

Chapter 2

Social Media-Based Health Interventions: Where Are We Now?



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Abstract The unprecedented growth in the use of modern technology and social media has revolutionized how health information is disseminated and shared among people. Social media sites such as Facebook and Twitter have been increasingly used for health promotion and other public health efforts. In this chapter, we aim to describe the state-of-the-art for health interventions that use social media by reviewing relevant systematic literature review papers. The chapter has three objectives: (1) to identify health interventions that included social media as an intervention component, (2) to evaluate how social media is being used in these interventions, and (3) to provide an update on the effectiveness of these interventions.

Keywords Social media · Intervention · Education · Social support · Health behavior · Mental health · Chronic disease

2.1 Introduction

The unprecedented growth in the use of modern technology and social media has revolutionized how health information is disseminated and shared among people. Social media sites such as Facebook and Twitter have been increasingly used for health promotion and other public health efforts. Social media encompasses a range of Internet-based communication tools, from traditional digital platforms such as blogs and online forums, to modern mainstream tools including Facebook, Twitter, YouTube, and other interactive web and mobile applications. These social media tools have great potential in delivering and upscaling health interventions in cost-effective ways since they can quickly reach a large number of audiences

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across geographic distances and potentially sustain high levels of user engagement and retention, compared to traditional Internet-based interventions. Over the past decade, there has been a growing interest in the use of social media to deliver health information and education programs. Social media-based interventions have been implemented and evaluated in many health areas including weight management, smoking cessation, cancer prevention and control, and diabetes self-management.

This chapter aims to describe the state-of-the-art for health interventions using social media. More specifically, the chapter has three objectives: (1) to identify health interventions that included social media as an intervention component, (2) to evaluate how social media is being used in these interventions, and (3) to provide an update on the effectiveness of these interventions. The remainder of the chapter is organized as follows. First, we present the methodology used to identify systematic reviews of social media-based interventions. Second, we detail the characteristics of the identified interventions by health areas and subareas. We summarize the ways by which social media is used in these interventions and the effectiveness of these interventions. Third, we discuss our results and the implications for future studies.

2.2 A Review of Reviews

In this chapter, the methodological approach that has been taken is a review of systematic literature review papers that summarize social media-based health-related interventions. We searched electronic databases, PubMed and Web of Science, for original review papers published through October 2018. Our search covered papers that contain terms “intervention,” “intervene,” or “intervening,” in combination with “social networks,” “social media,” “social network,” “social networking,” “Twitter,” “Facebook,” “Instagram,” “Tumblr,” “LinkedIn,” “Snapchat,” “Pinterest,” “YouTube,” “Google Plus,” “Reddit,” “Flickr,” “Vine,” or “WhatsApp” in the title or abstract. The search was limited to review papers published in English. We manually reviewed all titles and abstracts to exclude papers that (1) were not systematic reviews and (2) did not review any interventional studies. The literature search resulted in 18 systematic review papers for further analysis. We grouped the papers into the following health areas: modifiable health behaviors (11 reviews), mental health (two reviews), and chronic diseases (five reviews). Reviews by health areas and subareas were summarized in Table 2.1.

Table 2.1 Systematic reviews of social media-based interventions by health area

Health area	Subarea	Number of reviews	First author, year	Topic
Modifiable health behaviors	Diet/physical activity/body weight	9	Chang et al., 2013 [1]	Social media use in online weight management interventions
			Laranjo et al., 2014 [2]	Interventions using social networking sites (SNSs) to change health behaviors
			Maher et al., 2014 [3]	Review of evidence regarding the effectiveness of online social network health behavior interventions
			Williams et al., 2014 [4]	Use of social media to promote healthy diet and exercise in the general population
			Mita et al., 2016 [5]	Social media use as part of interventions to reduce risk factors for noncommunicable diseases
			Rose et al., 2017 [6]	Digital interventions for improving the diet and physical activity behaviors of adolescents
			Willis et al., 2017 [7]	Weight management interventions delivered through online social networks
			An et al., 2018 [8]	Social media-based interventions on weight-related behaviors and body weight status
			Hsu et al., 2018 [9]	Social media-based interventions in promoting positive changes in nutrition behaviors among adolescents
	Smoking	1	Naslund et al., 2017 [10]	Social media interventions for smoking cessation

(continued)

Table 2.1 (continued)

Health area	Subarea	Number of reviews	First author, year	Topic
	Vaccines and immunizations	1	Odone et al., 2015 [11]	Interventions that apply new media to promote vaccination uptake and increase vaccination coverage
Mental health	Schizophrenia	2	Alvarez-Jimenez et al., 2014 [12] Välimäki et al., 2016 [13]	Internet or mobile-based interventions for participants diagnosed with schizophrenia-spectrum disorders Social media interventions for supporting mental health and well-being among schizophrenic patients
Chronic disease	Cancer	1	Han et al., 2018 [14]	Interventions in cancer prevention and management
	Diabetes	2	Cotter et al., 2014 [15] Gabarron et al., 2018 [16]	Internet interventions to support lifestyle modification for diabetes management Social media interventions targeting people affected with diabetes
	HIV	2	Muessig et al., 2015 [17] Cao et al., 2017 [18]	Interventions to address the HIV continuum of care Interventions to promote HIV testing, linkage, adherence, and retention

2.3 The Effectiveness of Social Media-Based Health Intervention

2.3.1 *Modifiable Health Behaviors*

2.3.1.1 Diet, Physical Activity, and Body Weight

Obesity and overweight is a major public health problem in the United States and worldwide [19, 20]. It elevates the risks of various diseases that are leading causes of preventable death, including hypertension, heart disease, stroke, type 2 diabetes, and certain types of cancer [21]. According to the most recent data, the prevalence of obesity among US adults is worryingly high at 39.8%, affecting about 93.3 million individuals [22]. Further, obesity and overweight is a huge financial burden on the healthcare system. It is estimated that the medical expenditure attributable to obesity and overweight will reach ~\$900 billion US dollars by 2030, accounting for 16–18% of total US healthcare expenditures [23].

The key strategies for preventing obesity typically involve promoting an active, less sedentary lifestyle and a healthy diet [24]. Although these healthy behaviors have many benefits for health and well-being, a significant portion of the population are not sufficiently active or do not adhere to dietary recommendations [25–27]. Population-based interventions that target these healthy behaviors are delivered through various media, including printing media, television, the Internet, and recently, social media. In this chapter, we identified nine systematic reviews that summarized social media-based interventions aiming to promote physical activity and/or healthy diet [1–9]. Among these reviews, two focused on adolescence [6, 9] and seven did not impose any age restriction [1–5, 7, 8].

Among the seven review papers that did not impose any age restriction, six reviews conducted the database searches in or before 2015 and one review, An et al., conducted the searches in May 2017. There is an overlap of intervention studies across the six older reviews. Chang et al., Williams et al., and Mita et al. searched the major databases for diet- and exercise-related interventional studies and identified 20, 22, and 16 interventions, respectively. Among the three reviews, there are only 30 unique interventions. Lanranjo et al. and Maher et al. searched for interventions targeting modifiable health behaviors and identified an additional five unique interventions on diet and exercise. Willis et al. searched for interventions on diet and exercise that included online social networks as the main platform and identified three more unique interventions. In these 38 unique studies, the interventions typically involved components such as online diet and/or exercise programs, educational modules, and self-tracking of diet, physical activity, and/or weight, along with a social media component for providing social support. The majority of the studies used online text-based message and discussion boards as their social media component of the intervention. Few studies used a social media platform other than online discussion boards. Two studies used Facebook [28, 29] and two studies used Twitter [30, 31]. As the most recent systematic review and

the only one conducted after 2015, An et al. identified 27 social media-based diet and exercise interventions, among which many were newly conducted between 2015 and 2017. Many of these interventions used the mainstream social media sites: 17 used Facebook, four used Twitter, and one used Instagram. Findings from these systematic reviews suggest that behavioral interventions with a social media component have a moderate effect on diet and physical activity outcomes. However, the effect is not consistent across all interventions, with some studies reporting noneffective interventions. Further, most studies used social media as an integral part of the intervention. Therefore, the isolated impact from social media on diet and physical activity outcomes cannot be measured or assessed.

Two systematic reviews summarized social media-based interventions on diet and exercise targeting adolescence. Rose et al. identified a single social media-based intervention, in which Facebook was used to deliver educational content and weekly private messages to encourage exercise [32]. The investigators found the intervention had no effect on total physical activity as measured by accelerometer. In Hsu et al., the authors identified seven social media interventions for positive nutrition behavior published between 2004 and 2014. All the interventions used web-based programs, and none of the them used the mainstream social media sites. The majority of studies reported significant increases in fruit and/or vegetable intake. Overall, Hsu et al. claimed that social media intervention had a small to moderate impact on positive nutrition behaviors.

2.3.1.2 Smoking

Smoking is the leading cause of preventable death in the United States and worldwide [33]. In the US, cigarette smoking causes more than 480,000 deaths per year, responsible for roughly one in five deaths annually [34]. Worldwide, tobacco use causes about six million deaths per year [35]. Financially, smoking imposes a huge economic burden throughout the world [36]. The total economic cost of smoking is estimated to be \$1436 billion worldwide in 2012 [36] and more than \$300 billion a year in the United States [34, 37]. Although smoking rate has declined in the past few decades, the prevalence of smoking remains high [38]. It is estimated that 15.5% of all US adults (37.8 million individuals) are current cigarette smokers in 2016 [38]. Further, smoking prevalence differs across population subgroups. For example, smoking prevalence is significantly higher among males, American Indian/Alaska Natives, those with high school or lower education, and those living below the poverty level [38]. Therefore, it is critical to identify innovative approaches and tools to advance population level smoking cessation efforts by specifically targeting population subgroups with higher rates of smoking.

One systematic review (Naslund et al. 2017) examined the feasibility and preliminary effectiveness of social media-based interventions for smoking cessation [10]. Naslund et al. searched the major databases through July 2016 and identified seven relevant intervention studies on smoking cessation published between 2015

and 2016. Among the seven studies, three were pilot studies, four were RCTs, and the remaining study employed a quasi-experimental design. Typical intervention components included online interactive education modules, group discussions moderated by smoking cessation experts with individualized feedback, and a social media component for encouraging social support. All interventions used the mainstream social media sites, with five interventions using Facebook and another two using Twitter. In particular, two interventions used multiple social media sites: one intervention used an interactive website, Facebook, and YouTube; another intervention used WhatsApp and Facebook. In these interventions, social media were typically used to deliver educational and motivational messages, host group discussion sessions, send discussion session notifications and feedback, and host other group activities (e.g., photo-challenges). Overall, the majority of the interventions showed preliminary effectiveness in increasing interest in quitting, prompting quitting attempts, and sustaining abstinence. Although low participant retention was a potential concern, Naslund et al. concluded that social media sites were feasible and acceptable platforms for delivering smoking cessation interventions since the studies were successful in recruiting and retaining smokers online.

2.3.1.3 Vaccines and Immunizations

Vaccine-preventable diseases (VPDs) are a major cause of morbidity and mortality worldwide. Every year, 1.5 million children die from VPDs such as pneumococcal disease and Hepatitis B [39]. In adolescents and adults, VPDs include life-threatening diseases such as influenza, meningitis, and certain cancers. An extremely successful and cost-effective way of preventing VPDs is vaccination. It is estimated that vaccination prevents more than two million deaths every year worldwide [39]. However, vaccination coverage is suboptimal in certain population subgroups and for certain vaccines. One reason is the widespread misconceptions about vaccination side effects in the general population as many question the safety of vaccines, thinking vaccines can cause attention-deficit or autism [40]. The emergence of new media, including social media, has provided new ways through which people communicate and share information about vaccination for education purposes. Social media's ability to reach a large audience quickly has made it an ideal tool for delivering intervention aiming to improve vaccination coverage.

One systematic review (Odone et al. 2017) examined the effectiveness of interventions that apply new media (i.e., smartphone and internet-based mass communication tools) to improve vaccine uptake and coverage [11]. Odone et al. searched the electronic databases Medline and Embase for intervention studies, published between January 1999 and September 2013, that adopted the following new media: text messaging, smartphone applications, email communications, social networks and portals such as Facebook, Twitter, and YouTube, websites, and blogs. They considered interventions targeting vaccinations universally recommended for children, adolescents, and adults, including diphtheria, tetanus, pertus-

sis, poliomyelitis, hepatitis B, measles, mumps, rubella, Haemophilus influenzae b (Hib), varicella, pneumococcal vaccine, meningococcal vaccine, papillomavirus (HPV), and seasonal influenza vaccine. The authors identified 19 studies for review, in which 16 were published between 2010 and 2013. Seven studies were RCTs and five were nonrandomized trials.

Seven of the 19 studies reported findings on the use of internet-based, including social media-based interventions, to improve immunization coverage. These interventions typically included education modules and reminder/recall systems delivered through personalized portals, websites, and mainstream social media such as Facebook and YouTube. Only one study assessed vaccination uptake as the primary outcome. In this particular RCT, the investigators examined the efficacy of a personalized web-based portal on influenza vaccination uptake. The portal provided personal health records, social forums, and messaging tools that allowed consumers to interact with each other and with healthcare professionals. It was reported that participants with access to the portal were more likely than those with no access to receive an influenza vaccine. Other studies assessed perceived vaccine efficacy and safety, and willingness to get vaccinated as primary outcomes. These social media-based interventions in general increased individuals' willingness to get vaccinated.

2.3.2 *Mental Health*

2.3.2.1 *Schizophrenia*

Schizophrenia is a chronic and severe mental illness that has disabling symptoms, including hallucinations, delusions, thought and movement disorders, and negative symptoms [41]. Current schizophrenia treatments typically include pharmacotherapy, psychotherapy, and family psychoeducational interventions that target relapse prevention, symptom management, and functional recovery. It has been shown that psychoeducational interventions are effective in managing schizophrenia beyond pharmacotherapy alone [42]. However, traditional psychoeducational interventions have extremely low penetration rates (<10%) among schizophrenic patients that limit their use [43]. Common barriers for the low poor penetration rate include the high cost associated with intervention delivery and the stigma associated with mental health treatment. On the other hand, web-based psychoeducational interventions can overcome these barriers by lowering intervention cost and minimizing stigma. These online interventions have been shown to be effective among individuals diagnosed with schizophrenia [44]. It has become popular to use online tools, including social media, for delivering psychoeducation therapy.

Two systematic reviews (Alvarez-Jimenez et al. 2014; Välimäki et al. 2016) evaluated the effectiveness of social media-based interventions among individuals diagnosed with schizophrenia [12, 13]. Alvarez-Jimenez et al. systematically analyzed the evidence on the acceptability, feasibility, safety, and benefits of Internet and mobile-based interventions for supporting psychosis treatment among

individuals with schizophrenia. The investigators searched the major databases through August 2013 for Internet or mobile-based interventions conducted among individuals diagnosed with schizophrenia-spectrum disorders. A total of 12 studies, published between 2005 and 2013, were identified. Three out of the 12 studies included a social media component in their interventions. Välimäki et al. assessed the effects of social media-based interventions for supporting mental health and well-being among individuals diagnosed with schizophrenia-spectrum disorders. Ten major databases were searched through June 2015 for social media-based RCTs. Two trials, published in 2010 and 2011, were identified.

Between the two systematic reviews, we found four unique interventions with a social media component, including one pilot study, one quasi-experimental study, and two RCTs. The quasi-experimental study used a web-based family psychoeducation intervention that had a discussion board and real-time group chat sessions [45]. Although the participants reported high levels of satisfaction, the investigators found the intervention had little impact on the schizophrenic patients' clinical status or relatives' distress. Among the two RCTs, one employed a social media intervention using a peer support Listserv or bulletin board. Results showed that, compared to the control group, the intervention group reported improved symptoms and quality of life, but lower social support and less effective self-management at follow-up. The other RCT employed a web-based intervention with a family psychoeducation module (e.g., coping strategies, promotion of self-efficacy) and a moderated supporter and peer discussion forums. It was reported that the intervention group had improved stress level, but lowered perceived social support at follow-up, compared to the control groups. Overall, results from these interventions showed that social media use was generally less effective than the standard care (i.e., control) group among individuals diagnosed with schizophrenia.

2.3.3 Chronic Disease

2.3.3.1 Cancer

Cancer is the second leading cause of death in the United States and worldwide [46, 47]. Despite great progress in cancer prevention and management, it is estimated that approximately 18.1 million new cancer cases (1.7 million in the United States) will be diagnosed and 9.6 million individuals (0.6 million in the United States) will die from cancer in 2018 [46, 47]. In the United States, there are more than 15.5 million cancer survivors [47], many of whom experience persisting symptoms such as pain, fatigue, anxiety, and depression. To target populations at higher risk of cancer and cancer survivors for intervention, the use of innovative technology and tools, including social media, is needed to deliver cancer prevention and management interventions that are of high quality and cost-effective.

One systematic review (Han et al. 2018) summarized and evaluated intervention studies using social media for cancer prevention and control [14]. Han et al.

searched the major databases with cancer-related keywords, “cancer,” “prevention,” “management,” and “oncology,” and identified 18 studies published between 2011 and 2016. These studies included six RCTs, nine pilot studies with no control groups, and three survey studies with no interventions. Among the intervention studies, six targeted all cancer types, five targeted breast cancer, and one study each targeted pediatric, gynecological, skin, and colorectal cancers. The majority of the interventions used the mainstream social media sites. Facebook was the most frequently used social media either by itself or with other social media sites in 11 interventions. Twitter, YouTube, and blogs were used in 5, 6, and 7 interventions, respectively. Further, six interventions used more than one social media site. For example, Lauckner et al. compared the effects of Facebook, YouTube, Twitter, and blogs for delivering a cancer risk reduction message [48]. The primary goal of the social media-based interventions was to provide overall cancer-related knowledge and social support, a goal shared by 11 interventions.

Overall, evidence suggests that social media-based interventions can improve general cancer-related knowledge. Three studies delivered cancer prevention education through social media and showed a significant improvement in cancer knowledge and skills. Lauckner et al. suggested that YouTube might be the most effective in delivering educational messages. Only one study showed the intervention did not have a statistically significant impact on cancer knowledge and healthy lifestyles [49]. Among cancer survivors, a few studies showed that social media-based interventions could increase knowledge about cancer survivorship and decrease psychological distress, while others showed the interventions had no effect on these outcomes. In the studies included in Han et al., we found that social media interventions had no effect on quality of life among cancer survivors.

2.3.3.2 Diabetes Management

Diabetes affects more than 30 million individuals in the United States and over 422 million individuals worldwide [50, 51]. As the seventh leading cause of death, it is estimated that diabetes is responsible for more than 250 thousand deaths and cost \$327 billion (total costs of diagnosed diabetes) per year in the United States. Diabetes can lead to complications, and thus reduce quality of life and increase the risk of premature death. To manage diabetes, especially among those with type 2 diabetes, lifestyle modification and behavior changes are needed to improve glycemic control and reduce complications. It is important to develop and implement interventions that aim to educate diabetic patients and their families about diabetes self-management and healthy lifestyle and behaviors. However, many diabetic patients have failed to manage their diabetes and achieve the goals of glycemic control and complication reduction. Designing diabetes management interventions that are effective in the real world settings is critical, and social media has become a popular platform for delivering these interventions.

Two systematic reviews (Cotter et al. 2014; Gabarron et al. 2018) described the current evidence on the use of social media in interventions for diabetes management among individuals affected with diabetes [15, 16]. Cotter et al. searched the major databases through January 2013 for Internet-based interventions. The diabetes-related search terms included “diabetes management” and “diabetes control.” They identified nine interventions published between 2000 and 2012, including eight RCTs and one quasi-experimental study. Gabarron et al. searched the databases through February 2018 for interventions that included a social media component using keyword “diabetes” in combination with social media-related keywords. They identified 20 studies published between 2000 and 2017, including 16 RCTs and one quasi-experimental study. The majority of the interventions were published after 2012.

Between the two systematic reviews, 23 unique interventions included a social media component. The majority of the interventions were web-based interventions designed to promote diabetes education and healthy behaviors, such as being active, healthy eating, and glucose monitoring.

Although a few studies used social media as the main intervention platform, social media was typically used as a supporting tool for reinforcing regular visits of the main website and providing social support among patients. Cotter et al. reported that message boards and discussion forums were the most common types of social media. In contrast, Gabarron et al. included newer interventions and found that many interventions considered mainstream social media sites such as Facebook and Skype.

The primary outcomes of these social media interventions typically included diabetes knowledge and self-efficacy, behavior outcomes (physical activity, dietary behavior, medication adherence), and clinical outcomes (Hemoglobin A1C). It was shown that social media interventions were generally effective in increasing diabetes knowledge among individuals with diabetes. However, findings were mixed regarding healthy behaviors. Some studies reported improved physical activity, healthy eating, and medication adherence, while some found the interventions had no effect on these outcomes. The effect of social media intervention on Hemoglobin A1C is also mixed, with only a subset of the interventions showing decreased Hemoglobin A1C level at follow-up.

2.3.3.3 Human Immunodeficiency Virus (HIV)

Despite the global HIV control effort, it is estimated that approximately 36.9 million people live with HIV worldwide [52]. In 2017, about 1.8 million people became newly infected with HIV and 940 thousand people died from HIV-related causes. Some populations are disproportionately affected by HIV, such as men who have sex with men (MSM), those who inject drugs, sex workers, and transgenders [53]. HIV interventions targeting these high-risk populations face unique barriers, including persistent stigma, discrimination, and low-risk perception [54–56]. Therefore, innovative way of reaching these populations are needed to deliver HIV interventions

on HIV testing, linkage to care and therapy, and retention. In the past decade, social media sites have been gradually adopted to deliver HIV interventions, especially among the high-risk populations.

Two systematic reviews (Muessig et al. 2015; Cao et al. 2017) examined the effectiveness of social media-based interventions in promoting HIV testing, treatment, and care among key populations [17, 18]. Muessig et al. searched the major databases, including HIV-related conference databases, between 2013 and 2014 for smartphone-, Internet-, and social media-based interventions that address the HIV testing, treatment, and care continuum. The HIV-related conferences included Conference on Retroviruses and Opportunistic Infections (CROI); International AIDS Society (IAS2013 and AIDS2014), US Conference on AIDS (USCA), STD Prevention Conference, and Youth+Tech+Health (YTH). They identified ten social media interventions. Cao et al. searched the databases, including HIV-related conference databases, through August 2016 for HIV interventions using social media. They identified 26 studies published between 2011 and 2016, among which eight were RCTs. There were 33 unique social media interventions between these two systematic reviews.

The majority of the HIV-related interventions were designed to promote primary HIV prevention, HIV testing, and linkage. Many interventions used virtual communities that offered education modules about HIV and HIV testing, HIV counseling, referral for HIV testing, and expert and/or peer support. Social media was also used by many as a platform for identifying high-risk populations and delivering messages and HIV self-testing services. For example, some studies targeted men who have sex with men (MSM) by sending personal messages or promotional banners on social media and mailing home-based HIV self-testing kits [57, 58]. Both Muessig et al. and Cao et al. reported that Facebook was the most popular social media for HIV-related interventions. Grindr, a social networking app catering to MSM, was also used by many interventions. Other social media of choice included Twitter, YouTube, WhatsApp, and sexual networking sites and apps such as Gaydar.

Social media interventions that aimed to promote HIV testing uptake were generally shown to be effective. It was also shown that HIV testing uptake was even higher for interventions that were participatory and peer-driven. Further, social media interventions that delivered HIV self-testing services to MSM were shown to be effective in promoting HIV testing, as more than half of the participants returned the test kits. In one particular study conducted in China among MSM and transgender participants, social media was used as a crowdsourcing tool for delivering an intervention in the form of a video contest for promoting HIV testing [59]. The study showed that the intervention was as effective as a promotional video designed and delivered by social marketing experts, whereas the cost of the intervention was significantly lower than that of the social marketing intervention.

2.4 Discussion and Conclusion

Findings from our review suggest that, in health interventions, social media is mostly being used to deliver education programs that aim to increase awareness and knowledge, to send reminder messages that aim to encourage participation and healthy behaviors, and to facilitate communication among key stakeholders (e.g., participants, caregiver, healthcare providers) that aims to provide social support. Social media-based interventions have a small to moderate effect in promoting modifiable health behaviors including exercise and healthy diet, smoking cessation, and vaccination. However, social media-based psychoeducation interventions do not appear to be effective among individuals with schizophrenia. Findings are mixed for social media-based interventions aiming at cancer prevention and control and diabetes management, with some studies reporting noneffective interventions. Lastly, social media-based interventions are shown to be effective in promoting HIV testing among high-risk populations.

One limitation of these intervention studies is that most of them used social media in combination with other intervention components. As a result, almost none of them was able to examine the isolated effect of social media on outcome measures. Another limitation of these interventions is that many of them lacked a theoretical framework for behavior change and therefore did not explore the underlying behavioral mechanisms. Future social media-based interventions need to overcome both methodological and practical challenges related to participant recruitment and retention, sustaining clinically meaningful outcomes and identifying underlying behavioral mechanisms.

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