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Does Body Mass Index Confer Risk for Future Suicidal Thoughts and Behaviors? A Meta-analysis of Longitudinal Studies

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Abstract

Purpose of Review Body mass index (BMI) outside of the "normal" range is commonly cited as a predictor of adverse health outcomes and has been identified as a potential risk factor for suicidal thoughts and behaviors (STBs). This meta-analysis provides a descriptive and quantitative summary of the literature evaluating the longitudinal relationship between BMI/weight status and STBs.

Recent Findings The longitudinal literature examining the relationship between BMI/weight status and STBs is small and methodologically constrained. Within the existing literature, BMI and weight status are generally weak or nonsignificant risk factors for STBs. It is possible that body weight has a complex relationship with physical and mental health, including STBs, which may not be possible to accurately capture with a singular metric such as BMI.

Summary BMI and weight status do not appear to robustly predict STBs, at least within the methodological constraints of the existing literature.

Keywords Body mass index · Suicide · Meta-analysis · Risk factor

Body mass index (BMI) has been a mainstay of public health discourse for decades [1]. Worldwide, rates of "obesity" (i.e., BMI ≥ 30) have nearly tripled in the last 45 years [2]. In the USA, approximately 75% of adults have a BMI outside the "normal/healthy" range [3]. These staggering statistics have prompted sweeping calls to action, with considerable efforts devoted to changing these trajectories [4]. In part, this is because BMI outside the "normal/healthy" range is often cited as a risk factor for adverse and potentially lethal health outcomes, such as cardiovascular disease [5].

Aside from adverse physical health outcomes, BMI has also been identified as a possible risk factor for psychopathology, including suicidal thoughts and behaviors (STBs) [6–9]. STBs are a major public health concern; suicide is a leading cause of death worldwide, contributing to over 700,000 deaths each year [10]. In addition to those who die by suicide, an estimated 9.2% of individuals will experience suicidal ideation, and 2.7% will make a nonlethal suicide attempt [11]. Although it has been hypothesized that BMI plays a role in suicide risk, evidence in this domain has been mixed; while some studies have found positive associations between BMI and suicide risk [12], others have found little or no association [13], and some studies have detected an inverse relationship [14]. Many have questioned the utility of the BMI as an indicator of health risk more broadly, citing its poor predictive accuracy of health outcomes as one major concern [15, 16]. Given the gravity of STBs, the objective of this meta-analytic effort is to advance understanding of whether (and, if so, to what degree) BMI may confer risk for STBs.

Although BMI has been extensively studied, the vast majority of research connecting BMI to adverse health outcomes, including STBs, has been cross-sectional or retrospective. To confidently infer risk, however, longitudinal designs are necessary. A risk factor must be associated with and, critically, precede a target outcome [17]. As temporal precedence cannot be established using cross-sectional or retrospective designs, these designs are limited in their ability to shed light on risk. Although some research has examined the longitudinal relationship between BMI and STBs, results have been mixed. Studies have found BMI outside of the "healthy/normal" range

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to be both positively [6–9] and negatively associated with later STBs [18–23], raising questions about the true effect of BMI on future STBs.

A quantitative meta-analysis of the existing literature may clarify the relationship between BMI and STBs. Previous meta-analyses have examined the effects of BMI and weight status on STBs [14, 24, 25], but these efforts have been methodologically limited. Perera et al. [25] and Klinitzke et al. [14] included cross-sectional or retrospective studies in analyses, which prohibits interpretation of results with regard to risk. Amiri and Behnezhad [24] focused exclusively on longitudinal studies, though the scope of the meta-analysis was limited to the effects of "overweight" and "obese" categories; as a result, it was unable to evaluate the effects of BMIs outside of "overweight" and "obese" categories (e.g., "underweight" status; BMI considered continuously).

Taken together, there is a critical gap in our understanding of the effects of BMI on STBs. Beyond advancing scientific understanding, addressing this gap has important implications for practice. BMI is often used to inform clinical care. For instance, BMI influences eligibility for medical and psychiatric care as well as how life insurance policy rates are determined [26]. If assumptions about the risk conferred by BMI and weight status are substantiated by the existing empirical evidence, this would support the continued use of BMI to ensure accurate allocation of limited healthcare resources. If these assumptions are not supported, however, it would raise questions about the utility of using BMI to inform care decisions. Beyond informing care, the publicly available knowledge about BMI can influence public perceptions of health and weight [27]. The nature of that discourse can either promote or reduce weight stigma, which has been shown to predict health, health-seeking behaviors, and quality of care [28]. Emerging evidence also suggests that weight stigma (both externalized and internalized) may predict STBs beyond the influence of BMI [29, 30].

The present meta-analysis takes steps toward clarifying whether BMI confers risk for later STBs. Toward this end, we address four primary aims. First, we provide a descriptive summary of the longitudinal literature predicting STBs from BMI or weight status. Second, we examine the extent to which BMI and weight status predict discrete STBs (i.e., ideation, attempt, death). Third, we investigate potential moderating effects of publication year, follow-up length, population, and age in the association between BMI/weight status and suicide. Fourth, we contextualize our findings with regards to clinical utility.

Method

Literature Search

The present literature search was conducted as an extension of a larger meta-analytic effort [31] to include articles published prior to November 2019 in PsycInfo, PubMed, and Google Scholar. Search terms comprised variants of the words "longitudinal" and "suicide" (e.g., "longitudinally," "predict," "prospective," "suicidal," "suicidality"). To ensure that all potentially relevant articles were captured, we did not constrain our search based on weight-specific keywords.

Inclusion and Exclusion Criteria

All articles were required to be peer-reviewed, published studies available in English. Studies were required to include at least one longitudinal analysis in which BMI or weight status was used to predict a discrete STB. We did not include studies examining anorexia nervosa as an indicator of underweight status, as we were interested in the unique effects of BMI and weight status on STBs. Notably, we have presented these analyses elsewhere [32]. Results of this prior work indicated that eating disorder diagnosis was a statistically significant yet weak predictor of suicide attempt (wOR 2.19) but not suicide death. An insufficient number of studies were available to examine the unique effects of anorexia nervosa, bulimia nervosa, or eating disorder not otherwise specified (EDNOS).

Treatment studies, systematic reviews, meta-analyses, and articles that did not provide sufficient statistical information to calculate effect sizes were excluded.

Data Extraction and Coding

Author, publication year, follow-up length, population (i.e., general population, participants recruited based on psychopathology, or participants recruited for a history of self-injurious or suicidal behaviors), age (i.e., adolescents only, mixed adolescents and adults, all adults), weight-related predictor variable, STB outcome variable, and relevant statistics were extracted from each article. Initial codes were completed by the first author and independently checked for accuracy by the second author; discrepancies were discussed until resolved by consensus. Please see Franklin et al., 2017, for details on coding procedures from the original meta-analysis.

BMI and weight-related predictor variables varied. Whereas some studies reported BMI as a continuous measure (e.g., means and standard deviations), others categorized participants based on weight status categories (i.e., underweight, normal weight, overweight, or obese) or other descriptors (e.g., BMI 30 or more). To improve interpretability, we coded specific predictor variables into one of four broad categories: BMI (continuous), underweight, overweight, and obese. See Table 1 for a complete list of specific and broad weight-related predictors.

The term STBs can be used to refer to a wide range of thoughts and behaviors. For the purposes of the present study, we focus on cognitions related to suicide (i.e., suicidal ideation), self-directed harm with at least some intent to die (i.e., suicide attempt), and death resulting from self-directed harm with at least some intent to die (i.e., suicide death).

Many meta-analyses evaluate the effects of study quality on results; however, this generally occurs when included studies vary widely in terms of methodology. By contrast, studies included in the present meta-analysis were highly uniform, as they were required to share a common study design and assess both a weight-related predictor and a specific set of STB outcomes. Given the lack of objective criteria available to assess the effects of minor methodological differences such as follow-up length and study population on results, we instead assess the effects of these differences in moderator analyses to evaluate their effects on risk factor magnitude.

Statistical Analyses

Data were pre-processed and analyzed using R [33]. Meta-analytic procedures were conducted using Comprehensive Meta-Analysis, Version 3, a software program for meta-analysis developed by BioStat, Inc. [30]. Our primary effect sizes were weighted odds ratios (wORs), which represent the ratio of the likelihood of an event in one group to another, with 95% confidence intervals (CIs). When data were not reported in terms of ORs, they were calculated by a comprehensive meta-analysis from given data (e.g., 2 × 2 contingency tables, means, and standard deviations). A small number of effects were reported as hazard ratios; results of hazard ratio analyses are reported in Supplemental Materials. Random-effects models, which are robust to between-study heterogeneity (quantified with I^2 tests), were used for all meta-analyses. Publication bias was assessed using visual inspection of funnel plots, Egger's regression intercept, Begg and Mazumdar's rank correlation test, classic fail-safe N, Orwin's fail-safe N, and Duval and Tweedie's trim and fill.

We first conducted pooled meta-analyses to examine effects of all predictors on all STBs. Subsequent analyses were conducted to examine effects of all predictors on each unique STB, and effects of each unique predictor on all STBs. We then examined the effects of moderators (i.e., publication year, follow-up length, population, age group) on effect size estimates using meta-regression. We did not conduct analyses with fewer than five effect sizes to ensure accuracy and reliability of obtained estimates [31].

Table 1 Specific predictors and broad predictor categories

Broad predictor	Specific predictors
Body mass index (BMI)	BMI at age 18 Body mass index
Underweight	Body mass index < 18.5 Body mass index < 20 Underweight (vs. normal weight)
Overweight	Body mass index 25–25.9 Body mass index > 25* Overweight (vs. normal weight) Slightly/very overweight
Obese	Body mass index 30+ Obese (vs. normal weight)

Results were largely unchanged when this prediction case was included in analyses evaluating the effects of obese category on STBs; the effects of obese category on STBs remained nonsignificant, and effects of overweight category on STBs increased modestly (wOR 1.35 vs. 1.33)

Results

Descriptive Summary

From our original literature search, we retained 18 papers representing 47 prediction cases (i.e., unique statistical tests) (Fig. 1). Publication dates ranged from 1995 to 2019. The number of longitudinal studies examining the relationship between BMI/weight status and suicide increased over time, with most (52.9%) studies published between 2015 and 2019.

OR analyses included 38 prediction cases drawn from 12 papers published between 2011 and 2019. Hazard ratio analyses are available in Supplemental Materials. Nearly all prediction cases were drawn from community samples ($k = 36$, 94.7%), and two were drawn from samples recruited for psychopathology (i.e., symptoms of depression; 5.3%). No prediction cases were drawn from samples recruited for a history of STBs. Follow-up lengths ranged from one week to over 20 years; median follow-up length was 7 years ($M = 8.7$, $SD = 7.7$). Two studies (5.3% of prediction cases) implemented follow-ups of 2 months or less; the remainder of follow-up intervals exceeded 1 year. The most common outcome was suicide ideation ($k = 19$; 50%), followed by suicide death ($k = 10$, 26.3%) and suicide attempt ($k = 9$, 23.7%). Overweight category was the most common predictor of pooled STBs ($k = 21$, 55.3%), followed by continuous measures of BMI ($k = 7$, 18.42%), obese category ($k = 5$, 13.2%), and underweight category ($k = 5$, 13.2%). When STBs were considered separately, overweight category was the most common predictor of suicide ideation ($k = 11$) and attempts ($k = 7$); BMI measured continuously was the most common predictor of suicide death ($k = 4$).

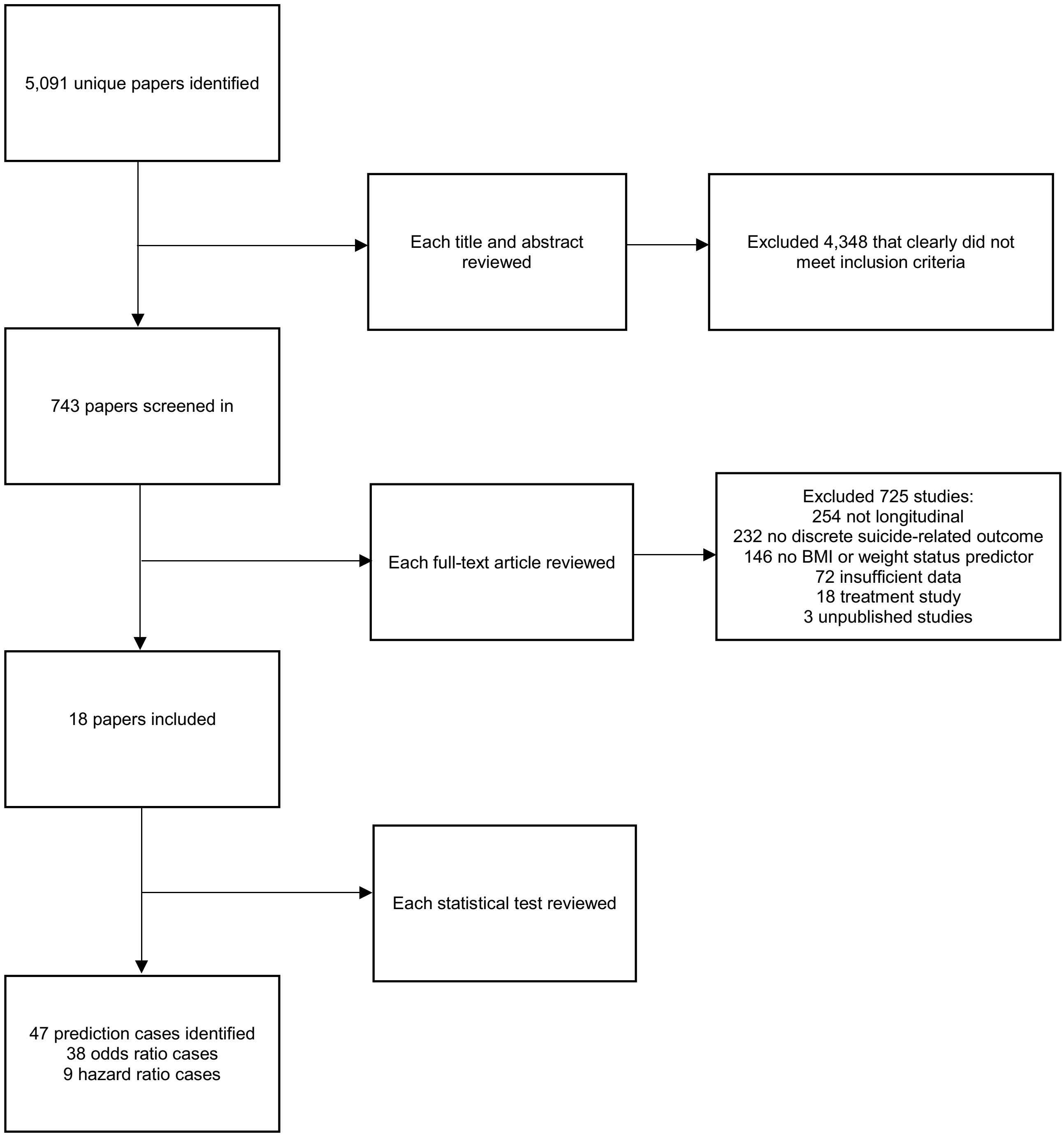

Fig. 1 PRISMA diagram

Overall Prediction and Publication Bias

Pooled OR analyses (Table 2) included 37 prediction cases; one case was dropped as a zero cell (i.e., no events in both groups). The overall wOR of all predictors on all STBs was 1.25 (95% CI: 1.11–1.40). Between-study heterogeneity was high ($I^2 = 84.9$). Significant publication bias was not detected. Please see Supplemental Materials for forest and funnel plots.

Suicide Ideation

Suicide ideation analyses included 18 prediction cases and yielded an overall wOR of 1.34 [95% CI: 1.17–1.54].

Table 2 Effect estimates and publication bias for pooled predictors on suicide-related outcome

Outcome	*k*	OR [95% CI]	Fail-safe *N*		Begg and Mazumdar rank correlation	Egger's test of intercept	Duval and Tweedie's trim and fill	
			Classic	**Orwin's**			**Missing effect sizes**	**Adjusted OR**
Overall	37	**1.25 [1.11, 1.40]**	468	365	$\tau = -0.11$, $p = 0.35$	$z = 1.18$, $p = 0.06$	0	1.25 [1.11, 1.40]
Suicide Ideation	18	**1.34 [1.17, 1.54]**	114	600	$\tau = -0.16$, $p = 0.34$	$z = -1.21$, $p = 0.10$	0	1.34 [1.17, 1.54]
Suicide Attempt	9	**1.40 [1.14, 1.73]**	118	68	$\tau = 0.17$, $p = 0.53$	$z = 4.11$, $p = 0.03$	3	1.24 [1.04, 1.49]
Suicide Death	10	1.00 [0.78, 1.30]	0	14	$\tau = 0.07$, $p = 0.79$	$z = -0.50$, $p = 0.77$	0	1.00 [0.78, 1.30]

Between-study heterogeneity was moderate ($I^2 = 41.7\%$). Significant publication bias was not detected.

Suicide Attempt

Suicide attempt analyses included nine prediction cases and yielded an overall wOR of 1.40 (95% CI: 1.14, 1.73). Between-study heterogeneity was high ($I^2 = 93.1\%$). Funnel plot asymmetry was detected via Egger's regression test and Duval and Tweedie's trim and fill method, indicating possible publication bias based on funnel plot asymmetry; however, failsafe *N* analyses indicated a robust effect, and Begg and Mazumdar's rank correlation test yielded nonsignificant results.

Suicide Death

Suicide death analyses included 10 prediction cases and yielded a nonsignificant wOR of 1.00 (95% CI: 0.78–1.30). Between-study heterogeneity was high ($I^2 = 86.1\%$). Significant publication bias was not detected.

Prediction by BMI and Weight Status (Table 3)

BMI

Analyses evaluating the effects of BMI on all STBs included seven prediction cases and yielded a nonsignificant wOR of 0.96 (95% CI: 0.78–1.17). Between-study heterogeneity was moderate ($I^2 = 53.3\%$). An insufficient number of prediction cases were available to evaluate effects of BMI on suicide ideation ($k = 3$), attempt ($k = 0$), or death ($k = 4$).

Underweight Category

Analyses evaluating the effects of underweight category on all STBs included five prediction cases and yielded a nonsignificant wOR of 1.27 (95% CI: 0.86–1.87). Between-study heterogeneity was substantial ($I^2 = 82.5\%$). An insufficient number of prediction cases were available to evaluate effects of underweight status on suicide ideation ($k = 2$), attempt ($k = 1$), or death ($k = 2$).

Overweight Category

Analyses evaluating the effects of overweight category on all STBs included 20 prediction cases and yielded a wOR of 1.33 (95% CI: 1.13–1.58). Between-study heterogeneity was substantial ($I^2 = 86.3\%$). Overweight category significantly predicted suicide ideation across three studies (OR = 1.42, 95% CI: 1.24–1.63, $k = 11$) and suicide attempt across two studies (OR = 1.47, 95% CI: 1.06–2.06, $k = 7$). An insufficient number of prediction cases were available to evaluate effects on suicide death ($k = 2$).

Obese Category

Analyses evaluating the effects of obese category on all STBs included five prediction cases and yielded a nonsignificant odds ratio of 1.26 (95% CI: 0.89–1.78). Between-study

Table 3 Effect estimates for each predictor on all suicide-related outcomes

	All outcomes		**Suicide ideation**		**Suicide attempt**		**Suicide death**	
Predictor	***k***	**OR [95% CI]**	***k***	**OR [95% CI]**	***k***	**OR [95% CI]**	***k***	**OR [95% CI]**
BMI	7	0.96 [0.78, 1.17]	3	-	0	-	4	-
Underweight	5	1.27 [0.86, 1.87]	2	-	1	-	2	-
Overweight	20	**1.33 [1.13, 1.58]**	11	**1.42 [1.24, 1.63]**	7	**1.47 [1.06, 2.06]**	2	-
Obese	5	1.26 [0.89, 1.78]	2	-	1	-	2	-

We did not conduct analyses with fewer than five effect sizes ($k < 5$) to ensure accuracy and reliability of obtained estimates heterogeneity was substantial ($I^2 = 78.4\%$). An insufficient number of prediction cases were available to evaluate effects on suicide ideation ($k = 2$), attempt ($k = 1$), or death ($k = 2$).

Moderator Analyses

Meta-regression results are reported in terms of the model sum of squares (Q_M), which is a test of whether any regression coefficients in the model significantly differ from zero.

Publication Year

No significant moderating effects of publication year were detected for pooled STBs or suicide death. Significant effects were detected for suicide ideation ($Q_M[df = 1] = 10.40$, $p = 0.001$) and suicide attempt ($Q_M[df = 1] = 4.12$, $p = 0.04$), indicating that more recent studies reported stronger effects of weight-related predictors on suicide ideation and attempt.

Given the significant effects detected for overweight status in pooled analyses, we conducted additional meta-regression analyses evaluating whether the effects of overweight status were moderated by publication year. Significant effects were detected for suicide ideation ($Q_M[df = 1] = 5.47$, $p = 0.02$) and attempt ($Q_M[df = 1] = 23.96$, $p < 0.01$). An insufficient number of prediction cases were available to evaluate effects on suicide death ($k = 2$).

Follow-Up Length

No significant moderating effects of follow-up length were detected for pooled STBs, suicide attempt, or suicide death. A significant moderating effect was detected for suicide ideation ($Q_M[df = 1] = 5.21$, $p = 0.02$), indicating that longer studies reported stronger effects on suicide ideation.

Population

No significant effects of population were detected for pooled STBs or suicide ideation. An insufficient number of effect sizes were available to evaluate effects on suicide attempt or death.

Age Group

A significant moderating effect of age group was detected for pooled STBs ($Q_M[df = 1] = 9.21$, $p < 0.05$) and suicide attempt ($Q_M[df = 1] = 4.12$, $p = 0.04$), indicating that studies in adolescent populations reported stronger effects of weight-related factors on these outcomes. No significant effects were detected for suicide ideation, and an insufficient number of effect sizes were available to evaluate effects on suicide death.

Discussion

Summary of Main Findings

This meta-analysis aimed to determine the extent to which BMI and weight status serve as risk factors for STBs by providing a descriptive and quantitative synthesis of the existing longitudinal literature. Given the importance of this topic, the evidence base was smaller than anticipated; less than 1% of over 5000 potentially qualifying papers met criteria for inclusion. All weight-related predictors were nonsignificant or weak predictors of STBs. Significant wORs ranged from 1.25 to 1.47, and the influence of moderators was minimal. Overweight status was the only significant predictor of STBs; however, effects on both suicide ideation and attempts were weak, and an insufficient number of effect sizes was available to assess effects on suicide death.

More recent studies reported greater effects of weight-related predictors on suicide ideation and attempts, and studies with longer follow-ups reported stronger effects on suicide ideation. Additionally, studies conducted in adolescent populations reported stronger effects on pooled STBs and suicide attempts. Despite statistically significant moderation, predictive accuracy was not meaningfully improved; wORs remained weak (i.e., < 2). Given the preponderance of recently published studies and studies with long follow-up lengths, it is unclear whether these effects would change with the publication of additional studies. As more research is conducted across both longer and shorter follow-up intervals, we anticipate that the reliability and accuracy of these estimates will improve, allowing stronger inferences about potential moderating effects to be drawn.

The strongest predictor of any STB in this study was overweight status (wOR for suicide attempt = 1.47). To contextualize this finding, it is important to note that the estimated cross-national annual prevalence of suicide attempts is 0.3% [32]; therefore, overweight status increases risk to approximately 0.4% ($1.47 \times 0.003 = 0.004$). Despite statistical significance, this represents only a marginal increase in predictive ability which is unlikely to be clinically meaningful. Rather than focusing on BMI or weight status as univariate predictors of STBs, it may be necessary to consider the complex interactions of body weight with other determinants of physical and mental health in order to elucidate its relationship to STBs [34]. Relationships between weight-related factors and STBs are likely to be not only small, but also highly variable; therefore, it is unlikely that simple combinations of several risk factors would enhance our ability to predict STBs. Instead, future research would benefit from advancing our understanding of how weight-related factors can be incorporated into complex conceptualizations of STBs, as accurate prediction is likely to involve many different factors combined in complex ways. This may require a shift away from traditional biopsychosocial models of STB risk, as others have suggested [35].

Within the methodological constraints of the existing literature, BMI and weight status do not appear to robustly predict STBs. Below, we expand upon these constraints and their relevance for interpreting our results.

Limitations

First, although the number of studies examining the longitudinal relationship between BMI and STBs has increased, the literature remains small. Certain weight-related factors may emerge as stronger predictors of STBs once additional studies are published. Contrary to this hypothesis, the effects that reached statistical significance in our analyses remained weak. This finding, which aligns with prior meta-analytic evidence that most biopsychosocial factors are weak predictors of STBs [27], suggests that, although detecting substantially stronger effects of BMI on STBs is possible with a larger evidence base, it is not highly probable. Notably, our findings diverge from prior meta-analytic evidence suggesting a weak inverse relationship between overweight or obese weight status and suicide attempts and death [19]. Minor differences in search strategy and meta-analytic methods may account for these distinct patterns of results. Because the literature is relatively small, the presence or absence of even a few studies in meta-analytic procedures has the potential to meaningfully influence effect size estimates. Additional studies that address common methodological issues of prior research will improve the reliability and precision of meta-analytic effect size estimates.

Second, follow-up lengths were long (i.e., *Mdn* = 7 years), and almost no studies leveraged short-term prediction. Because clinicians are often tasked with predicting imminent risk (e.g., days or weeks), rather than eventual suicidal behaviors (e.g., years or decades), studies that provide information about proximal risk may be the most clinically useful. Effects of BMI on STBs may vary over time, especially considering the fluctuating nature of both weight [36] and STBs [37]. Whereas significant changes in weight (e.g., unexpected weight loss) may be clinically relevant predictors of health outcomes (e.g., cancer) over subsequent weeks or months [38], they are likely to be less informative about distal outcomes over years or decades. Although evaluating the effects of short-term weight changes on STBs was not possible within the constraints of the existing literature, prior meta-analyses have not detected consistent patterns of predictive ability for STB risk factors over different follow-up intervals [27].

Third, BMI and weight status were typically evaluated as univariate predictors of STBs. As demonstrated in other meta-analytic efforts, even the strongest risk factors of STBs in a relative sense (e.g., prior suicide attempts) have demonstrated weak univariate relationships when considered in an absolute sense [31, 39]. Some have argued that this may be because the nature of suicide risk on a biopsychosocial level is highly complex, with accurate prediction requiring the simultaneous consideration of many factors [34, 35, 40]. From this perspective, the contributions of weight-related factors to STB risk may only emerge in the context of complex interactions with many other biopsychosocial factors.

Fourth, assessments of STBs across studies were idiosyncratic. Studies which reported effects on suicide death typically leveraged publicly available databases (e.g., the National Death Index). Conversely, nearly all studies examining suicidal ideation and attempt used different measures. Most relied on dichotomous single-item assessments (e.g., "during the past 12 months, did you ever seriously think about committing suicide?") rather than continuous measures (e.g., severity of ideation, number of suicide attempts). It is possible that outcome assessment type influenced detected effects; however, a prior meta-analysis of 16 broad risk factor categories did not detect any meaningful moderating effects of outcome assessment strategy (e.g., single-item vs. questionnaire total score) on risk factor magnitude [31]. We accordingly reason that it is unlikely that our analyses would have yielded different results if STBs had been assessed in a consistent manner across studies.

Fifth, the relationship between body weight and STBs may be further clarified by factors that were not assessed in the present meta-analysis. For example, we were unable to assess the potential moderating effects of sex, as no studies reported interaction terms where sex was used as a moderator of the effects of weight-related variables on STBs. Given the restricted range of variability in detected effects, we reason that additional moderators would have limited explanatory power; nevertheless, it is possible that sex may play a role in the relationship between weight and STBs. This remains an empirical question which may benefit from further study.

Other Considerations

It may be useful to contextualize these findings within the discourse surrounding the BMI and its validity as an indicator of health in general. BMI is simple to measure and interpret and has generally been accepted as a useful metric of health [16]. But, it was not created for this purpose [41]. In the years since the BMI classification system was adopted by the World Health Organization, it has received criticism regarding its validity and usefulness. There is a widespread belief that higher BMI leads to poorer health

[15, 42]; however, critics of the BMI have noted that the relationship between BMI and health may be confounded by third variables, including socioeconomic status, stress, metabolic dysfunction, and physical activity [43, 44]. Accordingly, many individuals who fall into the overweight and obese categories can be accurately classified as "healthy" based on a variety of cardiometabolic indicators, though misclassifications are common [45, 46]. Some have also raised concerns about the usefulness of the BMI as predictor of adverse health outcomes, as it does not consistently predict adipose tissue dysfunction (which has been linked to a variety of serious health conditions) [47] or mortality [48]. Notably, other anthropometric measures of body size and composition do not consistently outperform BMI at predicting mortality either [45–47], indicating that these concerns may translate to bodyweight measures more generally. Nevertheless, it may be the case that other weight-related anthropometric measures (e.g., waist circumference) or weight-related biological sequelae (e.g., inflammation, metabolic syndrome) are more strongly related to STBs than BMI. Future research is warranted to advance our understanding of the relationship between additional weight-related variables and psychological wellbeing.

A scarcity of longitudinal studies precluded us from evaluating the effects of weight stigma on STBs. Among cross-sectional studies, recent meta-analytic evidence suggests statistically significant weak effects of perceived overweight on suicidality [39], lending credence to the suggestion that perceptions of weight, including weight-related stigma, may influence the relationship between body weight and STBs. Because longitudinal effects are generally smaller than cross-sectional effects, it is unlikely that stronger univariate effects of weight stigma on STBs will be detected among future longitudinal studies. Rather, weight stigma is likely to represent one of many factors with the potential to influence STBs in highly complex ways.

Even if BMI were shown to be causally related to poor health outcomes, including STBs, some have suggested that body weight is not a viable intervention target for health improvement. Rather than focusing on body weight per se, there has been growing interest — for example, within the Health at Every Size (HAES) movement [49, 50] — in targeting health-related behaviors (e.g., binge eating) to reduce morbidity and mortality. Proponents of this movement propose that, although weight loss can be a side effect of improved health-related behaviors, it does not appear necessary for health improvement. Several randomized controlled trials have demonstrated that a weight-neutral approach led to not only increased health behaviors, but also improvements in physiological and psychological measures of health [51–53].

It may be fruitful for future efforts to assess the relationships between health-relevant behaviors and STBs, rather than focusing on body weight in isolation. Individuals within the "normal" weight category may rely on health risk behaviors, such as restricted caloric intake or excessive exercise, to maintain or suppress body weight. Regardless of the methods used, weight suppression (i.e. the difference between current weight and their highest previous weight) appears to predict not only future weight gain, but also increased risk for disordered eating [54]. Similarly, weight cycling, or repeated intervals of weight loss followed by weight gain [55], has been linked with increased risk for disease and mortality [56]. These statistics are particularly troubling considering that some evidence suggests the majority of overweight individuals who intentionally lose 10% or more of their body weight regain it within one year [57]. Taken together, this evidence indicates that, although weight loss alone is unlikely to promote sustained improvements in psychological wellbeing, increasing health-promoting behaviors has the potential to reduce adverse health outcomes typically associated with underweight, overweight, and obesity.

Conclusions

Our results revealed several notable findings. First, despite increases in research, the literature examining the longitudinal relationship between BMI/weight status and STBs is relatively small and methodologically constrained. Second, the longitudinal relationship between BMI and STBs is weak — at least when studied within the methodological constraints of the existing literature — and is not substantially influenced by study or sample characteristics. Third, contextualized within the suicide prediction literature, BMI is unlikely to represent a clinically useful indicator of suicide risk.

While these findings do not mean that the relationship between BMI and STBs is unimportant, they highlight the challenges associated with conceptualizing BMI and weight status as univariate predictors of health outcomes. Nevertheless, our findings have important clinical implications for suicide prevention. It is likely that body weight has a complex relationship with physical and mental health, including STBs, which cannot be adequately captured with a singular metric such as BMI. In primary care settings, assumptions about psychological wellbeing informed by BMI or weight status may lead to missed opportunities for intervention and misallocation of already limited resources. Although predicting suicide is challenging, even with the use of validated measures [58], incorporating brief risk assessments into routine medical visits may allow for the allocation of potentially lifesaving resources to individuals with elevations in suicidality.

Our findings also have implications for future research. Emerging experimental evidence indicates that the anticipated consequences of STBs may exert a large, direct causal effect on suicidal behavior [59]. Although questions remain about the relationship between BMI and STBs, factors related to body weight (e.g., weight stigmatization and discrimination, dieting behaviors, chronic low-grade inflammation) may influence causal relationships underlying STBs by amplifying expectancies about potentially desirable outcomes of STBs (e.g., ending the aversive experience of weight-related stigma or distress). Future studies may wish to examine whether malleable weight-related factors influence the anticipated consequences of suicide for some individuals, as these factors may represent viable intervention targets.

In sum, BMI and weight status do not appear to be robust risk factors for STBs, at least within the methodological constraints of the existing literature. Our findings highlight the challenges inherent to studying isolated biopsychosocial factors as predictors of STBs and the limitations of conceptualizing body weight as an indicator of psychological wellbeing. We look forward to future experimental studies exploring the complex interactions between body weight and STBs to further clarify the nature of this relationship and identify promising intervention targets.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s13679-022-00468-y.

Availability of Data and Material Data are available upon reasonable request to the corresponding author.

Code and Software Availability Comprehensive meta-analysis software can be purchased online at https://www.meta-analysis.com. R software can be freely downloaded online at https://www.r-project.org.

Compliance with Ethical Standards

Conflict of Interest The authors have no relevant financial or nonfinancial interests to disclose.

Human and Animal Rights and Informed Consent Not applicable; data were drawn from previously published studies in which informed consent was obtained by investigators.

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