Review

Social Comparison and Mental Health

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Abstract

Purpose of Review Opportunities for social comparison, or self-evaluation relative to others, are increasingly common via technologies such as mobile apps and social media. Comparison is often assumed to be detrimental for mental health, as many studies show negative associations. Yet, the majority of existing studies use weak methods that do little to inform clinical efforts. The goals of this review are to describe advances in methods for studying the impact of social comparisons on mental health and to identify critical next steps to advance treatment.

Recent Findings Methods such as intensive ambulatory assessment (e.g., ecological momentary assessment), creative approaches to experimental manipulation, and just-in-time adaptive interventions are increasingly popular and reveal the complexity of social comparison's short- and longer-term effects. Findings highlight the need for personalized and context-sensitive approaches to promoting mental health.

Summary Historical assumptions about the role of social comparison in mental health outcomes are based on a preponderance of cross-sectional research that offers little to our understanding of mechanistic pathways or effective treatments. As the consequences of

comparisons can be negative or positive, in the short and long terms, and can vary within person, there is a pressing need for treatment approaches that address this complexity in context.

Introduction

Social comparison describes the process of evaluating oneself in relation to others, in domains such as abilities, status, and performance [1]. This process can provide information about one's current status and guidance for how to achieve specific goals [2]. Yet, it is perhaps most known for its potential negative consequences; because it can also highlight one's perceived inferiority relative to others and inspire negative emotions such as jealousy, it is often characterized in idioms such as "comparisons are odious" and "comparisons are the thief of joy." One contributor to this negative reputation is the ubiquity of social media and other digital tools that facilitate social networking. These platforms present many opportunities for social comparison: users tend to post about only the positive aspects of their lives and thereby, present idealized views of their experiences [3].

Indeed, some studies on this topic show that social comparisons are associated with negative mental health outcomes. For example, McCarthy and Morina's [4•] review found a positive association between self-reported or experimentally induced social comparison and depression and anxiety in clinical populations. Social comparison orientation, which describes an individual's reported perception of their own tendency to compare themselves with others, has often been identified as a cross-sectional correlate of such outcomes [5] and as a risk factor for the development of clinically significant depressive symptoms [6] and symptoms of disordered eating [7] among women ages 12–24. Reports of social comparisons made on social media have also been correlated with negative mental health outcomes such as poor subjective well-being [8], and much has been made of the observation that increased rates of depression and self-harm have corresponded with increases in technology use [9]—particularly among young women [10].

Such evidence has led to public health recommendations to limit social media and other socially networked screen time (as a way to reduce comparison) [11] and to unhelpful lay *and expert* advice to "stop making comparisons." The latter is particularly problematic. As comparisons occur automatically in response to information about others' status or performance [12], advice to not make comparisons is as useful as any other advice to avoid certain thoughts: they only make these thoughts more likely to occur [13] and breed frustration with the resulting inability to avoid them. A more useful approach involves cognitive restructuring (cf. cognitive therapy), whereby the comparer is taught to evaluate comparative thoughts by weighing the evidence for and against its accuracy [14]. This typically results in recognition that comparative self-evaluations are inaccurate—or at least, not the absolute or only truth—and leads to reductions in negative affect.

Evidence consistent with this idea shows that the association between reported comparisons and negative affect is lower among individuals with more effective cognitive appraisal skills [15]. In intervention work, techniques such as written emotional disclosure that encourage cognitive processing or reappraisal of thoughts and feelings about a topic can show incidental effects on reported comparisons, which mediates the effect of the intervention on mental health outcomes (e.g., sleep quality, disordered eating behavior) [16]. Yet, social comparison is rarely the particular focus of treatment research; it is typically one of several types of maladaptive thoughts that can be addressed with cognitive intervention, either directly or indirectly [17]. Attempts to directly change negative comparisons by replacing them with positive comparisons have been unsuccessful [18], though meta-analysis shows that cognitive techniques can reduce reported comparison activity in the context of interventions to reduce body satisfaction [19].

Does Social Comparison Warrant Treatment?

Along with evidence for social comparison's associations with negative mental health outcomes, there is also evidence that social comparison is unrelated to mental health, or has *positive* associations with mental health outcomes (in general or specific to social media). Results from a recent umbrella review showed that although there is some evidence of a negative association between social media use (and associated comparison opportunities) and adolescent mental health, the literature predominantly suggests weak or inconsistent associations [20]. Interestingly, recent evidence suggests that social media use (and associated comparison opportunities) is one of the *least* powerful influences on adolescent mental health, as opposed to experiences such as bullying or insufficient family support [21]. Further, in a study conducted during the COVID-19 pandemic, social comparison specific to social media was positively associated with concurrent depressive symptoms, but predicted *lower* levels of loneliness and anxiety two to three weeks later [22•]. Similarly, time spent on Instagram (and associated comparison opportunities) was not related to psychological well-being, though using Instagram for social interaction was related to an individual's general positive emotions (e.g., happiness, joy) and flourishing (e.g., "I lead a purposeful and meaningful life"), and using Instagram for browsing was related to positive emotions [23].

Critically, not all comparisons are created equal, and differences between comparison experiences could help to explain equivocal findings. For example, comparisons of abilities (or behaviors) on social media are linked to negative cognitive experiences such as rumination, whereas comparisons of opinions are linked to positive cognitive experiences such as reflection [24]. In addition, we can compare ourselves to others we perceive as doing better than we are in a given domain (*upward comparison*), as doing worse than we are (*downward comparison*), or doing similarly (*lateral comparison*) [25•]. Upward comparisons have been identified as particularly problematic: comparisons to those perceived to be better off are the ones that can highlight the comparer's relative inferiority and inspire negative emotions such as envy as well as low self-esteem [26] and rumination [24]. Even when we have a range of options to choose from, many people approach comparison targets that are associated with negative outcomes (e.g., upward targets) [27–29].

Yet, even upward comparisons can be associated with benefits such as improved well-being, and correlations between social comparison and mental health outcomes show considerable heterogeneity between people [30]. Multiple theoretical models have proposed that people either identify with or contrast themselves against comparison targets, focusing on perceived similarities versus differences (respectively) [31, 32]. Evidence supporting these models shows that contrasting against upward targets and identifying with downward targets result in unfavorable self-evaluations, which are associated with negative experiences such as anxiety, discouragement, and stress [15, 33]. Conversely, identifying with upward targets and contrasting against downward targets result in favorable self-evaluations, which are associated with positive experiences such as hope, inspiration, and confidence in one's

ability to achieve desired goals [34]. As a result, concluding that comparisons are generally bad (or good) for mental health is problematic, particularly in the context of mental health treatment.

Weaknesses in Existing Work

Across comparison features and mental health outcomes of interest, much of our existing evidence relies on a narrow set of research designs that have considerable methodological limitations (see Table 1). First, directional (and often, causal) conclusions about the association are routinely drawn from cross-sectional designs that involve only retrospective self-report [5]. Available measures ask respondents to report on their comparisons aggregated over long periods—or worse, over unspecified periods [35]—to determine the extent to which they believe they are a person who makes comparisons. As noted, social comparison occurs automatically and often without conscious processing, and it carries stigma. Consequently, global, retrospective assessments are subject to a range of recognition problems, recall biases, and efforts to maximize social desirability. Further, similar comparison opportunities could have distinct effects on the same person, at different times and/or in different contexts—possibly due to within-person variability in identification and/or contrast processes [36••, 37]. These nuances are essential to our understanding of the role of comparisons in mental health outcomes, but cannot be detected with global, retrospective self-report.

In addition, that global assessments of social comparison are associated with negative mental health outcomes such as anxiety and depressive symptoms indicates only that *people who* report "more" social comparison (or who more strongly identify as a person who makes comparisons) have worse outcomes. It is likely that experiencing these mental health symptoms also increases sensitivity to and/or the likelihood of making comparisons that have negative consequences. Although the experience of negative-outcome comparisons may reciprocally contribute to negative mental health outcomes, this does not indicate that comparisons *cause* these outcomes. Longitudinal studies conducted over long periods represent a step toward establishing directionality. However, existing studies suffer from similar measurement issues (e.g., using retrospection over long periods) and have rarely controlled for mental health symptoms concurrent with social comparison at baseline.

Experimental designs do allow for drawing directional and causal conclusions, as well as for mapping mechanistic pathways that have direct implications for treatment. With respect to studying the effects of social comparison, however, experimental designs carry their own limitations: each participant typically experiences only one of a limited range of comparisons and the outcomes assessed are extremely short term (e.g., affect or behavioral intentions immediately after comparison exposure) [29]. These designs have high internal validity but limited external validity, and outcomes represent transient experiences rather than "mental health" as typically conceptualized. Such limitations dampen the immediate utility of traditional experiments

Table 1. Summary of strengths and weaknesses of traditional study designs used to link social comparison to mental health outcomes

Design	Examples	Strengths	Weaknesses
Cross-sectional (survey)	Alcaraz-Ibáñez et al. [5], Yue et al. [15], Rai et al. [23]	Can use validated measures with strong psychometric properties (allows for comparison between studies) Can be quicker and easier to collect data from large samples (relative to designs below)	Between-person only, retrospective (aggregating), low ecological validity Comparison measures are limited (cf. direction, dimension) Cannot establish direction of association, temporal sequencing of experiences, or causation
Longitudinal assessment	Arigo and Cavanaugh [6], Ruggieri et al. [22•], Yang et al. [24]	Can use validated measures with strong psychometric properties (allows for comparison between studies) Can establish long-term associations and risk profiles (e.g., for worsening symptoms) Can examine between-person differences in change over time (between-*within-person)	Often treated as between-person only Retrospective (aggregating) validated measures may not be sensitive to change, low ecological validity Direction often assumed rather than directly tested Cannot establish causation
Experiment	de Vries et al. [3], Arigo and Smyth [16], Lew et al. [18]	Can establish causation and mechanistic pathway(s), high internal validity Can be combined with other approaches to understand changes in perceptions and longer-term outcomes	Often treated as between-person only Outcome assessments may not be sensitive to context, low ecological validity

for informing mental health treatment, though innovation in this area holds promise, as outlined below.

In sum, social comparison is a complex phenomenon that includes significant measurement challenges. Consequently, unraveling the link(s) between social comparison and mental health outcomes—and identifying options for treatment, if appropriate—requires innovative and sophisticated research designs.

Innovative Work Linking Social Comparison to Mental Health Outcome Improvements in Observation

As an initial step toward mapping the complexity of social comparison, intensive ambulatory assessment designs use technologies such as text messages and smartphone applications to access experiences of comparison and its correlates as they unfold in daily life. This involves people reporting on comparison and other experiences of interest one or more times per day, focusing on what happened today, in the past few hours, or what is happening at the time of the report [36••]. As a result, this approach substantially reduces (if not eliminates) retrospective recall bias and allows for understanding *what happens when* we make comparisons, rather than merely *who* makes them. Consequently, strengths of this approach are the ability to determine within-person variability in comparison (and its contextual predictors) as well as the temporal sequencing of comparisons and experiences such as positive and negative affect as they occur (to determine the direction of potential effects; see Table 2) [38, 39•].

For example, event-contingent experience sampling asks participants to complete a self-report each time they recognize that they have made a comparison. Reports indicate that comparisons occur on a wide range of dimensions, in various directions, approximately 24 times over 13 days [40]. Ecological momentary assessment (EMA) using signal-contingent reporting (i.e., participants report on comparisons multiple times per day, in response to signals or prompts to do so) is an increasingly popular approach, particularly in the domain of body satisfaction and disordered eating behavior. These studies, which have typically focused on the comparison experiences of young women, show that upward social comparisons of appearance are associated with negative cognitive reactions (specifically body dissatisfaction) and behavioral responses such as binge eating, body checking, and restriction of food intake [41]. Unfortunately, existing findings of this nature are highly confounded by pre-existing body concerns (as associations are strongest among those with more severe body dissatisfaction prior to intensive assessment [42•]) and often draw incorrect conclusions about "increases" or "decreases" in comparisons (in the absence of a true baseline as the referent [43]). However, such studies illustrate the potential for EMA and other intensive ambulatory assessment methods to elucidate the nature of associations between comparisons and mental health outcomes as they occur in people's natural environments.

Table 2. Summary of recommendations for future work to understand associations between social comparison and mental health outcomes

Recommendation	Methodological approach/designs	Aims, rationale, strengths	Examples
Focus on *what happens when* comparisons occur, rather than only for whom they occur	Intensive ambulatory assessment (daily diary, experience sampling, ecological momentary assessment)	Maximize ecological validity by assessing comparison in the natural environment, as people go about their lives	Leahey et al. [42•], Moore et al. [52••], Arigo et al. [68]
- Assess comparison occurrence and processes uniquely (not merely social media exposure)		Establish temporal sequencing of comparison and mental health experiences in the natural environment	
		Identify contexts and in-the-moment characteristics that can help to explain associations	
Prioritize establishment of causality and mechanistic pathway(s)	Experimental designs	Establish causation and mechanistic pathway(s), high internal validity	Dondzilo et al. [54] Hunt et al. [55••]
Use advanced research designs to combine the above perspectives	Intensive ambulatory assessment with embedded randomization (e.g., ecological momentary intervention, micro-randomized trials, just-in-time adaptive intervention)	Maximize ecological *and* internal validity by randomizing in the natural environment, as people go about their lives	Andrade et al. [57•], Zhu et al. [64••], Mishra et al. [73]
		Establish causation and mechanistic pathway(s) in the natural environment	

Of note, many of the mental health outcomes of interest represent constellations of symptoms that occur over weeks or months (e.g., depression). Daily or momentary reports of a subset of these experiences are not typically intended to operationalize the syndrome or diagnosis, but can reveal details about how people experience these clinical outcomes in daily life. For instance, EMA of suicidal ideation and its predictors (e.g., hopelessness) shows that the intensity of these experiences varies considerably within person over 28 days [44], even among those who are at high risk for suicide [45]. EMA allows for both tracking the (in)stability of affective states and the specific emotions associated with high instability (e.g., hostility, fear, sadness) [46, 47•]. EMA of depressive symptoms has also shown associations with depression scores obtained from in-person assessments and has validity for tracking daily symptomatic changes in depression [48]. EMA shows good adherence, even in populations with affective disorders, indicating that the associated participant burden is manageable [49, 50]. Evidence also shows that single-item measures of symptoms are valid, which could be particularly useful with populations that have mental health concerns that make it difficult to respond to multi-item surveys [51].

With respect to social comparisons, EMA can also reveal the affective states that accompany comparisons [36••], to elucidate the temporal sequencing and timing of comparisons and relevant emotional or mental health experiences. For example, in a study of individuals with eating disorders, EMA showed that negative cognitive and emotional experiences were reported concurrently with social comparisons based on appearance [42•]. Further, when EMA has been examined in contrast with traditional pencil and paper responses, EMA has captured significant post-test changes that methods without the same time sensitivity overlook [52••]. As a result, EMA may be particularly useful for detecting changes in affect associated with depressive, affective, and personality disorders. This could improve the evaluation of interventions in these populations (relative to single assessments over longer periods), by detecting whether interventions change patterns of cognitive/emotional experiences (e.g., comparisons, affective states) or their within-person associations in daily life [52••].

This approach can also help to clarify causal and mechanistic models to be tested with other methods. For example, EMA allows us to move beyond questions of what happens in daily life, to determine *how* we get from naturally occurring opportunities (e.g., for social comparisons) to mental health outcomes (e.g., depression). As noted, researchers have proposed that it is not the occurrence of particular comparisons that result in positive or negative affect; it is *how we interpret* the information gleaned from a given comparison that determines how we respond emotionally (i.e., identification vs. contrast) [31, 32]. This is a promising model for several reasons. First, evidence consistently supports its validity with multi-item, between-person reports (global and retrospective) [34]. Although the full model has not yet been validated using temporally sensitive within-person methods, formative work shows that using single items in intensive ambulatory studies that use patient mobile phones for assessment is feasible and shows concurrent validity among adults with schizophrenia [53•].

Second, this approach provides logical, testable, and potentially modifiable pathways between comparisons and immediate experiences that can contribute to and/or maintain mental health conditions. For example, identification and contrast offer specific targets for cognitive restructuring, helping patients to target the precise link in the cognitive chain that can be addressed with alternative interpretations. This may enhance the effectiveness of cognitive approaches to treatment for anxiety, depression, and other mental health conditions where problematic comparisons are prevalent, particularly if EMA or similar methods can be used to help patients reflect on their comparisons in the moment. Importantly, however, we first need to validate identification and contrast processes within person, to verify these processes as determinants of response *when* comparisons occur (not just for whom).

Novel and Creative Approaches to Experimental Manipulation

More broadly, there is a critical lack of evidence indicating a *causal* link between comparisons and relevant outcomes. Recent work shows advances in this area using novel and/or creative approaches to experimental design, particularly with respect to social media and associated opportunities for comparisons (see Table 2). For example, a straightforward first step would be to establish a causal or dose–response association, via random assignment to social media exposure (vs. none) or to specific doses of exposure (such as hours per day, days per week, or particular platforms). Yet, prior or typical exposures are challenging confounds to eliminate, and ensuring adherence to a randomly assigned condition is difficult and costly, if it is possible at all.

To address these problems, researchers have used reduction methods: participants are asked to reduce their exposure by specified amounts from what is typical for them, and assessments of mental health outcomes are conducted before and after the reduction period. These studies showed a decrease in disordered eating symptoms among those who did not use social media for one week (vs. continued use as usual) [54] and decreased loneliness and depression among those who reduced social media use to 10 min per platform per day (vs. continued use as usual) [55••]. Although this method does not definitively identify social media or related opportunities for comparison as the root cause(s) of mental health problems, it provides compelling experimental evidence that reductions in or removal of exposure has benefits. As social media exposure can lead to poor mental health in more ways than via social comparison (e.g., bullying, lack of desired response from others), an important next step would be to isolate comparisons in such work, to determine its unique contributions.

Other researchers have used experimental work to establish social comparison as a mediator of the cross-sectional association between social media use and mental health outcomes. For example, Samra et al. [56] randomly assigned groups of college students to view different comparison targets and assessed their reactions and affect, as well as self-reported social media use and social comparison behaviors, showing that fixating on upward comparisons and negatively comparing oneself to others on social media mediates

the cross-sectional relation between problematic social media use and depressive symptoms. Examining social comparison response experimentally is a strength and an advancement in this area. As discussed, however, cross-sectional assessment of predictors and outcomes of interest is highly limited; depressive symptoms could be the driver of social media use and still show that social comparison response mediates this association.

In our view, research to investigate the potential causal pathway(s) between social comparison and mental health would be most compelling if it capitalized on the combined strengths of ambulatory, within-person assessment and experimental methods. One step in this direction asked college students to report on their comparisons via social media once per day for 14 days; midway through this period, those randomized to a "social savoring" intervention viewed a video about savoring as an alternative to comparison [57•]. Relative to those who did not watch the video, those who did reported better self-esteem and reported fewer comparisons on post-intervention days when they engaged in more social savoring. This offers compelling preliminary evidence that brief interventions *may* influence the impact of negative social comparisons on mental health. As there was no active control for the intervention in this study, and as both groups decreased their comparisons in the last 7 days of assessment, it is possible that merely raising awareness of comparisons via intensive assessment changed the process or its consequences. Further research is needed to fully identify the potential of such substitution approaches and the duration of their effects.

In addition, there is great promise in the use of multiple randomizations for the same person, across distinct assessments, to determine how and under what circumstances different types of comparisons lead to positive versus negative outcomes [58, 59]. This approach would allow for drawing strong causal conclusions about what happens when we make comparisons in daily life, improving our ability to identify and test (1) mechanistic pathways in the real world, and (2) effective intervention approaches. It could also help us to determine whether there are in fact person-level characteristics that differentiate those who use comparisons in problematic ways (suggesting that personalization or person-level tailoring of interventions might be useful), versus context-specific determinants that vary within person (suggesting that contextual adaptation would be more effective).

Personalization, Adaptation, and Tailored, Technology-Supported Intervention

It is in the areas of personalization and adaptation that advances in technology have afforded the most meaningful insights into social comparison's link to mental (and other) health outcomes. Initial steps in this area have assumed that there is an optimal type of comparison for each person and have focused on identifying the one that is most beneficial (i.e., personalization). A straightforward approach is to ask people what kind of comparison target they prefer to see (e.g., upward vs. downward), and facilitate exposure to either this type of target or a non-preferred type. In one such study, participants who were matched to their preferred type marginally increased

their daily step count over two weeks, whereas those who were matched to a non-preferred type demonstrated significant decreases in their step count over two weeks [60]. As social media companies are well aware, giving people what they prefer is an excellent way to promote engagement with technology. There are also benefits for treatment, as engagement with digital mental health tools is positively associated with improvement in outcomes of interest (e.g., depressive symptoms) [61].

However, here we raise several potential issues: people make comparisons for different reasons and may achieve one goal at the expense of another (e.g., feeling good in the moment vs. longer term) [62]. As a result, people may not have optimal insight into what works best for them, particularly if they are asked to aggregate over multiple, potentially distinct contexts. An alternative is to infer the optimal type of comparison for someone, which has been done in several creative ways. Jablonska and Zadel [63] used global, retrospective self-reports of women's social comparisons on Instagram (including identification and contrast processes) and mental health symptoms such as depression, anxiety, and well-being, to construct comparer types. These types were women who reported predominantly positive responses (i.e., using upward identification and downward contrast and experiencing associated positive affect), women who reported predominantly negative responses (i.e., using upward contrast and downward identification, with associated negative affect), and women who reported equal use of positive- and negative-outcome processes. Less depression and anxiety and greater well-being were reported by positive types than negative types.

This is an interesting step that confirmed the between-person associations between identification/contrast comparison processes and mental health. Yet, it relied on cross-sectional, self-report methods that do little to help identify the optimal comparison for a given person or context. An alternative approach is to assess an individual's comparison response across exposure to multiple types of comparison targets. Across multiple studies, Zhu et al. [64••] randomly assigned adults to a set of four upward, downward, or mixed targets (two upward, two downward) based on physical activity, once per day for nine days (phase 1). Participants could choose one of their assigned targets to view a profile, and motivation to be physically active in the moment was assessed before and after this process. Based on selection, change in motivation, and behaviorally assessed steps per day, a machine learning algorithm identified the optimal set of comparison targets for each participant to view and choose from, and either kept this consistent for the following 21 days or continued to randomize the choice set (phase 2). Those who received the personalized comparison target choice set showed greater increases in motivation to be physically active during phase 2 than those who continued to receive randomized sets.

Although motivation for physical activity is not a traditional mental health outcome of interest, there is considerable evidence that physical activity is strongly (and causally) associated with mental health [65–67]. Zhu et al.'s [64••] work also serves as an example of an approach that could help to identify the optimal comparison target for a given person—assuming that "optimal" is a person-level characteristic, rather than one that changes within person. As people use social media and related technology in multiple contexts

that may affect their response to comparison opportunities (e.g., distinct cognitive or affective states), this is an open question that warrants considerable attention. In a follow-up to Zhu et al., Arigo and colleagues [68] used the baseline, daily randomization period across three studies to demonstrate extensive within-person variability in selection and response to physical activity-based comparison targets. In other words, the same person selected the same type of target on multiple days and showed a range of responses, from moderate increases to *decreases* in motivation to be active. Understanding whether factors such as pre-comparison affective state and/or identification or contrast processes contribute to the consequences of a given comparison are critical to advancing both basic and intervention science in this area.

Such work would enable effective *adaptation* of comparison opportunities, to ensure that each opportunity is matched to the comparer's context as it changes over short periods. Mobile just-in-time adaptive interventions (JITAI) [69] test the effects of distinct treatment components on short-term outcomes of interest over multiple exposures, often using micro-randomization that embeds randomization into EMA or other intensive ambulatory assessment designs [59]. It then adjusts content, timing, frequency, and other aspects of the intervention to promote the most positive response. In this sense, it learns the contextual determinants of a user's variability and adapts to offer the optimal treatment for the user *in their immediate context*. Meta-analytic work in this area shows that JITAIs work better than non-adaptive interventions for improving mental health outcomes and that adaptation to context is more efficacious than personalization [70•].

To our knowledge, social comparison is rarely included as a treatment component in JITAIs for promoting physical health [71] and has not yet been tested in JITAIs for mental health outcomes. This work will be particularly useful if it elucidates the immediate experience of comparison and its short-term effects with longer-term outcomes. As noted, and given the current availability of necessary technology, this is a critical area of opportunity for advancing our basic understanding of social comparison, its associations with mental health outcomes, and our available treatments.

Discussion

In contrast to common assumptions, social comparison is a complex process: comparison opportunities are everywhere, though people show meaningful heterogeneity in the extent to which they make and respond to comparisons (via social media and elsewhere). Importantly, heterogeneity exists both between and *within* person; the latter is usually given little attention, and ignoring either is problematic with respect to treatment recommendations. Specifically, our current understanding of associations between comparisons and mental health is based on weak evidence, including cross-sectional or longitudinal associations that cannot speak to causality or traditional experimental designs that

reveal only the immediate effect of a single comparison event. Recent advances in research designs and mobile technology afford opportunities to overcome these limitations, by elucidating the comparison process as it unfolds in daily life and revealing the comparison contexts that might prompt optimal responses (see Table 2).

For instance, intensive ambulatory assessment designs such as EMA offer high ecological validity and help to clarify the timing, immediate context, and temporal sequencing of comparisons and their responses under naturalistic conditions. As noted, evidence generated with these methods could identify promising mechanistic pathways for intervention and point to opportunities to intervene in the moment, as needed. This approach could also be used to support patient progress in therapy, by providing daily or momentary reports for discussion during sessions or as assessments of progress (e.g., with respect to comparison responses). Micro-randomization (within person), JITAI, and related approaches also hold promise for identifying the people for whom and conditions under which distinct types of comparisons are beneficial (vs. harmful) for mental health outcomes. Specific next steps involve determining the extent to which variability in identification and contrast processes contribute to the effects of comparisons in real time and the extent to which they are modifiable. Intervention components such as cognitive restructuring may improve response; alternatives may include acceptance-based approaches such as cognitive de-fusion [72] and technological support using priming in the moment to prompt a particular response [73].

The ubiquity of social media and other socially networked technologies is only increasing, though their effects via social comparison remain unclear. As such, addressing open questions about comparison is critical for realizing the potential of personalized medicine. This line of work could reveal that comparisons do not directly affect mental health outcomes, freeing researchers and treatment providers to focus on the correct culprits. As it is likely that comparisons have a complex set of effects on mental health outcomes, however, using the combined strengths of intensive ambulatory assessment and experimental methods will be optimal for identifying and addressing the negative effects of social comparisons, for whom and under what circumstances they are most likely.

Author contributions

DA conceptualized the manuscript and led its development. All authors contributed to the initial manuscript draft and revisions and prepared the tables.

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This article does not contain any studies with human or animal subjects performed by any of the authors.

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References and Recommended Reading

Papers of particular interest, published recently, have
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1. Festinger L. A theory of social comparison processes. Hum Relat. 1954;7(2):117–40.
2. Bandura A. An agentic perspective on positive psychology. 2008. 1:167–96
3. de Vries DA, Möller AM, Wieringa MS, Eigenraam AW, Hamelink K. Social comparison as the thief of joy: emotional consequences of viewing strangers' Instagram posts. Media Psychol. 2018;21(2):222–45.
4.• McCarthy PA, Morina N. Exploring the association of social comparison with depression and anxiety: a systematic review and meta-analysis. Clin Psychol Psychother. 2020;27(5):640–71.
A recent meta-analysis of evidence linking social comparison with symptoms of depression and anxiety in both clinical and subclinical populations.
5. Alcaraz-Ibáñez M, Paterna A, Griffiths MD. Exploring the differentiated relationship between body-, eating-, and exercise-related social comparisons and depressive symptoms among adolescents. J Affect Disord. 2024;344:389–96.
6. Arigo D, Cavanaugh J. Social perceptions predict change in women's mental health and health-related quality of life during the first semester of college. J Soc Clin Psychol. 2016;35(8):643–63.
7. Arigo D, Schumacher L, Martin LM. Upward appearance comparison and the development of eating pathology in college women. Int J Eat Disord. 2014;47(5):467–70.

8. Wirtz D, Tucker A, Briggs C, Schoemann AM. How and why social media affect subjective well-being: multi-site use and social comparison as predictors of change across time. J Happiness Stud. 2021;22(4):1673–91.

9. Twenge JM. Increases in depression, self-harm, and suicide among U.S. adolescents after 2012 and links to technology use: possible mechanisms. Psychiatr Res Clin Pract. 2020;2(1):19–25.

10. Twenge JM, Joiner TE, Rogers ML, Martin GN. Increases in depressive symptoms, suicide-related outcomes, and suicide rates among U.S. adolescents after 2010 and links to increased new media screen time. Clin Psychol Sci. 2018;6(1):3–17.

11. https://www.apa.org [Internet]. [cited 2024 Jan 9]. Health advisory on social media use in adolescence. Available from: https://www.apa.org/topics/social-media-internet/health-advisory-adolescent-social-media-use

12. Gilbert DT, Giesler RB, Morris KA. When comparisons arise. J Pers Soc Psychol. 1995;69(2):227–36.

13. Wegner DM, Schneider DJ, Carter SR, White TL. Paradoxical effects of thought suppression. J Pers Soc Psychol. 1987;53(1):5–13.

14. Beck AT. Cognitive therapy: nature and relation to behavior therapy. Behav Ther. 1970;1(2):184–200.

15. Yue Z, Zhang R, Xiao J. Passive social media use and psychological well-being during the COVID-19 pandemic: the role of social comparison and emotion regulation. Comput Hum Behav. 2022;127: 107050.

16. Arigo D, Smyth JM. The benefits of expressive writing on sleep difficulty and appearance concerns for college women. Psychol Health. 2012;27(2):210–26.

17. Brownell KD. The LEARN program for weight management: lifestyle, exercise, attitudes, relationships, nutrition. American Health Publishing Company; 2004.

18. Lew AM, Mann T, Myers H, Taylor S, Bower J. Thin-ideal media and women's body dissatisfaction: prevention using downward social comparisons on non-appearance dimensions. Sex Roles. 2007;57(7–8):543–56.

19. Alleva JM, Sheeran P, Webb TL, Martijn C, Miles E. A meta-analytic review of stand-alone interventions to improve body image. PLoS ONE. 2015;10(9): e0139177.

20. Valkenburg PM, Meier A, Beyens I. Social media use and its impact on adolescent mental health: an umbrella review of the evidence. Curr Opin Psychol. 2022;44:58–68.

21. Panayiotou M, Black L, Carmichael-Murphy P, Qualter P, Humphrey N. Time spent on social media among the least influential factors in adolescent mental health: preliminary results from a panel network analysis. Nat Ment Health. 2023;1(5):316–26.

22.• Ruggieri S, Ingoglia S, Bonfanti RC, Lo Coco G. The role of online social comparison as a protective factor for psychological wellbeing: a longitudinal study during the COVID-19 quarantine. Personal Individ Differ. 2021;171:110486.

The findings from this longitudinal study indicate mixed associations between social comparison and mental health outcomes: concurrent social comparison and depressive symptoms were correlated, but social comparison predicted lower loneliness and anxiety at a later time-point two-three weeks later.

23. Rai R, Cheng MI, Scullion H. How people use Instagram and making social comparisons are associated with psychological wellbeing. J Technol Behav Sci. 2023 [cited 2023 Dec 8]; Available from: https://doi.org/10.1007/s41347-023-00319-0

24 Yang CC, Holden SM, Carter MDK, Webb JJ. Social media social comparison and identity distress at the college transition a dual-path model. J Adolesc. 2018;69:92–102.

25.• Wood JV, Taylor SE, Lichtman RR. Social comparison in adjustment to breast cancer. J Pers Soc Psychol. 1985;49(5):1169–83.

Explains social comparison orientation specifically for those coping with breast cancer with findings that suggest breast cancer patients tend to engage in downward (positive) comparisons.

26 Schmuck D, Karsay K, Matthes J, Stevic A. "Looking up and feeling down". The influence of mobile social networking site use on upward social comparison, self-esteem, and well-being of adult smartphone users. Telemat Inform. 2019;42:101240.

27. Arigo D, Smyth JM, Suls JM. Perceptions of similarity and response to selected comparison targets in type 2 diabetes. Psychol Health. 2015;30(10):1206–20.

28. Derlega VJ, Greene K, Henson JM, Winstead BA. Social comparison activity in coping with HIV. Int J STD AIDS. 2008;19(3):164–7.

29. Gerber JP, Wheeler L, Suls J. A social comparison theory meta-analysis 60+ years on. Psychol Bull. 2018;144(2):177–97.

30. Meier A, Johnson BK. Social comparison and envy on social media: A critical review. Curr Opin Psychol. 2022;45: 101302.

31. Buunk BP, Ybema JF. Social comparisons and occupational stress: the identification-contrast model. In: Health, coping, and well-being: Perspectives from social comparison theory. Mahwah: Lawrence Erlbaum Associates Publishers; 1997. p. 359–88.

32. Mussweiler T, Rüter K, Epstude K. The ups and downs of social comparison: mechanisms of assimilation and contrast. J Pers Soc Psychol. 2004;87(6):832–44.

33. Arigo D, Suls JM, Smyth JM. Social comparisons and chronic illness: research synthesis and clinical implications. Health Psychol Rev. 2014;8(2):154–214.

34. Van der Zee K, Buunk B, Sanderman R, Botke G, van den Bergh F. Social comparison and coping with cancer treatment. Personal Individ Differ. 2000;28(1):17–34.

35. Gibbons FX, Buunk BP. Individual differences in social comparison: development of a scale of social comparison orientation. J Pers Soc Psychol. 1999;76(1):129–42.

36.•• Arigo D, Mogle JA, Brown MM, Pasko K, Travers L, Sweeder L, et al. Methods to assess social comparison processes within persons in daily life: a scoping review. Front Psychol. 2020;10:02909.

A comprehensive review of within-person, intensive approaches to understanding social comparison processes in the natural environment, with emphasis on the potential for identification and contrast processes to elucidate heterogeneity in comparison response.

37. Locke KD, Nekich JC. Agency and communion in naturalistic social comparison. Pers Soc Psychol Bull. 2000;26(7):864–74.

38. Hoppmann CA, Ho A. Ecological momentary assessment. in: the encyclopedia of adulthood and aging [Internet]. 2015 [cited 2023 Dec 8]. p. 1–5. Available from: https://doi.org/10.1002/9781118521373.wbeaa102

39.• Smyth JM, Juth V, Ma J, Sliwinski M. A slice of life: ecologically valid methods for research on social relationships and health across the lifespan. Soc Personal Psychol Compass. 2017;11(10):e12356.

A brief overview of the strengths of intensive ambulatory assessment methods, with examples.

40. Wheeler L, Miyake K. Social comparison in everyday life. J Pers Soc Psychol. 1992;62(5):760–73.

41. Fuller-Tyszkiewicz M. Body image states in everyday life: evidence from ecological momentary assessment methodology. Body Image. 2019;31:245–72.

42.• Leahey TM, Crowther JH, Ciesla JA. An ecological momentary assessment of the effects of weight and shape social comparisons on women with eating pathology, high body dissatisfaction, and low body dissatisfaction. Behav Ther. 2011;42(2):197–210.

A good example of using ecological momentary assessment to evaluate the role of social comparisons in mental health experiences (e.g., negative affect, disordered eating thoughts and behaviors).

43. Leahey TM, Crowther JH, Mickelson KD. The frequency, nature, and effects of naturally occurring appearance-focused social comparisons. Behav Ther. 2007;38(2):132–43.

44. Kleiman EM, Turner BJ, Fedor S, Beale EE, Huffman JC, Nock MK. Examination of real-time fluctuations in suicidal ideation and its risk factors: results from two ecological momentary assessment studies. J Abnorm Psychol. 2017;126(6):726–38.

45. Husky M, Olié E, Guillaume S, Genty C, Swendsen J, Courtet P. Feasibility and validity of ecological momentary assessment in the investigation of suicide risk. Psychiatry Res. 2014;220(1):564–70.

46. Schoevers RA, van Borkulo CD, Lamers F, Servaas MN, Bastiaansen JA, Beekman ATF, et al. Affect fluctuations examined with ecological momentary assessment in patients with current or remitted depression and anxiety disorders. Psychol Med. 2021;51(11):1906–15.

47.• Trull TJ, Solhan MB, Tragesser SL, Jahng S, Wood PK, Piasecki TM, et al. Affective instability: measuring a core feature of borderline personality disorder with ecological momentary assessment. J Abnorm Psychol. 2008;117(3):647–61.

This study compares day-to-day affect fluctuations in individuals with current depressive or anxiety disorders using EMA demonstrating the ability of EMA to capture the instability of these affective states and also the associated emotions.

48. Targum SD, Sauder C, Evans M, Saber JN, Harvey PD. Ecological momentary assessment as a measurement tool in depression trials. J Psychiatr Res. 2021;136:256–64.

49. van Genugten CR, Schuurmans J, Lamers F, Riese H, Penninx BWJH, Schoevers RA, et al. Experienced burden of and adherence to smartphone-based ecological momentary assessment in persons with affective disorders. J Clin Med. 2020;9(2):322.

50. Porras-Segovia A, Molina-Madueño RM, Berrouiguet S, López-Castroman J, Barrigón ML, Pérez-Rodríguez MS, et al. Smartphone-based ecological momentary assessment (EMA) in psychiatric patients and student controls: a real-world feasibility study. J Affect Disord. 2020;274:733–41.

51. Song J, Howe E, Oltmanns JR, Fisher AJ. Examining the concurrent and predictive validity of single items in ecological momentary assessments. Assessment. 2023;30(5):1662–71.

52.•• Moore R, Depp C, Loebach Wetherell J, Lenze E. Ecological momentary assessment versus standard assessment instruments for measuring mindfulness, depressed mood, and anxiety among older adults. Journal of Psychiatric Research. 2016;(75):116–123.

This article highlights the sensitivity of EMA in assessing outcomes post-treatment in comparison with more traditional measurement instruments such as paper and pencil surveys.

53.• Arigo D, Torous J. Development of a mobile assessment tool for understanding social comparison processes among individuals with schizophrenia: two-phase survey study. JMIR Form Res. 2022;6(5):e36541. **This study shows the utility of an intensive measure of identification and contrast processes among adults with serious mental illness.**

54. Dondzilo L, Mahalingham T, Clarke PJF. A preliminary investigation of the causal role of social media use in eating disorder symptoms. J Behav Ther Exp Psychiatry. 2024;82: 101923.

55.•• Hunt MG, Marx R, Lipson C, Young J. No More FOMO: limiting social media decreases loneliness and depression. J Soc Clin Psychol. 2018;37(10):751–68. **This study uses a simple but creative approach to demonstrating a causal association between social media exposure and mental health outcomes.**

56. Samra A, Warburton WA, Collins AM. Social comparisons: a potential mechanism linking problematic social media use with depression. J Behav Addict. 2022;11(2):607–14.

57.• Andrade F, Erwin S, Burnell K, Jackson J, Storch M, Nicholas J, et al. Intervening on social comparisons on social media: electronic daily diary pilot study. JMIR Ment Health. 2023;10:e42024.

This intensive assessment study provides preliminary evidence to support the use of interventions such as introducing "social savoring" as an alternative to social comparison on social media.

58. Baga K, Salvatore GM, Bercovitz I, Mogle JA, Arigo D. Daily social comparisons among women in midlife with elevated risk for cardiovascular disease: a within-person test of the identification/contrast model. Appl Psychol Health Well-Being. under revision.

59. Klasnja P, Link to external site this link will open in a new tab, Hekler EB, Shiffman S, Boruvka A, Almirall D, et al. Microrandomized trials: an experimental design for developing just-in-time adaptive interventions. Health Psychol. 2015;34(Suppl):1220–8.

60. Mollee JS, Klein MCA. The Effectiveness of upward and downward social comparison of physical activity in an online intervention: 15th International Conference on Ubiquitous Computing and Communications and 2016 8th International Symposium on Cyberspace and Security, IUCC-CSS 2016. Georgalas N, Jin Q, Garcia-Blas J, Carretero J, Ray I, editors. 2016 15th Int Conf Ubiquitous Comput Commun 2016 8th Int Symp Cyberspace Secur IUCC-CSS. 2017;109–15.

61. Gan DZQ, McGillivray L, Han J, Christensen H, Torok M. Effect of engagement with digital interventions on mental health outcomes: a systematic review and meta-analysis. Front Digit Health [Internet]. 2021 [cited 2024 Jan 9];3. Available from: https://www.frontiersin.org/articles/https://doi.org/10.3389/fdgth.2021.764079

62. Arigo D, Cornell M, Smyth JM. Social comparisons in adults with type 2 diabetes: patients' reasons for target selection. Psychol Health. 2018;33(7):906–24.

63. Jabłońska MR, Zajdel R. Artificial neural networks for predicting social comparison effects among female Instagram users. PLoS ONE. 2020;15(2): e0229354.

64.•• Zhu J, Dallal DH, Gray RC, Villareale J, Ontañón S, Forman EM, et al. Personalization paradox in behavior change apps: lessons from a social comparison-based personalized app for physical activity. Proc ACM Hum-Comput Interact. 2021;5(CSCW1):116:1–116:21.

This series of studies highlights the potential benefits of personalizing social comparison opportunities, as well as the potential of utilizing machine learning in intervention development.

65. Krogh J, Hjorthøj C, Speyer H, Gluud C, Nordentoft M. Exercise for patients with major depression: a systematic review with meta-analysis and trial sequential analysis. BMJ Open. 2017;7(9): e014820.

66. Moreno-Peral P, Pino-Postigo A, Conejo-Cerón S, Bellón D, Rodríguez-Martín B, Martínez-Vizcaíno V, et al. Effectiveness of physical activity in primary prevention of anxiety: systematic review and meta-analysis of randomized controlled trials. Int J Environ Res Public Health. 2022;19(3):1813.

67. Rebar AL, Stanton R, Geard D, Short C, Duncan MJ, Vandelanotte C. A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. Health Psychol Rev. 2015;9(3):366–78.

68. Arigo D, Gray RC, Dallal DH, Villareale J, Zhu J. Selection of and response to physical activity–based social comparisons in a digital environment: series of daily assessment studies. JMIR Hum Factors. 2023;10: e41239.

69. Nahum-Shani I, Smith SN, Spring BJ, Collins LM, Witkiewitz K, Tewari A, Murphy SA. Just-in-time adaptive interventions (JITAIs) in mobile health: key components and design principles for ongoing health behavior support. Ann Behav Med Publ Soc Behav Med. 2017;52(6):446–62.

70.• Wang L, Miller LC. Just-in-the-moment adaptive interventions (JITAI): a meta-analytical review. Health Commun. 2020;35(12):1531–44.

A recent meta-analysis of the effects of just-in-time adaptive interventions (JITAIs).

71. Hardeman W, Houghton J, Lane K, Jones A, Naughton F. A systematic review of just-in-time adaptive interventions (JITAIs) to promote physical activity. Int J Behav Nutr Phys Act. 2019;16(1):31.

72. Hayes SC, Strosahl KD, Wilson KG. Acceptance and commitment therapy: the process and practice of mindful change, 2nd ed. New York: Guilford Press; 2012. xiv, 402 p. (Acceptance and commitment therapy: The process and practice of mindful change, 2nd ed).

73. Mishra SR, Dempsey W, Klasnja P. A text messaging intervention for priming the affective rewards of exercise in adults: protocol for a microrandomized trial. JMIR Res Protoc. 2023;12(1): e46560.

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