

Peer Review File

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Reviewer

The authors examine the association between marital status and overweight/obesity in China. I think the paper overall is decent. I have some suggestions and also, I would encourage the authors to do a bit more in depth analysis on how marital status changes are associated with changes in BMI.

(Comment 1) Line 67 I think there should be a little bit of reasoning as to why changes in family structure would contribute to the increase in BMI over time.

Reply: We appreciate the reviewer's comments. We have added sentences about family structure and BMI in the introduction as follows: "Family structure transitions disrupt family relationships, necessitating considerable reorganization of family roles and increasing family stress, e.g., divorce (1). Marital transitions as social factors may influence body weight in adulthood (2)."

1. Hetherington ME, Stanley-Hagan M. The adjustment of children with divorced parents: A risk and resiliency perspective. *Journal of Child Psychology & Psychiatry* 1999; 40:129-140.
2. Umberson D, Liu H, Powers D. Marital status, marital transitions, and body weight. *J Health Soc Behav.* 2009;50(3):327-343.

(Comment 2) Line 95, it is unclear how the authors handled duplicates, which survey year was picked for respondents that participated in multiple waves? Respondents cannot be included more than once in the cross-sectional data (as having multiple observations of one respondents gives the data a multilevel structure), in this case perhaps there should be a random draw on survey year for respondents who participated in multiple waves.

Reply 2: We appreciate the reviewer’s comments. For a cross-sectional study, we pooled the data from all five surveys together to investigate the association between marital status and participants' BMI. Our data only included the participants for the first time. For example, the participants participated in this study in 2000,2004 and 2006, and we only included the 2000 data.

We established a retrospective cohort by including participants who participated in at least two rounds of the CHNS surveys from 2004 to 2015. Our data only included the participants' previous two surveys (Table S2 in the Supplementary material).

Table S2. Distribution of cohort participants by starting and ending year of the survey

Starting	Ending				Total
	2006	2009	2011	2015	
2004	862	699	1864	1881	5306
2006	0	242	590	578	1410
2009	0	0	642	666	1308
2011	0	0	0	1622	1622
Total	862	941	3096	4747	9646

(Comment 3) Line 100/101 The baseline is when participants enter the survey, but then it is unclear what year forms the comparison. Is it the next wave or is it the final wave the participant was in? Probably the latter, but this can cause a bias in that those who have been in more waves are more likely to have had a transition to marriage. Furthermore, Table S2 indicates when participants entered the survey and when they had their last entry. However, it does not show if participants dropped out and dropped in again, e.g. entering in 2004 and then entering and leaving in 2009. Perhaps this never happened and participants who participated always did so in consecutive years, but this needs to be made clear by the authors.

Reply 3: We appreciate the reviewer's comments. It is the final wave the participant taken part in during the first two rounds of the CHNS surveys from 2004 to 2015 for comparison.

Yes, Table S2 indicates when participants entered the survey and when they had dropped out, it is not clear what other changes the marriage has undergone in this cohort, we have only examined the marital status at two points of the cohort. We put this in the limitations of the paper, as follow: "Lastly, it is not clear what other changes the marital status has undergone in this cohort, we have only examined the marital status of the two points of the cohort."

(Comment 4) I think the authors should consider a robustness checks, perhaps with a survival analysis structure and perhaps with a subsample of those participating in three waves or more, in order to see if changes in marital status are indeed linked with BMI changes. However, it still has to be noted that the time gaps between the waves are relatively large (especially 2011 and 2014). Although already mentioned in the limitations it should also be stressed in the limitations that one cannot be certain at what point the married start to diverge from the never married. Also the long time gaps may cause some information to be missed, for instance a divorce and remarriage taking place within the two waves.

Reply: We don't think the data can be used for survival analysis structure. The main reason is that the survey was not designed as a cohort study and the gap between the consecutive years is very large. The difference in time exposure is huge between participants, consider people have 3 rounds and 4 rounds of participation, the time exposure is 5 years different. This makes a survival analysis unsuitable.

Yes, and we talked about that in the limitations, as follows: "it is not clear what other changes the marital status has undergone in this cohort; we have only examined the marital status of the two points of the cohort."

(Comment 5) Line 102 "and..." add what is missing

Reply: We appreciate the reviewer's comments. We added the content of "and...", as follows: "This was to investigate the association between changes in marital status and resulting BMI.

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(Comment 6) Line 112 Age groups are a bit broad. I think 5/6 year age groups would be more appropriate.

Reply: We appreciate the reviewer’s comments. We did the age composition of the 5 year age group and the 10 year age group in different years. However, if we divide by five years, there are too many age groups, and we finally decide to divide by ten years. As follow:

Table 1. Basic characteristics of study participants of the China Health and Nutrition Survey (2004–2015), stratified by study years of the longitudinal study (N=36310) (**Only Age groups**)

Variable	2004 (n=6542)	2006 (n=6344)	2009 (n=6881)	2011 (n=9505)	2015 (n=7038)
Age groups, n (%)					
18-24	244(3.7)	192(3.0)	251(3.6)	261(2.7)	131(1.9)
25-29	394(6.0)	293(4.6)	285(4.1)	442(4.7)	338(4.8)
30-34	581(8.9)	515(8.1)	385(5.6)	596(6.3)	382(5.4)
35-39	719(11.0)	690(10.9)	700(10.2)	776(8.2)	490(7.0)
40-44	814(12.4)	908(14.3)	832(12.1)	1082(11.4)	693(9.8)
45-49	831(12.7)	647(10.2)	885(12.9)	1257(13.2)	808(11.5)
50-54	880(13.5)	934(14.7)	854(12.4)	1042(11.0)	1000(14.2)
55-59	706(10.8)	702(11.1)	880(12.8)	1352(14.2)	850(12.1)
60-64	474(7.2)	505(8.0)	677(9.8)	1054(11.1)	924(13.1)
65-69	411(6.3)	417(6.6)	473(6.9)	702(7.4)	650(9.2)
70-74	277(4.2)	293(4.6)	347(5.0)	467(4.9)	409(5.8)
75-79	143(2.2)	156(2.5)	209(3.0)	301(3.2)	232(3.3)
≥80	68(1.0)	92(1.5)	103(1.5)	173(1.8)	131(1.9)

Table 1. Basic characteristics of study participants of the China Health and Nutrition Survey (2004–2015), stratified by study years of the longitudinal study (N=36310) (**Only Age groups**)

Variable	2004 (n=6542)	2006 (n=6344)	2009 (n=6881)	2011 (n=9505)	2015 (n=7038)
Age groups, n (%)					
18-29	638(9.8)	485(7.6)	536(7.8)	703(7.4)	469(6.7)
30-39	1300(19.9)	1205(19.0)	1085(15.8)	1372(14.4)	872(12.4)
40-49	1645(25.1)	1555(24.5)	1717(25.0)	2339(24.6)	1501(21.3)
50-59	1586(24.3)	1636(25.8)	1734(25.2)	2394(25.2)	1850(26.3)
60-69	885(13.5)	922(14.5)	1150(16.6)	1756(18.5)	1574(22.3)
70-79	420(6.4)	449(7.1)	556(8.1)	768(8.1)	641(9.1)
≥80	68(1.0)	92(1.5)	103(1.5)	173(1.8)	131(1.9)

(Comment 7) Line 120/121 I think there should be gender and age specific cut-off points for overweight and obesity. Perhaps taking the 85/95 percentile would be a better approach. Any weights to account for missings?

Reply: We appreciate the reviewer’s comments. This should be a very appropriate approach to take the 85/95 percentile of BMI in different gender and age groups as specific cut-off points for overweight and obesity. However, considering that the number of people in different marital status varies greatly by gender and age group. Some groups have fewer people in the high age group and unmarried group, which increases the calculation error. Finally, we used the Chinese BMI criterion.

(Comment 8) Line 128 “Statuses8” probably “Statuses (8)”

Reply: We appreciate the reviewer’s comments. I guess I wrote an extra 8 number. This sentence should be written as “The prevalence of overweight and obesity among the

participants and its 95% confidence intervals (CI) were estimated for different marital statuses”.

(Comment 9) Line 132/133 would be good to have a control for having (had) children

Reply: We appreciate the reviewer’s comments. We also initially considered having (had) children as a control variable, but unfortunately, in the CHNS longitudinal survey, this variable was only used for women, not for men. In the end, we didn't control this variable.

(Comment 10) Line 186 It would also be interesting to know the differences between those becoming married compared with those staying married.

Reply: Yes, there was no significant difference in the risks of overweight, or obese between those who remain married compared with those become married. However, people who remained married (RR, 0.56; 95% CI, 0.34-0.93) were significantly less likely to be underweight than those who became married (Table S3, Model 3).

Table S3. The relative risk of underweight, overweight and obesity in participants who remained married compared with participants who became married, in a pooled cohort of CNHS participants across five consecutive longitudinal surveys (n=8580)

Total (Marital status change)	Model 1	Model 2	Model 3
Underweight (ref: Normal weight)			
Become married	1.00	1.00	1.00
Remain married	0.57(0.35-0.94)	0.56(0.34-0.94)	0.56(0.34-0.93)
Overweight (ref: Normal weight)			
Become married	1.00	1.00	1.00
Remain married	1.10(0.85-1.42)	1.14(0.88-1.47)	1.12(0.87-1.45)
Obesity (ref: Normal weight)			
Become married	1.00	1.00	1.00

Remain married	1.15(0.79-1.67)	1.21(0.83-1.76)	1.17(0.81-1.70)
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Model 1 adjusted for variables in model 1 as well as gender and age, the duration in the cohort at baseline;

Model 2 adjusted for variables in model 2 as well as education level, income level, residence, employment status at baseline;

Model 3 adjusted for variables in model 3 as well as sleep time, smoking, alcohol drinking at baseline.

Variables assignment: gender: male=1, female=2; age (year): a continuous variable; the duration in the cohort: a continuous variable; education: primary school and below=1, middle/high school=2, university/higher=3; income levels: low income=1, middle income=2, high income=3; residence: urban=1,rural=2; employment status: unemployed=0, employed=1; sleep time: a continuous variable; smoking: no=0, yes=1; alcohol drinking: no=0, yes=1; marital status changes: become married=1, remain married=2.

(Comment 11) Line 212-218 would like to see references for this

Reply: We appreciate the reviewer’s comments. Line 212-218, that was what we're speculating about and we supplemented the references as much as possible. Those sentences were modified to “Being divorced/widowed may have a more pronounced adverse physical and psychological effects on men than women (1). Men's BMI decreases in the time following divorce, which has been reported previously (2). Two possible explanations for this effect seem plausible. First, Chinese men are known to be more reliant on their partners' physical and emotional care than women. Thus, Chinese men often require a longer period to recover their feelings when their partners leave or die. This suggested that being divorced/widowed may lead to persistent psychological distress, which could explain the significantly lower prevalence of overweight and obesity in divorced/ widowed men compared to women. Second, the loss of mood may lead to reduced exercise. However, whether these factors contributed to our findings in this study requires further investigation.”

1. Wilson SE. Marriage, gender and obesity in later life. *Econ Hum Biol.* 2012;10(4):431-453.

2. Syrda J. The impact of marriage and parenthood on male body mass index: Static and dynamic effects. *Soc Sci Med.* 2017;186:148-155.

(Comment 12) Line 254-259 while it is good to think of mechanisms as to why marriage may be associated with an increase in BMI, but it could also be that those who do not marry have selective traits that make them less likely to become obese.

Reply: We appreciate the reviewer's comments. We added some content to make the paper more substantial, as follows: "Mechanisms through which marital status may influence BMI include, the amount of energy intake and expenditure, and metabolic changes (1). We speculate endorphins may also play a role in weight control among the unmarried individuals (2). In contrast, married individuals are very unlikely to experience an endorphin rise from lack of exercise and an indirect cause of weight gain."

1. Janghorbani M, Amini M, Rezvanian H, et al. Association of body mass index and abdominal obesity with marital status in adults. *Arch Iran Med.* 2008;11(3):274-281.
2. Singh DK, Tuli L. Obesity and its mechanisms--who to blame after marriage? *Med Hypotheses.* 2010;75(5):472-473.