

PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Urban-rural differences in overweight and obesity among 25-64 years old Myanmar residents: a cross-sectional, nationwide survey
AUTHORS	Thapa, Rupa; Dahl, Cecilie; Aung, Wai Phyo; Bjertness, Espen

VERSION 1 – REVIEW

REVIEWER	Tushar Trivedi University of South Carolina, USA
REVIEW RETURNED	13-Aug-2020

GENERAL COMMENTS	<p>Author report further urban rural differences in BMI or W/H-ratio by urban-rural location and further by SES in Myanmar. Overall well conducted study, I would like to recommend following edits:</p> <ol style="list-style-type: none">1. For BMI, present another model using BMI as a categorical variable (normal wt, overweight, and obese) and use logistic regression to present the point estimates by exposure group. This can be a sensitivity analyses, and can be presented as an additional table.2. In your discussion section, please discuss why the results are so different in South East Asian population in comparison to Western population. Cite papers who have studied this concept in Western population and have presented different results .
-------------------------	--

REVIEWER	David Guwatudde School of Public Health, Makerere University, Kampala, Uganda
REVIEW RETURNED	28-Aug-2020

GENERAL COMMENTS	<p>General comments:</p> <ol style="list-style-type: none">1. Overweight and obesity are important risk factors for quite a number of noncommunicable diseases; and disparities of these between urban and rural residents may help inform targeted policy and formulation of interventions meant to reduce the prevalence of these. Therefore this manuscript addresses an important public health problem.2. The data used for analysis in this manuscript was from a STEPs survey, which follows standard methodology for collection of data on NCD risk factors. The methods used for data collection are well described and clear in the manuscript.3. The specific objectives of the analysis are clearly stated, and these are followed through the manuscript. They include:
-------------------------	--

	<p>i) To investigate whether urban-rural location and socioeconomic factors (income, education, and employment) are associated with BMI;</p> <p>ii) To investigate whether urban-rural location and socioeconomic factors (income, education, and employment) are associated W/H ratio;</p> <p>iii) To explore whether the associations between urban-rural location and BMI or W/Hratio could be mediated through variations in socioeconomic factors.</p> <p>Specific comments:</p> <p>1. INTRODUCTION: pages 2 – 3, is very clear.</p> <p>2. METHODOLOGY:</p> <p>i) Page 6, line 58 - 60: correct the typing error in the sentence: “Differences in categorical variables were tested using the chi-square test of Fischer exact test, whereas... “</p> <p>ii) Page 7, lines 18- 55: It is un-conventional to refer to results tables in the methods section. I suggest the authors focus on describing the methods used to address each objective, without referring to the results at this stage.</p> <p>iii) Page 7, lines 37 – 45: the authors attempt to describe how they calculated the Social Economic Status (SES) for each participant, and the composite SES score calculated. Then they refer to “high education attainment”. But they do not explain what they mean by “high education attainment”. But this becomes clear later when one reviews Supplementary Table 1 that this refers to “high school grade completion”. It would be better to include this detail in the text here.</p> <p>3. RESULTS:</p> <p>i) Although the results from the analysis are largely clearly presented, to aid readers who may not be familiar with the meaning of the β-coefficients from linear regression analysis, I suggest the authors try to report these coefficients with their actual meanings. For example on page 9, lines 54 – 55, the sentence here could alternatively be written as: “The mean BMI was higher among urban than rural residents by 2.49 kg/m² (β=2.49 kg/m²; 95% CI 2.28, 2.70; p<0.001) when adjusting for”.</p> <p>Review comments on manuscript bmjopen-2020-042561 2</p> <p>ii) Presentation of the results in Tables 2 & 3 is little confusing, in regards to Model 1 & Model 2. On careful scrutiny, it becomes clear that actually “Model 1” are crude (unadjusted) estimates, whereas “Model 2” are the adjusted estimates. If indeed this is correct, I suggest that instead of using the column sub-title “Model 1”, they replace it with “crude estimates”. Similarly, instead of using the column sub-title “Model 2”, they replace it with “adjusted estimates”.</p>
--	--

	<p>Likewise, reference to “Model 1” and “Model 2” in the text in the RESULTS section should be corrected accordingly</p> <p>iii) The titles for Table 2 and Table 3 are too long, and might confuse readers. A suggested title for Table 2 is: “Level of association between Body Mass Index and urban-rural residence, and other covariates”. Similarly for Table 3: “Level of association between Waist-Hip Ratio and socioeconomic characteristics”.</p>
--	---

VERSION 1 – AUTHOR RESPONSE

Reviewer 1: Tushar Trivedi, University of South Carolina, USA

1. Please state any competing interests or state ‘None declared’

Authors’ response:

The statement ‘None declared’ has been added.

2. For BMI, present another model using BMI as a categorical variable (normal wt, overweight, and obese) and use logistic regression to present the point estimates by exposure group. This can be a sensitivity analyses, and can be presented as an additional table.

Authors’ response:

We have conducted the logistic regression analysis which did not change our findings from linear regression analysis as shown in the table below (See Table 1 below).

Table 1: Odds ratios (ORs) for the association between urban-rural location and socioeconomic factors with overweight and obesity

Variables	Category	Crude estimates		Adjusted estimates	
		Overweight	Obesity	Overweight	Obesity
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Location	Rural	1	1	1	1
	Urban	2.05* (1.84-2.29)	3.07* (2.57-3.66)	1.97 ^{a*} (1.76-2.20)	2.90 ^{a*} (2.42-3.46)
Income¹	<1.9 USD/day	1	1	1	1
	≥ 1.9 USD/day	1.66* (1.37-2.00)	1.89* (1.34-2.65)	1.36 ^{b*} (1.12-1.66)	1.36 ^b (0.96-1.93)

Education	Low	1	1	1	1
	Medium	1.38* (1.23-1.56)	1.76* (1.43-2.16)	1.41 ^{c*} (1.24-1.59)	1.69 ^{c*} (1.36-2.10)
	High	1.95* (1.66-2.30)	2.12* (1.62-2.79)	1.68 ^{c*} (1.40-2.02)	1.53 ^{c**} (1.14-2.06)
Employment ²	Employed	1	1	1	1
	Unemployed	0.97 (0.81-1.16)	1.13 (0.85-1.49)	0.94 ^d (0.78-1.13)	1.10 ^d (0.82-1.47)

*p<0.001, **p<0.01, ¹982 participants with missing value for income excluded in both crude and adjusted estimates; ²4 participants with missing employment status excluded in crude and adjusted estimates; OR, Odds ratio; USD, United States Dollar

a) adjusted for age and gender

b) adjusted for age, gender, urban-rural location, education, and employment

c) adjusted for age, gender, and urban-rural location

d) adjusted for age, gender, urban-rural location, and education

We think logistic regression is a too weak way of conducting a sensitivity analysis. Therefore, we suggest not adding it to the manuscript, unless the reviewer and editor insist on doing so. However, we did an additional analysis which have strengthened our findings: “We tested for heteroscedasticity by using robust estimator and there were only minor changes in the estimates, which indicates there was no problem of heteroscedasticity” (See Tables 2 and 3 below). We have added the above sentence to the statistical methods part (page 7) of the revised manuscript, but we think there is no need to add the table to the manuscript or supplementary file.

Table 2: Level of associations between urban-rural location and socioeconomic factors with BMI (kg/m²) among 25-64 years old Myanmar residents using robust estimator

Variables	Category	Crude estimates	Adjusted estimates
		β (95% CI)	β (95% CI)
Location	Rural	Ref.	Ref.
	Urban	2.62** (2.38-2.86)	2.49 ^{a**} (2.25-2.73)
Income ¹	< 1.9 USD/day	Ref	Ref.
	≥ 1.9 USD/day	1.44** (1.16-1.72)	0.74 ^{b**} (0.46-1.02)

Education	Low	Ref.	Ref.
	Medium	0.98** (0.77-1.19)	0.88 ^{c**} (0.68-1.08)
	High	2.28** (1.90-2.65)	1.48 ^{c**} (1.10-1.85)
Employment ²	Employed	Ref.	Ref.
	Unemployed	0.04 (-0.32-0.40)	-0.06 ^d (-0.42-0.29)

****p<0.001, *p<0.05, ¹982 participants with missing value for income excluded in crude and adjusted estimates; ²4 participants with missing employment status excluded in crude and adjusted estimates; BMI, Body mass index; CI, Confidence interval; Ref., reference category; SD, Standard Deviation**

a) adjusted for age and gender

b) adjusted for age, gender, urban-rural location, education, and employment

c) adjusted for age, gender, and urban-rural location

d) adjusted for age, gender, urban-rural location, and education

Table 3: Level of associations between urban-rural location and socioeconomic factors with W/H-ratio among 25-64 years old Myanmar residents using robust estimator

Variables	Category	Crude estimates	Adjusted estimates
		β (95% CI)	β (95% CI)
Location	Rural	Ref.	Ref.
	Urban	0.016 ^{***} (0.011-0.021)	0.015 ^{a***} (0.010-0.020)
Income ¹	< 1.9 USD/day	Ref.	Ref.
	\geq 1.9 USD/day	0.010 ^{***} (0.005-0.015)	0.007 ^{***b} (0.002-0.012)
Education	Low	Ref.	Ref.
	Medium	0.005* (0.00-0.009)	0.002 ^c (-0.002-0.006)
	High	0.006 (-0.002-0.013)	0.002 ^c (-0.006-0.009)
Employment ²	Employed	Ref.	Ref.
	Unemployed	0.018 ^{***} (0.010-0.025)	0.006 ^d (-0.001-0.014)

*****p<0.001, **p<0.01, *p<0.05; 7 participants with missing W/H-ratio excluded in crude and adjusted estimates; ¹982 participants with missing value for income excluded in crude and adjusted estimates; ²4 participants with missing employment status excluded in all models; CI, Confidence interval; Ref., Reference category; SD, Standard Deviation; W/H-ratio, Waist-hip ratio**

a) adjusted for age and gender

b) adjusted for age, gender, urban-rural location, education, and employment

c) adjusted for age, gender, and urban-rural location

d) adjusted for age, gender, urban-rural location, and education

3. In your discussion section, please discuss why the results are so different in South East Asian population in comparison to Western population. Cite papers who have studied this concept in Western population and have presented different results.

Authors' response:

A new paragraph has been added to the discussion section on page 15-16 of the revised manuscript.

Rural populations in high income countries have excess BMI compared to urban populations.^{12,51-54} As compared with urban populations in high income countries, rural populations often have lower income and education, limited access to healthy and fresh food choices, and they have less sports facilities and recreational activities, possibly explaining the higher rural BMI.^{55,56} In high-income countries, the obesity risk is often higher for individuals in low SES groups compared to high SES groups,⁵⁷⁻⁶⁰ as those in the high SES groups are more likely to consume healthy foods, such as whole grains, lean meats, fish, low-fat dairy products, and fruit and vegetables.^{61,62} They also more often have several physical activity opportunities and more knowledge about healthy choices.⁶³

Reviewer 2: David Guwatudde, School of Public Health, Makerere University, Kampala, Uganda

1. Please state any competing interests or state 'None declared':

Authors' response:

Thank you, we have added 'None declared'.

General comments:

1. Overweight and obesity are important risk factors for quite a number of non-communicable diseases; and disparities of these between urban and rural residents may help inform targeted policy and formulation of interventions meant to reduce the prevalence of these. Therefore, this manuscript addresses an important public health problem.
2. The data used for analysis in this manuscript was from a STEPs survey, which follows standard methodology for collection of data on NCD risk factors. The methods used for data collection are well described and clear in the manuscript.
3. The specific objectives of the analysis are clearly stated, and these are followed through the manuscript. They include:
 - i) To investigate whether urban-rural location and socioeconomic factors (income, education, and employment) are associated with BMI;
 - ii) To investigate whether urban-rural location and socioeconomic factors (income, education, and employment) are associated W/H ratio;
 - iii) To explore whether the associations between urban-rural location and BMI or W/H-ratio could be mediated through variations in socioeconomic factors.

Specific comments:

1. INTRODUCTION: pages 2 – 3, is very clear.

2. METHODOLOGY:

i) Page 6, line 58 - 60: correct the typing error in the sentence: “Differences in categorical variables were tested using the chi-square test of Fischer exact test, whereas... “

Authors’ response:

Thank you, the error has been corrected. The sentence now reads: “Differences in categorical variables were tested using the chi-square test or Fischer’s exact test, whereas differences in the mean for continuous variables were tested using two tailed t-tests.”

ii) Page 7, lines 18- 55: It is un-conventional to refer to results tables in the methods section. I suggest the authors focus on describing the methods used to address each objective, without referring to the results at this stage.

Authors’ response:

We have made the appropriate changes throughout the text.

iii) Page 7, lines 37 – 45: the authors attempt to describe how they calculated the Social Economic Status (SES) for each participant, and the composite SES score calculated. Then they refer to “high education attainment”. But they do not explain what they mean by “high education attainment”. But this becomes clear later when one reviews Supplementary Table 1 that this refers to “high school grade completion”. It would be better to include this detail in the text here.

Authors’ response:

We have added a sentence on page 7 of the revised manuscript. The paragraph now reads: “To study the combined statistical effect of the SES variables (income, education, and employment status), the variables were assigned SES values (0/1) and a composite SES score was calculated. For this, education level was collapsed into two groups: high education (defined as high school completion and above) and low education (defined as education below high school completion). Participants with earnings above poverty line, high education attainment (binary) and employment were assigned SES value=1 and the lower category was assigned SES value=0. Total SES score for each participant was obtained by summing up values and total SES score was further categorized into three SES groups: low (total SES score=0), medium (total SES score=1 and 2), and high (total SES score=3) (See Supplementary Table 1). We assessed the association between SES groups and BMI or W/H-ratio with adjustment for confounders (age, gender, and urban-rural location).”

3. RESULTS:

i) Although the results from the analysis are largely clearly presented, to aid readers who may not be familiar with the meaning of the β -coefficients from linear regression analysis, I suggest the authors try to report these coefficients with their actual meanings. For example on page 9, lines 54 – 55, the sentence here could alternatively be written as: “The mean BMI was higher

among urban than rural residents by 2.49 kg/m² ($\beta=2.49$ kg/m²; 95% CI 2.28, 2.70; $p<0.001$) when adjusting for

Authors' response:

Amendments to the result-section have been made to make the meaning of the estimates more clear.

ii) Presentation of the results in Tables 2 & 3 is little confusing, in regards to Model 1 & Model 2. On careful scrutiny, it becomes clear that actually "Model 1" are crude (unadjusted) estimates, whereas "Model 2" are the adjusted estimates. If indeed this is correct, I suggest that instead of using the column sub-title "Model 1", they replace it with "crude estimates". Similarly, instead of using the column sub-title "Model 2", they replace it with "adjusted estimates".

Likewise, reference to "Model 1" and "Model 2" in the text in the RESULTS section should be corrected accordingly

Authors' response:

We agree, and have changed the column headings.

iii) The titles for Table 2 and Table 3 are too long, and might confuse readers. A suggested title for Table 2 is: "Level of association between Body Mass Index and urban-rural residence, and other covariates".

Similarly, for Table 3: "Level of association between Waist-Hip Ratio and socio-economic characteristics".

Authors' response:

Thank you, we hope it is less confusing in the revised version.

VERSION 2 – REVIEW

REVIEWER	Tushar Trivedi Regional Medical Center, Orangeburg
REVIEW RETURNED	16-Nov-2020

GENERAL COMMENTS	This is my second review of the paper. I am satisfied with the response and update. The authors have addressed my concerns.
-------------------------	---

REVIEWER	David Guwatudde Department of Epidemiology and Biostatistics, School of Public Health, College of Health Sciences, Makerere University, Kampala, Uganda
REVIEW RETURNED	11-Nov-2020

GENERAL COMMENTS	Only one outstanding correction to be made: The authors did not correct the typing error at the top of Page 7 of the revised version in the sentence: "Differences in categorical variables were tested using the chi-square test of Fischer exact test, whereas... " The correction should be "Fisher's Exact Test".
-------------------------	---