reducing sodium intake, increasing physical activity levels and monitoring blood pressure) per month, 93% used the online health care consulting with a case-manager between 1 and 3 times per month and 83% sent test results (e.g., blood pressure) via WeChat 4–8 times in 12 months (Wang et al., 2020).

Retention and usability of the custom-made social media websites was high (measured via website logins and interactions) (Wan et al., 2017; Gnagnarella et al., 2016), however engagement and retention in one study for participants with cancer was not (Gnagnarella et al., 2016). This study had the highest dropout (28%) and provided nutritional information via an interactive website (Gnagnarella et al., 2016). Participants were grouped into three categories based on levels of activity (e.g., a comment or vote on a post on the website) and n = 11 (31%) did not interact at all, n = 10 (29%) had low interaction defined by less than five activities, and n = 14 (40%) had high levels of interaction defined by more than five activities (Gnagnarella et al., 2016). This may have been due to the nature and complexity of cancer and cancer treatment.

Two studies compared participant levels of engagement with the social media interventions and while they found a trend, there was no significant association between engagement and change in health behaviour (Naslund et al., 2018; Gnagnarella et al., 2016). The other included studies did not appear to compare the relationship engagement with health outcomes.

Two studies reported on adverse events, of which one study reported none (Dorje et al., 2019), and the second study (Wan et al., 2017) reported 24 adverse events unrelated to the intervention (e.g., abdominal pain, mental health crisis, kidney problems, fractured foot and a car accident). Two studies reported implementing a safety session for participants which included a briefing on safety precautions for sharing and posting personal information online and the outline of intervention rules include no toleration of hurtful or rude comments on the Facebook group (Naslund et al., 2018; Naslund et al., 2016b). Another two studies implemented procedures to protect participant privacy and data security (Bender et al., 2017; Jiang et al., 2020).

3.5. Effect of social media on diet and exercise behaviours

As shown in the Supplementary material 1, assessment measures of physical activity and diet behaviours differed between studies. Those assessing changes in physical activity related behaviours assessed cardiorespiratory fitness (Naslund et al., 2018; Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Wan et al., 2017; Dorje et al., 2019), adherence to self-reported physical activity (Wan et al., 2017; Wang et al., 2020), step count (Bender et al., 2017; Wan et al., 2017; Dorje et al., 2019) and exercise self-efficacy (Jiang et al., 2020), while diet was assessed by adherence to a healthy diet (Wang et al., 2020) and a nutrition questionnaire (Gnagnarella et al., 2016). The effects of the social media interventions are grouped and described below according to study design.

3.5.1. Randomised controlled trials

Four of the five included RCTs reported significant increases in physical activity behaviours (Wan et al., 2017; Dorje et al., 2019; Jiang et al., 2020; Wang et al., 2020), and one of these studies also reported significant improvement in diet behaviour (Wang et al., 2020). Two studies which compared cardiac rehabilitation delivered via WeChat compared to usual care both found significant improvements in physical activity behaviours (Dorje et al., 2019; Wang et al., 2020). Dorje et al. (2019) randomised participants to either 6 months of cardiac rehabilitation and secondary prevention delivered via WeChat alone or to usual care which involved standard outpatient cardiology follow up. Intention to treat analysis found significant between-group differences in fitness levels (measured by the 6-min walk test), with greater improvements in the intervention group compared to the control group, who received only standard care, at 2 months (mean between-group difference from baseline (20.6 m (95% CI 7.5–33.8))) and at 6 months (22.3 m (8.2–36.4)). This study also measured participants step count and dietary habits, however these data are yet to be published. The second cardiac rehabilitation intention to treat analysis found that the intervention group (who received WeChat in addition to usual care) had significantly greater adherence to regular physical activity at 12 months, compared to the control group (cardiac rehabilitation as usual) (64.2% vs. 48.2%; $P < .04$) (Wang et al., 2020). Differences in dietary intake were also found in the intervention group at 12 months, however it was not specified how changes were assessed and the results were not significant (Wang et al., 2020).

Of the two studies conducted for people with COPD, both showed improvements in physical activity related behaviours (Wan et al., 2017; Jiang et al., 2020). One study evaluated the effect of the effect of a 6-month pulmonary rehabilitation intervention delivered via WeChat compared to an outpatient face-to-face group and intention to treat analysis found equivalent improvements in exercise self-efficacy, as measured by the exercise self-efficacy questionnaire (Ex-SRES) ($P = .63$) (Jiang et al., 2020). The second study among a group of US veterans with COPD evaluated an intervention involving a pedometer and an interactive custom website versus a pedometer alone (Wan et al., 2017). Intention to treat analysis found a significant improvement in step count during the intervention from baseline compared to the pedometer only control (804 ± 356.5 steps per day, $P = .02$) which was sustained until

the end of the study (Wan et al., 2017).

Finally, the study by Gnagnarella et al. compared a social media delivered nutrition intervention for cancer patients to a control group who were provided with printed versions of the content (Gnagnarella et al., 2016). Among participants who completed both the pre- and post-Nutrition Questionnaire (NQ), there was a statistically significant increase over time in the global score (indicative of improved awareness of lifestyle and healthy eating habits, knowledge of nutritional problems during cancer and food consumption) after the 6-month intervention (mean +6.6, $P < .001$), though this was not significantly different between the two groups (Gnagnarella et al., 2016). This study also showed that there were no significant differences in nutrition scores between those who engaged regularly with the interactive website compared to those who didn't.

3.5.2. Pilot and feasibility studies

Two of the three feasibility/pilot studies were conducted with people living with severe mental illness by the same research team, and both showed non-significant improvements in fitness as assessed by the 6-minute walk test over a 6-month period (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b). These two feasibility studies were also delivered in addition to a face-to-face lifestyle intervention and were underpowered to detect changes in physical activity behaviours (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b), however one study reported on mean change and found that 17% of participants had clinically significant improvements in cardiovascular fitness with a mean change in distance of 74.78 (SD = 205.1) feet (Aschbrenner et al., 2016a). The pilot RCT conducted by Bender et al. compared a Facebook and Fitbit delivered intervention versus a Fitbit only control group for people with type 2 diabetes and found significant improvements in overall step count (Cohen's d = 1.44) (Bender et al., 2017).

3.6. Effect of social media interventions on other health outcomes

The effect of social media interventions on other health outcomes and behaviours is reported in the Supplementary material 1. The studies assessed various health outcomes, including disease specific assessments (e.g., dyspnoea), body composition, medication adherence, mental wellbeing, quality of life and other health behaviours e.g., coronary heart disease knowledge. The most frequently assessed outcome was anthropometry, with five out of the eight studies assessing weight, body mass index (BMI) or both (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b; Bender et al., 2017; Dorje et al., 2019; Wang et al., 2020).

The two studies among participants with heart disease adopted measures of cardiovascular function and cardiovascular disease risk factors, e.g., heart rate, blood pressure, BMI, blood lipid profiles, smoking status and medication adherence (Dorje et al., 2019; Wang et al., 2020). Both of these studies were primarily delivered via social media, with hospital or clinic check-ups every few months. The intervention groups in both studies significantly decreased systolic blood pressure and lipid concentrations and were significantly more likely to adhere to medications (Dorje et al., 2019; Wang et al., 2020). The studies targeting respiratory disease and type 2 diabetes also used disease-specific measures including respiratory disease symptoms, i.e., dyspnoea, blood glucose and HbA1c levels and findings were mixed (Bender et al., 2017; Wan et al., 2017; Jiang et al., 2020).

3.7. Methodological quality

Outcomes of the quality assessments are shown in the Supplementary material. Of the six included RCTs (including one pilot RCT), five were considered good quality and one was considered fair according to the PEDro scale. Summary scores for the pilot and feasibility studies ranged from 65 to 95% using the QualSyst checklist.

4. Discussion

This review identified ten articles describing eight individual studies that evaluated the feasibility, acceptability and/or effectiveness of a social media intervention targeting exercise and diet behaviours among people with NCDs. Most studies used existing social media platforms including Facebook and WeChat, while two studies designed their own interactive websites with social media capability. Only three studies solely used social media, while three predominantly used social media with face-to-face assessments, and two used social media to support a face-to-face intervention. These modes of delivery appeared feasible for people with NCDs including severe mental illness, COPD, coronary heart disease and cancer. The interventions were based on behaviour change techniques and social media was primarily used as a platform to distribute health information, provide tailored one-on-one feedback, interact with participants and health professionals, and facilitate social support among peers. The included interventions provide preliminary evidence that social media delivered interventions may improve physical activity behaviours, however the effect on diet behaviours remains unclear. While many of the studies reported meaningful improvements in other health-related outcomes relevant to NCD management including symptoms, comorbidities, medication adherence, weight loss

Table 2
Summary of current evidence among 5 NCDs.

NCD	Included studies	Key findings
Cardiovascular disease	• 2 RCTs (Dorje et al., 2019; Wang et al., 2020). Delivered via WeChat. Large sample sizes (n = 179 and n = 312)	• Both studies found significant improvements in physical activity assessed via functional capacity (fitness) and adherence to physical activity • Diet was only assessed in one study and changes were not significantly different between groups
Diabetes	• 1 pilot RCT (Bender et al., 2017). A weight loss lifestyle intervention using Facebook and Fitbits among n = 45 participants with T2DM	• Significant improvements in overall step count
Chronic respiratory disease	• 2 RCTs (Wan et al., 2017; Jiang et al., 2020). Sample sizes >100. One intervention delivered via WeChat and one via an interactive website. Interventions 3–6 months duration	• Both studies showed improvements in physical activity related behaviours including exercise self-efficacy (equivalent to face-to-face) and step count (significant improvements compared to face-to-face)
Cancer	• 1 RCT (Gnagnarella et al., 2016). N = 125 participants with a range of cancer diagnoses (breast, gastrointestinal, gynaecologic, lung, and other). 6-month nutrition intervention delivered via an interactive website	• 28% dropout and 31% of participants did not interact with the website • No significant improvement in nutrition scores compared to the control
Mental illness	• 2 pilot studies among people with severe mental illness (Aschbrenner et al., 2016a; Aschbrenner et al., 2016b). Small sample sizes between n = 13 and n = 32. Both 6-month lifestyle programs conducted via a private Facebook group and supplemented with face-to-face intervention	• Feasible and high engagement although some discrepancy regarding participant satisfaction with the engagement on the Facebook groups • No-significant improvements in fitness

Note: RCT = randomised controlled trial, T2DM = type 2 diabetes.

Table 3
Key questions and recommendations for future social media delivered lifestyle interventions.

Key question	Current evidence	Future research recommendations
1) Are physical activity and diet interventions delivered via social media for people with NCDs feasible, safe and acceptable?	• Interventions appear feasible among people with NCDs • Retention rates were high (72%–100%), with the majority reporting retention rates >85% • Majority reported high levels of engagement however engagement measures differed greatly between studies e.g., posts, website logins, likes • 2 studies assessed associations between engagement and change in health behaviour and found no significant difference • Overall interventions appeared well-accepted and safe however there was inconsistent reporting of adverse events. Only 2 studies reported adverse events (1 reported no adverse events and the other reported 24 unrelated events)	• Examine the relationship between engagement and health outcomes • Develop protocols so that there is consistency in collecting adverse events and standardised reporting of social media related online harassment and privacy concerns
2) What specific intervention components and strategies are employed to promote user engagement and retention?	• Social media was mostly used to distribute health information, provide tailored one-on-one feedback, interact with participants and health professionals, and facilitate social support among peers • One study used gamification to encourage patients with COPD to compete through challenges and awards • One study was co-facilitated with peers with lived experience to encourage sharing of experiences between participants • Some studies integrated social media with peripheral monitoring devices, such as pedometers, blood-pressure and heart-rate monitors and wireless data collection and transfer for real time information sharing with clinicians	• Examine factors impacting engagement and who this mode of delivery will most benefit • Explore features of social media including gamification • Collaborate across disciplines e.g., computer science, marketing, and communication to best consider participant preferences
3) Do physical activity and diet interventions delivered via social media for people with NCDs improve physical activity and diet behaviours?	• 4/5 RCTs found either significant improvements in physical activity behaviours including step count, cardiorespiratory fitness, exercise self-efficacy and self-reported adherence to exercise compared to control groups or equivocal improvements to face-to-face delivery. • Most studies relied on self-report measures. • While most studies targeted physical activity and diet, only 2 studies assessed diet related outcomes and both showed non-significant improvements	• Conduct replication studies • Conduct dismantling studies to understand the core components of social media that lead to behaviour change • Assess dietary outcomes to determine efficacy • Compare the effectiveness of social media interventions to that of face-to-face delivery and hybrid models • Evaluate the cost-effectiveness of online delivery
4) Do physical activity and diet interventions delivered via social media improve health outcomes beyond physical activity and diet?	• High heterogeneity regarding health outcomes including disease specific assessments (e.g., dyspnoea), body composition, medication adherence, mental wellbeing, quality of life and other health behaviours e.g., coronary heart disease knowledge. Findings are mixed • The most frequently assessed outcome was anthropometry, with 5/8 studies assessing weight, body mass index or both	• Conduct more RCTs among individual NCD populations and replication studies to understand the impact on disease specific outcomes

and quality of life, given the heterogeneity of interventions and modes of delivery the evidence is inconclusive. A summary of the findings for each NCD is listed in Table 2 and the key questions and future recommendations are summarised in Table 3.

Results suggest that social media is a feasible platform to deliver physical activity and diet promotion interventions to people with NCDs. The high usability and acceptability reported by participants suggests that social media platforms may be a promising mode of delivering health interventions as stand-alone treatments, or in addition to face-to-face to enhance social support. High retention rates were observed (>70%), and while only reported in two studies, no adverse events related to the studies were reported. Pre-intervention training on the use of social media, safety and privacy concerns were employed or recommended in many of the included studies however this was not evaluated in the primary studies. It is suggested that health interventions delivered via social media establish training materials for participants and guidelines around online etiquette prior to commencement. Social media platforms should also be monitored at least daily by study staff to minimise risk. While no adverse events related to the social media interventions were reported, there are potential risks which have been identified in previous research which clinicians and researchers should consider, including unknown credentials, exposure to online harassment or destructive behaviours (Naslund et al., 2016c). Clear definitions, criteria, collection and reporting protocols of adverse events should be established prior to commencing a trial. All adverse events and unintended consequences associated with social media interventions including online harassment or bullying, privacy concerns e.g., unsolicited sharing of personal information, and inappropriate content should be reported. Reasons why participants withdrew from the study should also be recorded. Therefore, future research in this area should include standardised implementation of data security policies, measurement and reporting of adverse events including as per face-to-face interventions.

The facilitators of the interventions varied greatly between studies including specialists, health professionals and research personnel. The facilitators of each study were responsible for creating and posting content, managing and monitoring the group and in some studies

monitoring health outcomes. While the training backgrounds of the facilitators differed, the content was similar across studies and included healthy eating, weight loss, increasing step count. The content was based on well-established behaviour change techniques including goal setting, self-monitoring and social support (Michie et al., 2011). Therefore, while there may be different NCD specific barriers and facilitators to physical activity and diet participation, the core lifestyle behaviour promotion content is similar.

Of the studies that involved a face-to-face component, the social media component was mostly utilised to create and support online peer networking where participants could share their experiences with each other. For example, one Facebook-delivered intervention compared engagement between types of posts and found that personal sharing posts generated more interaction compared to posts from facilitators with motivational messages or information about healthy eating (Naslund et al., 2018). This is an important feature of social media given that previous research has established that interpersonal communications and social support are linked to intervention effectiveness and health behaviour change (Cohen, 1988; Greaves et al., 2011).

The correlation between engagement with the social media intervention and physical activity or diet behaviours was only reported in two studies, and both found that engagement was not significantly associated with improvements in health behaviours. It is therefore unknown what level of engagement is necessary for successful behaviour change to occur. This relationship has been identified in previous research with online support groups whereby 'lurking,' referring to reading rather than regularly sharing content, may be as empowering as regularly posting in groups (Mo and Coulson, 2010). Therefore, future studies should consider reporting views of content, rather than only active engagement with content.

While there were limited studies from each specific NCD, there is promising feasibility data among people with severe mental illness from two small scale feasibility studies, and two RCTs demonstrating significant improvements in physical activity behaviours in cardiac rehabilitation and COPD. Four of the five included RCTs found either significant improvements in physical activity behaviours including step count, cardiorespiratory fitness, exercise self-efficacy and self-reported adherence to exercise compared to control groups or equivocal improvements to face-to-face delivery.

Evidence for diet is limited, with only two studies reporting outcomes related to diet behaviours, despite seven studies delivering some type of dietary component. Of those that assessed diet related outcomes, both found non-significant improvements compared to control groups. While many studies reported anthropometry related outcomes, exercise and diet promotion are transdiagnostic interventions and improvements in health outcomes can occur irrespective of weight loss (Ross and Bradshaw, 2009; Phillips and Joyner, 2019). A recent review of 43 technology-based tools for dietary intake assessment identified different methods of inputs for assessment including text, voice, and digital images (such as visualisation for portion size reporting) and the benefits including improved accuracy, participant preference and rapid and remote interaction between participations and nutrition professionals (Eldridge et al., 2019). Future research should therefore integrate some of these tools and functions to be able to determine the efficacy of targeting diet behaviours via social media.

The social media interventions included in this review highlight the opportunities and unique capabilities of this form of delivery, for example the bidirectional communication between health professionals and patients, but also between peers with a shared experience. The integration of social media with peripheral monitoring devices, such as pedometers, blood-pressure and heart-rate monitors and wireless data collection and transfer as shown in the studies by Dorje et al. (2019) and Jiang et al. (2020) demonstrate the multi-modal connectivity of e-health devices and their diverse potential for real time information sharing with clinicians. The evolution of social media provides increased opportunities to engage with people and transform how health information is shared, for example gamification, however only one study in this review utilised this.

Some studies, for example the cardiac rehabilitation interventions demonstrate the opportunities of the online delivery for long-term continued care (up to 12 months), with the support of specialists and real time sharing of health outcomes. This may have scalable implications for groups experiencing health disparities, as evidenced in a previous review (Vereen et al., 2021) and in low-middle income countries where the burden of NCDs is rising and greater access to long term care is needed, however no interventions included in this review were conducted in these countries. More research is needed to warrant the upscaling of physical activity and diet interventions for NCD management.

5. Limitations and future directions

Resulted should be interpreted in light of limitations including the potential confounding impact of treatments (e.g., pedometers and face-to-face intervention components), mixed diagnoses and uses of social media. The outcomes assessed varied between interventions, making it difficult to compare across studies. Secondly, of the three included feasibility studies, two were targeting the same NCD population (severe mental illness) and were similar interventions conducted by the same research team and therefore replication in other contexts is needed. All studies were published since 2016, highlighting the relative infancy of the field. Most of the included studies were the first of their kind with the specific NCD and therefore replications are needed to establish the evidence-base. Consistent with previous systematic reviews on internet delivered behavioural interventions (Chang et al., 2013), the included studies did not isolate the unique impact of social media on physical activity or diet behaviours and some combined social media with other delivery methods e.g., face-to-face visits or physical activity tracking devices which may have been responsible for the intervention effects. In addition, most outcomes assessed relied on self-report which may affect the validity and so biological end points (e.g., walking distance) should be used in future research to determine the efficacy. The socio-demographic characteristics of participants is another important limitation since social media delivered interventions may not be accessible to people who lack confidence using online technologies, or who live in regions with limited or no access to internet or to those facing language barriers.

Dismantling studies will be important in future research to understand the core components of social media that lead to behaviour change. Research should also compare the effectiveness of social media interventions to that of face-to-face delivery as well as hybrid models and consider cost-effectiveness analyses. An understanding of the factors impacting engagement and consideration of who this mode of delivery will most benefit is also important to understand how best to tailor interventions that fit participant personality traits and individual preferences. It will be critical for behavioural health and physical activity/diet researchers to collaborate across disciplines including computer science, data science, marketing, and communication to best consider the perspectives and preferences of participants.

6. Conclusion

Social media interventions targeting lifestyle behaviours are feasible, well accepted and have the potential to improve physical activity behaviours among people with various NCDs. The evidence for diet behaviours is limited and remains unclear. While this is an emerging field, there has been relatively little evaluation of social media as a tool for promoting physical activity and diet with only eight studies identified. Our findings may help inform the design and development of lifestyle interventions utilising various social media functionalities as the intervention platform however more research is needed to determine the efficacy of social media delivered interventions in isolation and

combined with face-to-face programs for people with NCDs.

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