PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Does weight-related stigmatization and discrimination depend on educational attainment and level of income? A systematic review
AUTHORS	Bernard, Marie; Fankhänel, Thomas; Riedel-Heller, Steffi G.; Luck-Sikorski, Claudia

VERSION 1 – REVIEW

REVIEWER	David Rehkopf Stanford University, United States of America
REVIEW RETURNED	08-Jan-2019

GENERAL COMMENTS	This is a well written manuscript that makes an important contribution to the literature, thank your for the opportunity to review it. I have the following suggestions: Major. -Given the heterogeneity of exposure types, the use of the “vote counting” method for summarizing the results is reasonable. I agree with the fact that a meta-analysis for this type of data is not recommended. Nevertheless, the vote counting approach is generally criticized in the systematic review literature since information is thrown away regarding the strength and direction of association, and traditional p-value cut-offs are arbitrary. The p-value essentially combines sample size and degree of magnitude of study findings, so using the p-value only means that larger studies are more likely to contribute, while not allowing smaller studies to give additional information to the review. Measures of the direction and magnitude of association should be presented for all studies, and this information should be incorporated into the interpretation of study findings. -While the manuscript methods section does differentiate the two groups of studies that are stigmatizing attitudes and discriminating attitudes (as nicely presented in Figure 2), this is not emphasized in the interpretation. These are very different constructs, and should be treated more independently in the paper. In addition, I think this should be emphasized in the title and abstract as well, that this is the review of both stigmatizing attitudes as well as discriminating attitudes. While I agree correlated, a modest level of correlation does not mean that the two are not different constructs. For example, these should be divided within the tables so the differences are highlighted, and summarized separately. As another example, the first paragraph of the discussion section should consider these results separately. The difference between stigmatizing and discriminating are at least as important as the

	differences between income and education, which the authors appropriately stratify findings by and report separately. -One item that needs to be defended for its inclusion is the evolution of the statement “Obesity is a major burden to society in terms of healthcare costs.” This is not related to the passage of laws that would protect those who are overweight from discrimination, and is not related to asking about the causes of obesity. I am not suggesting that this article needs to be dropped, but the inclusion criteria need to be more specific to have this included, and the purpose of the question and validity need to be defended. For example, perhaps giving data on healthcare costs of obesity and showing that this is a relatively small part of healthcare budgets will help readers to interpret the question. It is an opportunity to education scientists on this as well. For example, Beiner 2017 in J Gender Intern Med can be cited and discussed here in relation to this question. -I find that the conclusion of the paper, in the final sentence of the first paragraph of the discussion section, as well as in the abstract, is a bit perplexing. Would the authors really expect this to be a universal association across countries? What I mean is, I don’t think it means that there is no “reliable correlation” just because it differs by context. This is not a pill that someone takes that should have the same biological impact across time and place, it is a context contingent relationships that we would expect to differ across time and place. The authors should either defend why they believe a universal association should exist, or else reframe their interpretation (it is too late to reframe the hypothesis). The authors do an excellent job in the third and fourth paragraphs of the discussion section explaining this, which seems inconsistent with the framing that there should be expected to be a universal association. To me the most interesting part of the paper is describing that heterogeneity, where and when those associations exist, and this does not mean the findings are not “reliable." Minor. -The manuscript is generally clearly written, but I would suggest review by a native English writer as there are phrases and word usage throughout that are awkward and are distracting as not typical of scientific writing in the English language. The manuscript also contains several grammatical and typographical errors that a close proofreading should correct. -I don’t understand the sentence in the discussion section that begins “Therefore, a possible explanation might be that income can be seen…” Optional. -One aspect which was not discussed was whether the prevalence of obesity in a country has a role in bias. This seems consistent with some of the increase in bias in the United States, as well as the differences between U.S. and Mexico as compared to Germany. If this is not likely to have a role or there is no evidence for this this does not need to be added. -It may be a bit ambitious to say that this research was supposed to “close this research gap”, instead perhaps address the gap or contribute to closing the gap.

REVIEWER	Paul Jenkins Bassett Healthcare One Atwell Road Cooperstown, New York 13326
REVIEW RETURNED	21-Feb-2019

GENERAL COMMENTS	This is a well-written and interesting article. Here are some comments: It would be helpful if you explained why only articles in English or German were included Also, with regard to this exclusion: (e) studies with a homogenous sample in regard to educational attainment (e.g., students) or level of income; Although income and/or educational attainment was a constant in these studies, might they not have been informative for the conclusions? You state: The statistical analysis of these two studies revealed significant correlation between educational attainment and discriminating ($p<0.01$) and stigmatizing ($p<0.05$) attitudes, respectively, in the Icelandic sample [37, 38]. Please give the value of these correlation coefficients. I think you meant to say "countries" here, not "counties" Correct? Since all four counties here discussed can be considered as developed, a deeper insight in cultural differences is needed.

VERSION 1 – AUTHOR RESPONSE

Comment	Answer to comment	Change in manuscript
Reviewer: 1 **This is a well written manuscript that makes an important contribution to the literature, thank your for the opportunity to review it.**		
5. Given the heterogeneity of exposure types, the use of the "vote counting" method for summarizing the results is reasonable. I agree with the fact that a meta-analysis for this type of data is not recommended. Nevertheless, the vote counting approach is generally criticized in the systematic review literature since information is thrown away regarding the strength and direction of association, and traditional p-value cut-offs are arbitrary. The p-value essentially combines	We added the directions of the relationship between weight bias and SES in Table 1 and Table 2, respectiveley. Moreover, revised the column reporting the results. Therefore, we added the appropriate statistical characteristic given or stated when they were not reported. We acknowledge the shortcomings of a vote counting	Table 1 and Table 2 p. 28 However, studies that did use the same instrument, such as items weighing support for specific laws and policies differed with regard to how they were analyzed (as single items or as an item battery). Therefore, the authors had to decide again against a meta-analysis and applied a vote-counting approach despite its shortcomings.

sample size and degree of magnitude of study findings, so using the p-value only means that larger studies are more likely to contribute, while not allowing smaller studies to give additional information to the review. Measures of the direction and magnitude of association should be presented for all studies, and this information should be incorporated into the interpretation of study findings.	approach within the limitations.	Educational Attainment, Level of Income, and Stigmatizing Attitudes p. 24 Moreover, six studies [35, 36, 38, 40, 46, 48] did not show any significant association, nor a clear direction of the assumed association. p. 25 However, the direction of the (insignificant) associations did not show any pattern. We found three studies reporting an (insignificant) positive association [10, 37, 46], and one study each reporting an (insignificant) positive [36] or mixed associations [48]. Educational Attainment, Level of Income, and Discriminating Attitudes p. 25 Only one study [39] did not found a significant association between educational attainment and discriminating attitudes, nor did it report the direction of the insignificant association. p. 26 Suh et al. [44] found a significant association of stronger support for weight-related laws with decreasing income until they controlled for other sociodemographic variables, such as educational attainment. They reported mixed (insignificant) results concerning the direction of the assumed association. A possible explanation for these insignificant results after controlling for education might be that income can be seen as a proxy variable for education, in the way that the level of income depends on educational attainment. Again, Lund and colleagues [39] who asked Danish citizen by whom medical treatment and weight-loss surgery should be funded, found no significant association, nor did they report a direction of the association.

6. While the manuscript methods section does differentiate the two groups of studies that are stigmatizing attitudes and discriminating attitudes (as nicely presented in Figure 2), this is not emphasized in the interpretation. These are very	We revised the result section and reported our findings separately. We also interpreted the results as suggested (see	p. 20 Associations between educational attainment and weight-related stigmatization We found ten studies that reported an association between educational attainment and stigmatizing attitudes, whereas only two of them [37, 42] showed a positive association between

different constructs, and should be treated more independently in the paper.	therefore also comment no. 8)	higher educational attainment and weight-related stigmatization. In addition, the study of Puhl and colleagues [42, 43] found a significant association in the Icelandic (Beta=0.160, p<0.05), but not in the American sample. However, two German studies [10, 41] showed an inverse correlation. Both of these studies found evidence that higher education is associated with lower stigma [41] and less belief in individual responsibility [10] for an obese condition. The remaining studies did not report significant associations. <u>Associations between educational attainment and weight-related discrimination</u> Six studies [43–46, 49, 50] reported increased discriminating attitudes with higher education. The study of Puhl and colleagues found no significant association between weight bias and educational attainment in the US sample, but did find an association in the Icelandic sample (Beta = -0.221, p<0.01). The study of Hilbert and colleagues [47] revealed inconsistent findings: Higher education is associated with less support for general but more support for employment specific weight-related antidiscrimination laws or policies. <u>Associations between the level of income and weight-related stigmatization</u> We found no study that reported a significant association between the level of income and weightrelated stigmatization. <u>Associations between the level of income and weight-related discrimination</u> Four American [45, 46, 49, 50] revealed stronger weight-related discrimination with increasing income. One German study [47] found less support for general, but not for employment specific policies and laws among more affluent people. Although the study of Suh et al. [44] found a significant positive association between level of income and support for two laws and policies (law a: χ^2=6.06. p=0.01; law d: χ^2=3.81, p=0.05), these results could not be validated by logistic regression analysis. Moreover, the

		assumption that discrimination, in the form of views on the funding for medical or weight-loss surgery, is somehow associated with income was not found [39].

7. In addition, I think this should be emphasized in the title and abstract as well, that this is the review of both stigmatizing attitudes as well as discriminating attitudes.	We thank the reviewer for this comment. We modified the title and the abstract in order to underline the different concepts.	Title Does weight-related stigmatization and discrimination depend on educational attainment and level of income Abstract This study aims to review the quantitative state of research regarding socioeconomic characteristics' influence on weightrelated stigmatization and discrimination. p. 3 Although weight-related stigmatization and discrimination are closely linked, they need to be considered as two divergent concepts. However, in the following, we will refer to weight-related stigmatization and discrimination as "weight bias", but will differentiate between both concepts whenever needed.

8. While I agree correlated, a modest level of correlation does not mean that the two are not different constructs. For example, these should be divided within the tables so the differences are highlighted, and summarized separately. As another example, the first paragraph of the discussion section should consider these results separately. The difference between stigmatizing and discriminating are at least as important as the differences between income and education, which the authors appropriately stratify findings by and report separately.	We thank the reviewer for this comment. We revised the tables and divided them with regard to educational attainment and level of income. Moreover, we added another column that displays either weight-related stigmatization or discrimination. We hope thus to correspond the reasonable wish to separate the two concepts of weight bias more clearly.	See Table 1, 2, and 5 p. 24 In the following the results are discussed separated by education and income, as well as weightrelated stigmatization and discrimination: Please see the changes in the manuscript (p. 24-26).

9. One item that needs to be defended for its inclusion is the evolution of the statement "Obesity is a major burden to society in terms of healthcare costs." This is not related to the passage of laws that would protect those who are overweight from discrimination, and is not related to asking about the causes of obesity. I am not suggesting that this article needs to be dropped, but the inclusion criteria need to be more specific to have this included, and the purpose of the question and validity need to be defended. For example, perhaps giving data on healthcare costs of obesity and showing that this is a relatively small part of healthcare budgets will help readers to interpret the question. It is an opportunity to education scientists on this as well. For example, Beiner 2017 in J Gender Intern Med can be cited and discussed here in relation to this question.	We thank the reviewer for make us aware of this information gap. We added the required information to the "Inclusion Criteria". We assume that the reviewer refers to Biener, A., Cawley, J., & Meyerhoefer, C. (2017). The high and rising costs of obesity to the US health care system (J Gen Intern Med) – correct? We added this citation.	p. 6-7 Inclusion criteria Studies that report associations between weight bias and either educational attainment or level of income were included. Weight bias was operationalized to reflect stigmatizing and discriminating attitudes. Therefore, studies that measured stigmatizing attitudes by applying explicit and implicit instruments will be included, but also studies that assessed causal beliefs about obesity, which can be considered as proxy variable as previously done before [31]. Studies that assessed discriminating attitudes, for example, by measuring the support for weight-related antidiscrimination policies and law, or considering obesity as a financial burden are considered for inclusion. According to Woolford et al. [32], who found less support to cover obesity-related costs by public health insurances, the public's opinion can be seen as a potential guideline for insurance funds [32]. In other words, based on the public's view, discrimination might occur in the field of health insurance policies. This assumption might be of particular importance when considering the increased obesityrelated healthcare cost [33].

10. I find that the conclusion of the paper, in the final sentence of the first paragraph of the discussion section, as well as in the abstract, is a bit perplexing. Would the authors really expect this to be a universal association across countries? What I mean is, I don't think it means that there is no "reliable correlation" just because it differs by context. This is not a pill that someone takes that should have the same biological impact across time and place, it is a context contingent relationships that	We agree with the reviewer. Although the review aimed to investigate the association between weight bias and socioeconomic status, we are not surprised about the heterogeneous results among countries and cultures. Therefore, we revised this statement in the abstract and in the discussion.	p. 2 In light of the inconsistent and heterogeneous results of the studies that report a significant association between weight bias and socioeconomic variables, the findings must be discussed concerning their cultural context, i.e., cultural and governmental differences. p. 24-25 In light of divergent results of studies that report a significant association between socioeconomic variables and stigmatizing attitudes, the findings must be discussed with regard to their cultural context: American, Mexican, and Icelandic studies were found to support the working hypothesis, whereas two

we would expect to differ across time and place. The authors should either defend why they believe a universal association should exist, or else reframe their interpretation (it is too late to reframe the hypothesis). The authors do an excellent job in the third and fourth paragraphs of the discussion section explaining this, which seems inconsistent with the framing that there should be expected to be a universal association. To me the most interesting part of the paper is describing that heterogeneity, where and when those associations exist, and this does not mean the findings are not “reliable."		German studies [10, 41] revealed findings to the contrary. These differences might be explained when considering cultural distinctions. In cultures, in which individual responsibility is considered as one of the leading causes of self-fulfillment, health, and wealth, obesity might be perceived as a self-inflicted condition. Highly educated people might attempt to keep people down to maintain their high(er) social status. In contrast, in cultures in which individuals’ situations are principally considered as a result of various circumstances, obesity might consequently not only be seen as self-inflicted. In these cultures, especially highly educated people might be aware of social barriers as determinants for self-fulfillment, wealth, and health, i.e., body weight. In conclusion, the direction of the relationship between weight bias and socioeconomic status might depend on divergent socio-cultural perspectives. Hence, future research should consider expansion and reorientation of stigma’s theoretical framework by focusing on the meso and macro socio-cultural structures, as Bonnington and Rose [52] suggest.

11. The manuscript is generally clearly written, but I would suggest review by a native English writer as there are phrases and word usage throughout that are awkward and are distracting as not typical of scientific writing in the English language. The manuscript also contains several grammatical and typographical errors that a close proofreading should correct.	We did a final proofreading.	See whole manuscript

12. I don't understand the sentence in the discussion section that begins "Therefore, a possible explanation might be that income can be seen…"	We consider that education and income are closely correlated, in the way that the individual income depends on the educational attainment. We revised the sentenced and hope that it is now clearer.	p. 26 A possible explanation for these insignificant results after controlling for education might be that income can be seen as a proxy variable for education, in the way that the level of income depends on educational attainment.
13. One aspect which was not discussed was whether the prevalence of obesity in a country has a role in bias. This seems consistent with some of the increase in bias in the United States, as well as the differences between U.S. and Mexico as compared to Germany. If this is not likely to have a role or there is no evidence for this this does not need to be added.	We added this aspect within the Discussion section.	A final point of discussion might be whether the prevalence of obesity has an impact on the magnitude of weight bias. When comparing the prevalence and the stigmatization of obesity between the USA and Germany, for example, the following can be stated: In both countries, the prevalence of obesity increased over time (1995, USA 21.9%; GER 14.5%; 2005 USA 29%; GER 18%) [54]. However, not only the prevalence of obesity itself increased, but also the (perceived) stigmatization toward people with obesity in the US but also in Germany [7, 8, 10, 55].
14. It may be a bit ambitious to say that this research was supposed to "close this research gap", instead perhaps address the gap or contribute to closing the gap.	We agree with the reviewer and diluted this statement.	p. 29 Since this question has not yet been answered sufficiently, this review was supposed to address this gap in research and aimed to contribute to closing this gap.

Reviewer 2		
15. It would be helpful if you explained why only articles in English or German were included	We included articles written in English or German only since the authors do not speak another language on a similar level.	p. 29 Since the study team has only sufficient language skills in English and German, the current research includes only papers written in English or German
16. Also, with regard to this exclusion: (e) studies with a homogenous sample in regard to educational attainment (e.g., students) or level of income; Although income and/or educational attainment was a constant in these studies, might they not	We discussed this question comprehensively in the author team before the review was conducted. We decided against the inclusion of homogenous sample since there	p. 28 We also excluded studies based on homogenous samples, such as health care professionals and students. We considered these studies as inadequate since there would have

	have been informative for the conclu-	would have been no possibility	
	sions?	to compare and thus interpret these results. A comparison of the results with other study result was evaluated as problematic with regard to many different instruments.	been no possibility to compare and thus interpret these results with regard to the research question. Moreover, stigmatizing attitudes among some professions, such as dietitians and nutritionists, were already investigated systematically.
17.	You state: The statistical analysis of these two studies revealed significant correlation between educational attainment and discriminating ($p<0.01$) and stigmatizing $p<0.05$) attitudes, respectively, in the Icelandic sample [37, 38]. Please give the value of these correlation coefficients.	We noticed a translation error: In the two studies no correlation coefficients, but linear regression models were calculated/reported. We revised the statement and added the standardized linear regression coefficients.	p. 20 In addition, the study of Puhl and colleagues [42, 43] found a significant association in the Icelandic (Beta=0.160, $p<0.05$), but not in the American sample.[…] The study of Puhl and colleagues found no significant association between weight bias and educational attainment in the US sample, but did find an association in the Icelandic sample (Beta = -0.221, $p<0.01$).
18.	(I think you meant to say "countries" here, not "counties" Correct? Since all four counties here discussed can be considered as developed, a deeper insight in cultural differences is needed.	Yes, correct. We thank the reviewer for drawing attention to this typing error. We conducted a final proofreading and corrected the misspelling(s) throughout the manuscript However, since we restructured the discussion section, this sentence was deleted.	Deleted: Since all four countries here discussed can be considered as developed, a deeper insight in cultural differences is needed.

VERSION 2 – REVIEW

REVIEWER	David Rehkopf Stanford University, U.S.
REVIEW RETURNED	29-Sep-2019

GENERAL COMMENTS	Thank your for your careful attention to my earlier review. I have no further comments.

REVIEWER	Paul Jenkins Bassett Research Institute USA
REVIEW RETURNED	21-Aug-2019

GENERAL COMMENTS	One minor point "data" is plural "datum" is the singular Within this study, no patient data was collected. "were collected"

VERSION 2 – AUTHOR RESPONSE

Comment	**Answer to comment**	**Change in manuscript**
Reviewer: 1		
Thank you for your careful attention to my earlier review. I have no further comments.	–	–

Reviewer: 2		
One minor point "data" is plural "datum" is the singular Within this study, no patient data was collected. "were collected"	We thank the reviewer for drawing our attention to this mistake; we corrected it.	Within this study, no patient data were collected.