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The impact of social media influencers on health outcomes: Systematic review

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ABSTRACT

A fast emerging area of public health interest is the potential role of social media influencers in spreading health information and affecting health behaviour. The aim of this research was to systematically synthesise evidence on the impact of social media influencers on health outcomes. A systematic search of six databases (Medline, Embase, PsycINFO, CINAHL, Science Citation Index and Sociology Collection) was conducted in October 2021, with an update search in January 2023. Two reviewers independently screened titles and abstracts. We included interventional study designs which examined the effect of social media influencer as the primary or only exposure on a quantified health outcome. We used narrative synthesis to summarise the characteristics and main findings of studies within each of four main topic areas. We assessed quality using a critical appraisal checklist for quasi-experimental studies. We identified twelve studies across four areas that met the inclusion criteria: children's dietary behaviour (n = 5), body image dissatisfaction (n = 4), influenza and COVID-19 (n = 2), and social comparison and anxiety (n = 1). Influencer marketing of unhealthy foods had a statistically significant effect on increasing children's immediate energy intake, but no effect was found for influencer promotion of vegetables. When an unhealthy food is marketed by an influencer of unhealthy appearance, this led to an increased preference for healthy snacks. Exposure to idealised influencer body imagery had statistically significant negative impacts on body image and mood. Anxiety caused by viewing idealised portrayals of motherhood was the same whether or not the portrayal was by an influencer. Public health campaigns harnessing influencers to promote hygiene habits in the context of COVID-19 and influenza showed some positive changes in health behaviours. Most of the published studies are of poor methodological quality with poor generalisability and statistical weaknesses. We conclude that social media influencers have both negative and positive impacts on health outcomes, with negative impacts seen consistently in studies of body image dissatisfaction. Further research is needed to harness the potential positive health impact of social media influencers, while mitigating against harmful effects.

1. Introduction

Digital health has emerged as a new determinant of health (Morley et al., 2020; Kickbusch et al., 2021). A growing area of research is focussing on the intersection between social media and health, with particular focus on the health effects of social media use on children and young people (The Lancet, 2019; Vogel et al., 2021; Richards et al., 2015), and more recently the potential harmful spread of health disinformation (Gottlieb and Dyer, 2020; Gisondi et al., 2022). The prolific, largely unregulated, user-generated nature of social media means individuals can be exposed to misleading or dangerous health information (Suarez-Lledo and Alvarez-Galvez, 2021). Studies have shown the potential for harm from social media messaging (Memon et al., 2018; Chu et al., 2018; Liu et al., 2020), with less attention paid to health benefits. Some of the most prominent content on social media is produced by social media influencers: influential individuals on social media platforms who impact the attitudes and behaviours of their followers through endorsements, perceived credibility, and engaging content (Freberg et al., 2011; Zou et al., 2021).

The phenomenon of social media influencers and their role in spreading health information and influencing health behaviours and other outcomes is of growing interest to the public health community and is the subject of this current study. Prior to undertaking this work, we were aware of an emerging evidence base using a variety of study

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designs examining aspects of the role of social media influencers in relation to health. For example, studying what influencers say about health (Zou et al., 2021), investigating the credibility (Jenkins et al., 2020; Sabbagh et al., 2020) or other characteristics of influencers that may influence how their message is perceived (Lou and Kim, 2019), as well as studies addressing our central question of whether influencers affect health outcomes, but there has been no previous systematic review to establish the current evidence base for this area, and therefore no synthesis of primary research to guide policy or further research. The aim of this research was therefore to systematically identify and synthesise the evidence from intervention studies which examine the impact of social media influencers on health outcomes, and to draw conclusions on the implications for policy and future research.

2. Methods

2.1. Eligibility criteria

We included either experimental or observational interventional study designs which examined the effect of social media influencer as the primary or only exposure (or intervention). We defined the population of social media influencers as: "individuals, or individual accounts, who impact the attitudes and/or actions of a significant number of their followers through their social media content". This is in line with Oxford's 'Dictionary of Social Media' (Chandler and Munday, 2016). We included any type of a comparison group. Studies needed to report an observed or self-reported quantified health outcome as a primary outcome. In the analysis studies were grouped by health topic area. Inclusion and exclusion criteria are shown in Table 1.

2.2. Identification of studies

The authors worked with a healthcare librarian to refine the search terms, and the search strategy was applied to six bibliographic databases all searched from inception to 15th October 2021 (Medline; EMBASE; CINAHL; PsycINFO; Science Citation Index - Web of Science Core Collection; Sociology Collection via ProQuest). An update search using the same strategy was undertaken on 11th January 2023. The search strategy used MeSH terms where available and keyword searches in title, abstracts and author keywords. The strategy used Boolean operators to combine the terms as follows: [specific terms for social media influencer such as Instagrammer or YouTuber] OR [general terms for influencer such as influencer or endorser or parasocial combined AND with general terms for social media such as social adjacent to media or names of platforms such as Instagram, Facebook, TikTok etc]. In medical literature databases (Medline and EMBASE) no further limits or filters were applied. In other databases exploded search terms for health topics were used and combined using 'AND' with the above string in order to reduce hits to studies likely to have a health focus. The search strategy is included as Appendix 1.

Table 1
Eligibility criteria.

Inclusion criteria	Exclusion criteria
• Interventional study designs (experimental or observational). • Studied social media influencers were the sole or primary intervention in an experimental study, or exposure in an observational study. • All study population characteristics (such as age or gender). • All settings and geographic locations. • Any comparator. • Measured a health outcome as a primary outcome, defined as an observed or self-reported quantified change in health outcome including health behaviour. • Published in a peer-reviewed journal in English (or with a published translation in English).	• Cross-sectional correlation studies, qualitative studies, secondary research, reviews, commentary-style articles. • Social media influencers were not the main interventional element or exposure, or were a peripheral part of a broader complex intervention, or were only investigated as a mediating or moderating factor. • Influencers in the study did not have a wide following, for example as peer-influencers (within a friendship group). • No, or insufficient, health outcomes were measured. For example, only measuring an intention to buy a health-related product, or an attitudinal change, or level of engagement with health-related posts. • Not peer-reviewed. • Not published in English or with an official translation in English.

2.3. Study selection

The selection process encompassed a title sift followed by an abstract sift (Mateen et al., 2013). This approach was taken given that these articles were not well indexed in bibliographic databases and the sensitive search strategy employed identified a large number of articles which could be excluded by title alone. The title sift was undertaken by one author who coded them as '1' (include), '2' (exclude) and '3' (uncertain). All titles coded as either '1' or '3' were included for the abstract sift. The second author (JP) coded 10% of the original sample which showed a greater than 90% agreement with the coding. The disagreements were discussed to ensure consistent understanding of the eligibility criteria and inform the future coding. The second author additionally reviewed every title that the first author had coded as 'exclude' to ensure no relevant papers were excluded, maximising sensitivity. 557 of the original search results were identified for abstract screening, and a further 128 from the update. After double screening of abstracts by both authors, with referral to full text during this process when the decision was unclear, we identified 18 full text papers for data extraction. At this stage a further six papers were excluded. The most common reason for exclusion at extraction stage was an outcome that did not meet our threshold criteria for a measurable health outcome (such as 'intention to buy a fitness product' which was deemed as insufficient). Twelve eligible studies were finally included.

2.4. Data extraction and quality assessment

Data relating to aims, methods and results were extracted into a spreadsheet by one author, and extraction checked for each study by the second author. Items related to study quality (including risk of sampling bias, presence of a control group, control of confounding factors, justification of sample sizes, reporting of effect sizes, reliability of measurement tools, setting generalisability, and use of appropriate statistical analysis) were extracted to complete the critical appraisal checklist for quasi-experimental studies from the University of Adelaide (Joanna Briggs Institute, 2020). The results section summarises the quality appraisal of all studies before this is considered within the synthesis of results by topic area.

2.5. Synthesis methods

Extracted data were tabulated to summarise characteristics and findings for included studies and to confirm inclusion. Studies were grouped by topic area (research focus). Within each of these areas the findings were then summarised from the data extraction sheets, using a narrative approach to capture the study designs, populations, interventions, comparators and main health outcome results as presented by the authors of each study, and comparing with the other studies within same topic area. This narrative synthesis also took account of the study limitations identified through the use of the critical appraisal checklist. Given the heterogeneity of topic areas, study designs and outcome measures, meta-analysis was not appropriate. This narrative synthesis was conducted by both authors working collaboratively. We followed PRISMA reporting guidance and the PRISMA checklist is available as Appendix 2.

3. Results

3.1. Search results

The first search identified 3493 hits. The update search identified 2274 hits. After removal of duplicates (a larger proportion in the update search as there was some overlap in dates searched), and ineligible records (conference abstracts, news items, books, and dissertations), a total of 2489 titles remained (1362 in the first search, 1127 in the update). PRISMA flow diagram is shown in Fig. 1.

3.2. Characteristics of included studies

Table 2 shows the characteristics of the twelve included studies (Coates et al., 2019a, 2019b; Folkvord and de Bruijne, 2020; De Jans et al., 2021, 2022; Lowe-Calverley and Grieve, 2021; McComb and Mills, 2021; Tiggemann and Anderberg, 2020; Zhang et al., 2021; Bonnevie et al., 2020; Yousuf et al., 2020; Kirkpatrick and Lee, 2022). All were published in the years 2019–2022. Nine studies found influencers had a statistically significant effect on health outcomes (Coates et al., 2019a, 2019b; De Jans et al., 2021, 2022; Lowe-Calverley and Grieve, 2021; McComb and Mills, 2021; Tiggemann and Anderberg, 2020; Zhang et al., 2021; Bonnevie et al., 2020). One found influencers combined with traditional media may have a significant effect on health outcomes (Yousuf et al., 2020). Another study found that new mothers experienced anxiety when viewing images of idealised motherhood whether or not this was portrayed by an influencer (Kirkpatrick and Lee, 2022). The remaining study, which investigated the effect of influencer promotion of vegetables on adolescents' subsequent intake, found no statistically significant associations between influencers and health outcomes (Folkvord and de Bruijne, 2020).

3.3. Assessing risk of bias and evidence quality

The twelve included studies were quality appraised using a checklist for quasi-experimental design studies (Joanna Briggs Institute, 2020). Most of the eligible studies had significant methodological limitations. Evidence of risk of bias was found in all studies. Generalisability to a real world context was poor in ten of the twelve studies (Coates et al., 2019a, 2019b; Folkvord and de Bruijne, 2020; De Jans et al., 2021, 2022; Lowe-Calverley and Grieve, 2021; McComb and Mills, 2021; Tiggemann and Anderberg, 2020; Zhang et al., 2021; Kirkpatrick and Lee, 2022). A number of the studies relied on convenience sampling of school or university student volunteers (Coates et al., 2019a, 2019b; Lowe-Calverley and Grieve, 2021; McComb and Mills, 2021) or recruits who volunteered through online platforms (Folkvord and de Bruijne, 2020; Tiggemann and Anderberg, 2020; Zhang et al., 2021; Kirkpatrick and Lee, 2022). Three studies did not state which statistical tests were used to determine significant differences (De Jans et al., 2021, 2022; Bonnevie et al., 2020). Six of the twelve studies failed to report effect size of statistical findings (Folkvord and de Bruijne, 2020; De Jans et al., 2022; Zhang et al., 2021; Bonnevie et al., 2020; Yousuf et al., 2020; Kirkpatrick

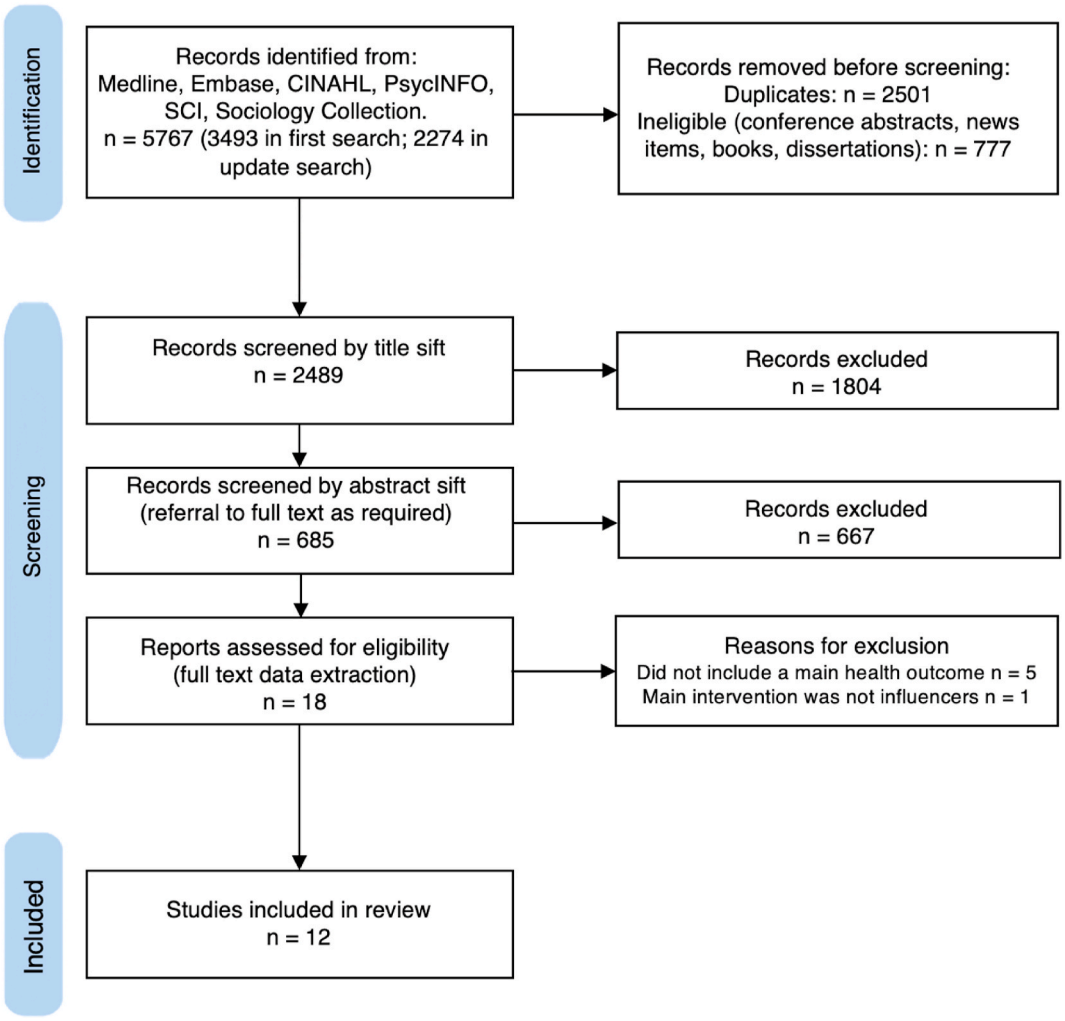

Fig. 1. PRISMA flow chart showing identification of intervention studies..

Table 2
Summary characteristics and findings for all included studies.

Study	Research Focus	Aim	Design	Intervention/exposure	Health outcomes	Key Findings
Coates et al. (2019a)	Dietary behaviour	To examine the impact of Instagram marketing of foods on children's food consumption	Randomised between-subjects design (two conditions and control). N = 176 children aged 9-11	Exposure to mock Instagram profiles of famous YouTube vloggers in a healthy food marketing condition, unhealthy food marketing condition, or non-food marketing control (control)	Ad libitum snack intake (kcals) of healthy vs unhealthy snacks	Children who viewed influencers with unhealthy snacks had significantly increased overall intake (mean 448.3 kcals versus 357.1 kcals; P = .001), and significantly increased intake of unhealthy snacks specifically (388.96 kcals versus 292.2 kcal P = .001), compared with children who viewed influencers with non-food products. There was no statistically significant difference in overall kcals consumed between the healthy snack condition and the control condition
Coates et al. (2019b)	Dietary behaviour	To examine the impact of YouTube influencer marketing of foods on children's food consumption	Randomised 3 × 2 between-subjects design (with control). N = 151 children aged 9-11	Exposure to YouTube videos of famous vloggers in an unhealthy food marketing condition (no advertising disclosure), an unhealthy food marketing condition (with advertising disclosure), or a non-food marketing condition (control)	Ad libitum snack intake (kcals) from branded vs unbranded chocolate biscuits	Children exposed to influencer food marketing with or without the advertising disclosure consumed more of the marketed snack relative to the alternative (180.5 kcals versus 97.4 kcals; P < .001); the control showed no difference (P = .186). Children who viewed influencer food marketing with a disclosure (and not those without) consumed 41% more of the marketed snack compared with control (214.4 kcals versus 149.6 kcals; P = .002)
Folkvord and de Bruijne (2020)	Dietary behaviour	To examine if an Instagram influencer promoting a healthy vegetable (red pepper) increased subsequent consumption among adolescents	Randomised between-subjects design (two conditions and control). N = 132 adolescents aged 13-16	Exposure to manipulated posts of a popular Dutch influencer in a vegetable marketing condition, an energy-dense marketing condition and a non-food marketing condition (control)	Ad libitum vegetable snack intake	There was no significant effect of type of Instagram post (vegetable post, energy-dense post, non-food control post) on vegetable intake (P > .05, only P value presented in paper no absolute results)
De Jans et al. (2021)	Dietary behaviour	To examine whether exposure to an Instagram profile showing a healthy, athletic lifestyle or a sedentary lifestyle, and promoting either a healthy or unhealthy snack, can affect children's snack choice	Randomised 2 × 2 between-subjects design (no control). N = 190 children aged 8-12	Exposure to a fictitious Instagram profile showing either an active influencer lifestyle or a sedentary influencer lifestyle, with the influencer portraying a snack of either low or high nutritional value	Food choice behaviour (strawberry vs donut)	There was no difference in snack choice when the product high in nutritional value was promoted by an athletic versus a sedentary influencer (54.2% versus 47.1% chose the healthy snack; P = .605). However, the children chose a healthy snack more frequently when the product low in nutritional value was promoted by the sedentary influencer compared to when it was promoted by the athletic influencer (58.1% versus 38.3% made this choice; P = .020)
De Jans et al. (2022)	Dietary behaviour	To examine the effect on food choice of promotion of unhealthy (cookie) versus healthy (carrot) snacks by either an overweight or a thin-ideal influencer	Between-subjects experimental design. N = 146 children aged 11-13	Exposure to thin-deal or overweight influencer, promoting either a healthy or unhealthy snack (two by two design)	Food choice behaviour (carrot vs cookie)	When young people were exposed to an influencer with a thin-ideal weight marketing either a healthy or unhealthy snack, there was no significant difference in their subsequent choice for the healthy snack (18.2% vs

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Table 2 (*continued*)

Study	Research Focus	Aim	Design	Intervention/exposure	Health outcomes	Key Findings
						20%; P = .850). When they were exposed to the same marketing from the overweight influencer, they were significantly more likely to choose the healthy snack after viewing the post from the 'unhealthy' influencer promoting the unhealthy product (50% made this choice versus 21.1% who did so after viewing the overweight influencer promoting the healthy product; P = .007)
Lowe-Calverley and Grieve (2021)	Body image	To investigate the impact of high versus low popularity influencer images on mood and body dissatisfaction	Randomised between-subjects design (two conditions and control). N = 111 women aged 17–40	Exposure to idealised Instagram images of influencers in a high-metric condition, low-metric condition, or exposure to control images of nature scenery	Measures of mood and body dissatisfaction	Participants exposed to the influencer images experienced statistically significantly greater negative mood than the control group, who were exposed to Instagram images of nature and scenery (P < .001). The effect size was medium (d = 0.66). There were no significant differences between the influencer-high and influencer-low image conditions (P = .214)
McComb and Mills (2021)	Body image	To measure the effect on young women's body image following exposure to idealised body images of Instagram influencer models (each with>11 million followers)	Randomised between-subjects design (one condition and control). N = 142 female undergraduates	Exposure to idealised, unaltered Instagram images of influencer models with many followers, alongside completion of a body comparison task, or exposure to an Instagram account showing landscape images alongside completion of a comparison task (control)	Measures of weight and body dissatisfaction, measures of cognitive emotion regulation	Those exposed to the idealised body images felt significantly more weight dissatisfaction (P < .001) and appearance dissatisfaction (P < .001) and less confidence (P < .001), than those in the control group who viewed landscape images
Tiggemann and Anderberg (2020)	Body image	To investigate the effect of exposure to idealised male Instagram images on men's body satisfaction	Randomised between-subjects design (two conditions and control). N = 300 men aged 18-30	Exposure to manipulated idealised Instagram posts of male influencers in either a clothed condition or a bare-chested condition, or exposure to images of scenery (control)	Post exposure measures of body and facial satisfaction	Viewing the fitspiration (bare chested) influencer images resulted in significantly lower body satisfaction than viewing the control images of nature scenery (P = .014). Viewing the fitspiration images also resulted in significantly lower body satisfaction than viewing the fashion (clothed) images (P = .23). There were no differences between these groups in scores of facial satisfaction
Zhang et al. (2021)	Body image	To investigate the impact of high versus low popularity social media influencer images on young women's body satisfaction and mood	Randomised between-subjects design. N = 420 women aged 18–35	Exposure to idealised influencer imagery alongside high engagement metrics, or the same idealised imagery adjusted for low engagement metrics, or a set of nature image (control)	Mood and body satisfaction	Viewing both the high- and low-popularity images led to lower body satisfaction and greater negative mood than viewing the nature control images, (P = .004 and P < .001). There was no significant difference between the image group with high popularity and the image group with low popularity in terms of young females' body satisfaction and mood, (P = .28 and P = .13)

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Table 2 (*continued*)

Study	Research Focus	Aim	Design	Intervention/exposure	Health outcomes	Key Findings
Bonnevie et al. (2020)	Influenza	To assess the impact of a social media influencer campaign on vaccination behaviour	Pre- and post- exposure survey (with control). Large population-based observational study. 5447 respondents completed post-intervention survey	Exposure to vetted messages promoting knowledge about flu vaccination by micro influencers in the campaign area (no exposure in control region)	Change in vaccination-related behaviour	Those who had seen a flu promotion post on social media had higher self-reported vaccination coverage compared to those who had not seen flu promotions (50.9%, n = 195 vs 43.3%, n = 1011, P = .005)
Yousuf et al. (2020)	Covid-19	To determine whether a social media campaign including influencer marketing, can influence hygiene and distancing behaviour and reduce person-to-person transmission of SARS-CoV-2	Pre- and post- exposure survey (no control). Large population-based observational study. 17189 participants completed post-intervention survey	Exposure to campaign video and infographics promoted by news media and a popular social influencer	Change in handwashing and physical distancing behaviour	Exposure to newspaper infographics and influencer video was positively associated with washing hands in all areas (adjusted odds ratio 2.14; 95% CI, 1.83–2.50; P < .001), and washing hands long enough (adjusted odds ratio, 1.86; 95% CI, 1.59–2.16; P < .001). Exposure to the influencer video alone was not associated with any changes in handwashing behaviour compared to the unexposed group (P = .630). Findings on physical distancing were mixed (see main text)
Kirkpatrick and Lee (2022)	Idealised portrayals of motherhood.	To investigate the impact of social comparison by new mothers to idealised and non-idealised portrayals of motherhood, by influencers and non-influencers	Within-subjects experimental design. N = 464 new mothers	Exposure to idealised and non-idealised Instagram posts portraying motherhood by mommy influencers and 'everyday' mothers (two by two design)	Measures of envy and state anxiety	While participants reported greater levels of state anxiety and of envy after exposure to the idealised portrayals of motherhood compared to the non-idealised portrayals (both P < .001), there was no significant difference whether these portrayals were by influencers or 'everyday' mothers

and Lee, 2022). Ten of the twelve studies failed to report if the assumptions underlying their chosen statistical tests were assessed and met (Coates et al., 2019a, 2019b; De Jans et al., 2021, 2022; Lowe-Calverley and Grieve, 2021; Tiggemann and Anderberg, 2020; Zhang et al., 2021; Bonnevie et al., 2020; Yousuf et al., 2020; Kirkpatrick and Lee, 2022). Power calculations or explanations for how sample sizes were adapted from prior research designs were absent in six studies (Folkvord and de Bruijne, 2020; De Jans et al., 2021, 2022; Zhang et al., 2021; Bonnevie et al., 2020; Kirkpatrick and Lee, 2022), and unjustified in a further two studies (Coates et al., 2019a; Lowe-Calverley and Grieve, 2021).

3.4. Dietary behaviour

Five studies investigated the effect of social media influencers on dietary behaviour in children or adolescents using randomised between-subjects experimental designs. Two studies from the same team, one investigating Instagram (Coates et al., 2019a) and the other YouTube (Coates et al., 2019b), showed that influencer marketing of unhealthy snacks to UK primary school children increased their immediate kcal intake, and that advertising disclosures did not prevent this effect. Children who had been exposed to Instagram influencer marketing of unhealthy snacks had a significantly higher mean intake of these snacks, whereas promotion of healthy food did not increase their intake, suggesting a food-type specific effect. In the YouTube study, children exposed to influencer food marketing with or without the advertising disclosure consumed more of the marketed snack relative to the alternative snack, and the presence of the disclosure led to increased intake versus the control.

In another study children were exposed to Instagram profiles of influencers with an active lifestyle or influencers with a sedentary lifestyle, with each influencer profile promoting either healthy or unhealthy snacks (De Jans et al., 2021). When a healthy snack was promoted, there was no significant intake on snack choice between the two influencer types. However, when both influencers promoted the unhealthy snack, children chose the healthy snack more often in the sedentary influencer condition compared to the active influencer condition. The authors theorise that viewing perceived negative repercussions of unhealthy habits motivated the children to select the healthier option. The same authors conducted a similar study (De Jans et al., 2022), in which they showed that choice of a healthy snack was higher when an overweight influencer promoted an unhealthy snack compared to a healthy snack. Using a thin-ideal influencer did not affect snack choice. The final dietary study used influencer posts of a famous Dutch influencer in three conditions: promoting vegetables, promoting energy-dense foods, and promoting a non-food item (Folkvord and de Bruijne, 2020). The absolute values for intake are not presented in the results but the authors state that promotion of vegetables (specifically, red peppers) had no statistically significant effect on adolescents' immediate intake of vegetables when compared to those who had viewed the other products.

3.5. Body image

Four studies evaluated the impact of social media influencers on body dissatisfaction using randomised between-subjects designs. Two studies investigated how idealised influencer imagery affects body image and mood, and assessed how 'influencer metrics' (popularity) moderate this effect (Lowe-Calverley and Grieve, 2021; Zhang et al., 2021). Exposure to idealised imagery of influencers (both low and high metric types) resulted in significant increases in reported body dissatisfaction compared to control imagery. There was no significant difference in body dissatisfaction when comparing low and high metric conditions. Female body dissatisfaction was also the focus of a study of the effects of upwards comparison to idealised images of Instagram model influencers, versus control images of landscape paintings (McComb and Mills, 2021). Statistically significant increases in weight and body dissatisfaction, and reductions in confidence were found for participants exposed to Instagram influencer models. Lastly, a study researched how men's body image and satisfaction changes in response to exposure of Instagram influencer images of fashion and fitspiration (Tiggemann and Anderberg, 2020). Male participants who viewed bare-chested (fitspiration) images experienced statistically significant decreases in body satisfaction compared to participants who viewed the control images or who viewed the fashion (clothed) images.

3.6. Influenza and COVID-19

Two studies assessed the impact of using social media influencers to promote protective behaviours against respiratory viruses, one focussing on influenza (Bonnevie et al., 2020) and one on COVID-19 (Yousuf et al., 2020). The influenza study was a public health campaign, with selected campaign and control areas (each consisting of eight US regions with similar demographics) to promote influenza vaccination and knowledge awareness among African American and Hispanic populations (Bonnevie et al., 2020). The intervention consisted of influencers in the campaign regions posting content in their usual style but including a preapproved message relating to the influenza vaccination. Engagement with these influencers' ($n = 117$) posts was estimated to have potentially reached more than 9 million individuals. Pre- and post-intervention surveys showed that among participants who explicitly recalled exposure to the campaign posts (14.5%) there was a statistically significant self-reported uptake in vaccination ($P = .005$). The second study investigated whether a social media influencer-driven public health campaign in the early days of the COVID-19 pandemic (March to April 2020) could promote hygiene and physical distancing behaviours (Yousuf et al., 2020). The impact of the influencer video was a joint central focus, along with newspaper infographics, and thus this study was included. Influencer-specific findings were limited by the small sample size of respondents who reported having only seen the video compared to those reporting seeing newspaper infographics only or those who saw both. There were no significant improvements in handwashing behaviours in the video-only (influencer-only) group. However, participants who reported viewing both the video and the newspaper infographics, compared to the newspaper infographics alone, had a greater adjusted odds ratio for handwashing (2.14 compared to 1.31). The findings on physical distancing when the participants had symptoms were mixed and show that the infographic-only group had slight increases in these behaviours (adjusted odds ratio 1.1), whereas the combined and video-only groups were associated with slight decreases (adjusted odds ratio of 0.79 and 0.62 respectively). There was a small significant increase in these behaviours in the infographic-only group for physical distancing when a household member had symptoms, and no significant effect in the other two exposure groups.

3.7. Anxiety

One study examining social comparisons, measured self-reported state anxiety after viewing idealised and non-idealised portrayals of motherhood (Kirkpatrick and Lee, 2022). While the study showed that mothers viewing these profiles did experience increased anxiety and envy, this was the case whether the portrayals were presented by influencers or 'everyday' mothers (no significant difference).

4. Discussion

4.1. Summary of main findings

The majority of intervention studies on the effects of social media influencers on health have examined influencer marketing of health or unhealthy foods on dietary intake, or the impact of influencer imagery on body image dissatisfaction. We also found studies of public health campaigns in relation to influenza and COVID-19, and a study on social comparison and idealised motherhood. Most studies used between-subjects experimental designs, often with student volunteers, with the two public health campaigns the only ones in real-world settings.

Dietary habits during developmental years are associated with short and long-term consequences on health (Chang et al., 2021; Reichelt and Rank, 2017). Children are explicitly targeted by food advertisements because of their perceived vulnerability to persuasive product marketing (Smith et al., 2019). Children's exposure to influencer food marketing was the commonest topic included in the review. We excluded a large number of studies which had investigated the impact of influencer food marketing on 'intention to try' as this did not meet our criterion of a health outcome (Abell and Biswas, 2023). Influencer marketing of unhealthy snacks to children was significantly associated with increases in immediate kcal intake in two studies (Coates et al., 2019a, 2019b), and unexpectedly, introducing a "protective" advertising disclosure did not mitigate these effects, and was associated with increased intake of branded unhealthy snacks compared to control (Coates et al., 2019b). The messenger is potentially more important than the message, and influencer lifestyle can also affect children's dietary decision choice: children were more likely to choose the healthier snack over the unhealthy snack when the unhealthy snack was promoted by a sedentary or an overweight influencer (De Jans et al., 2021, 2022). The desire to avoid the perceived negative consequences of unhealthy food may have driven this choice.

Increased body dissatisfaction has been linked to decreased mental health and disordered eating behaviours in both men and women (Barnes et al., 2020; Bucchianeri and Neumark-Sztainer, 2014; Lavender et al., 2017). There is an extensive body of work examining the impact of viewing social media images *per se* on body dissatisfaction, not specifically in relation to influencers, but these papers did not meet our criteria. In some cases this was a close judgment to make: McComb and Mills who authored one of our included papers (McComb and Mills, 2021) conducted a similar study (McComb and Mills, 2022) showing a negative impact on body dissatisfaction among 402 female undergraduates after viewing any of three types of idealised body image compared with a control condition. While these images were taken from Instagram the authors state that they chose images from accounts with fewer than 60000 followers to remove any influencer effect of "celebrity worship" or "parasocial interaction", hence we excluded this paper. Other work that examines the impact of idealised imagery on social media (not influencers) show similar decreases in body satisfaction (Jiotsa et al., 2021; de Valle et al., 2021; Grabe et al., 2008). It is not surprising, then, that in our included studies exposing female participants to idealised imagery of female influencers (regardless of influencer popularity) led to greater reported body dissatisfaction and decreased mood (Lowe-Calverley and Grieve, 2021; McComb and Mills, 2021). When men were exposed to idealised male influencer images (clothed and bare-chested), they experienced statistically significant decreases in body satisfaction in the bare-chested condition, but not in the clothed condition (Tiggemann and Anderberg, 2020). The authors observe that this differs from literature findings for women, where negative effects of

viewing idealised imagery occurs regardless of clothing.

Two studies assessed the feasibility and impact of implementing influencer-driven public health campaigns. An influenza vaccine campaign found statistically significant improvements in knowledge and attitudes towards the influenza vaccine, as well as increased vaccine uptake amongst individuals in the campaign area who recalled exposure to the influencer campaign posts (Bonnevie et al., 2020). A study using influencers and traditional news to rapidly promote hygiene behaviours in the Covid-19 pandemic found that viewers who watched both an influencer video and viewed newspaper infographics reported greater improvements in handwashing behaviours (Yousuf et al., 2020). Statistical significance was also found for those who viewed the newspaper infographics alone, but not for those who only watched the influencer video. The authors' findings on physical distancing suggest that those exposed to the influencer video either alone or in combination with the infographics actually had a decrease in self-reported physical distancing when the respondent had symptoms (and no effect when a household member had symptoms).

We were surprised to find only one intervention study meeting our criteria that looked at anxiety as an outcome, that was not related to body image. The included study showed that new mothers experienced anxiety when making social comparison to idealised motherhood imagery whether or not this was presented by an influencer. We excluded a second study (Parsons et al., 2021) as the focus of this excluded paper was to examine the impact of social comparisons with influencers on social rank, and although they did include some measures of affect and social anxiety, the analyses of these were secondary and the outcomes for these measures were not presented separately. Consistent with the study of idealised motherhood, the authors reported that participants (student volunteers) who had higher levels of social anxiety at baseline experienced greater decreases in positive affect, greater increases in negative affect, and greater decreases in state self-esteem after viewing influencer profiles.

4.2. Strengths and weaknesses of this study

Despite limiting to intervention studies, most included studies had methodological limitations, with risk of bias in all studies. As with all systematic reviews, it is possible that we may have missed a study. We are confident that by developing a sensitive search in consultation with a healthcare librarian, tailored to different databases, and using gold standard approaches to support our rigour we have minimised the chance of this. However due to the inconsistent uses of terms such as 'social media influencer' it was challenging to apply eligibility criteria. For example, a study in 2018 used 'influencers' to promote messages relating to skin cancer prevention, but these were 'local TV weather presenters' which did not meet our criteria (Gough et al., 2017). Similarly, in an analysis study aiming to improve male sexual health in China, the 'sexual health influencers' were self-defined based on how actively they discuss sexually transmitted infections with their peers (Yang et al., 2021). Studies which used the term 'blogger' were a source of ambiguity. For example, in a study on 'mommy bloggers', the 75 recruited bloggers reached a total of 445 readers, not enough to be social media influencers (Wright et al., 2019). Ambiguity also arose from celebrity studies. For example, in one study, 'celebrity involvement' included interactions on social networking sites but these were traditional celebrities rather than influencers (Ho et al., 2016). It was sometimes difficult to disentangle if brand advertising or influencer marketing was the focus: in a study on Twitch users' attitudes and behaviours in response to food marketing on Twitch and YouTube, the focus was on users' broader exposure to advertising, not influencer-specific marketing, and was therefore excluded (Pollack et al., 2021). It was also challenging to assess whether a health outcome had been measured, and not just an intention or attitude change such as intention to engage in Covid-19 preventive behaviours (Looi et al., 2023), engagement with Covid-19 misinformation (Wasike, 2022), or intention to do exercise (Durau et al., 2022).

Because of the challenges with applying the eligibility criteria, in this discussion we have provided details of two studies which were close to being included (McComb and Mills, 2022; Parsons et al., 2021), and these show findings consistent with those of the included studies. We restricted this review to intervention study designs as representing a good level of evidence of effectiveness. However, there is other literature using cross-sectional methods (mainly self-completion surveys) investigating correlations between self-reported use of influencers and health measures (Heiss and Rudolph). Although these studies are at higher risk of bias and provide evidence of association rather than causation, they can add value to our understanding of the role of influencers and further work should synthesise these. In conducting this review we followed a protocol but we did not preregister this which is a limitation.

4.3. Implications and recommendations

A key finding of this systematic review has been to identify the methodological shortcomings in the included studies, and therefore help set the agenda for future work where our main recommendation is for more primary research using rigorous methodology to explore the impact of influencers on health behaviour, and potentially on clinical outcomes. Studies in real-world settings are particularly needed. We also need to investigate the spread of health misinformation through influencers, and to understand what characteristics of influencers, or of their message or platform, are key, and whether certain people are more likely to be influenced. We need theoretical frameworks to explain the mechanism of influence and inform the design of public health interventions which harness influencers. Regulatory bodies, as well as public health agencies, should monitor this evolving landscape, take note of these early findings and the areas of uncertainty in the evidence base, and recognise the potentially harmful health effects of increasingly pervasive influencer marketing on social media.

5. Conclusion

Consumption of social media content has become a routine aspect of many people's lives. Social media influencers are an increasingly pervasive global phenomenon with the potential to exert wide influence on their followers. In this context, where large numbers of people, especially young people, are being exposed to persuasive content daily, we sought to examine the potential effects of social media influencers on health outcomes. This is an emerging field of study, and all the included studies were published within the last four years, with the main focus being on food intake and body image. There are significant methodological limitations in the current evidence base and further interventional work is needed. Understanding the impact of influencers will protect against current and future harm to health outcomes and may also enable public health agencies to generate strategies to harness influencers to promote positive health behaviours.

Authorship

JP conceived, designed, and supervised the study. TP wrote the protocol, devised and implemented the search strategies, led the screening process and assessed the publications, created data extraction tables, and extracted and analysed the data. JP was the second screener and second extractor. JP and TP jointly drafted the manuscript and interpreted the findings. JP is guarantor.

Data sharing

The primary data are in the original papers included in the review. The data extraction tables are available from the authors on request.

CRediT authorship contribution statement

John Powell: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Tabitha Pring:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing.

Declaration of competing interest

We declare no competing interests.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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