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)	Comparison of two malnutrition risk screening tools with nutritional biochemical parameters, BMI and length of stay in Chinese geriatric inpatients: a multicenter, cross-sectional study
AUTHORS	Miao, Jian-Ping; Quan, Xiao-Qing; Zhang, Cun-Tai; Zhu, Hong; Ye, Mei; Shen, Li-Ya; Guo, Qiu-Hui; Zhu, Gang-Yan; Mei, Qi-Jian; Wu, Yan-Xia; Li, Shu-Guo; Zhou, Hong-Lian

VERSION 1 – REVIEW

REVIEWER	Pia Lopez Jornet University Murcia, Spain
REVIEW RETURNED	29-Mar-2018

GENERAL COMMENTS	This paper analyzes a very interesting topic.The conclusions have practical implications I need to indicate the sample size calculation

REVIEWER	Lisa Söderström Center for Clinical Research Västerås, Uppsala University, Sweden
REVIEW RETURNED	17-Apr-2018

GENERAL COMMENTS	Comparison of two malnutrition risk screening tools with nutritional biochemical parameters in Chinese geriatric inpatients: a multicenter, cross-sectional study Summary This is an interesting study with the aim to evaluate the prevalence of malnutrition among older adults admitted to hospital in China with the two screening instruments, MNA and NRS-2002. The aim was also to compare the screening tools with each other and with age, BMI and laboratory parameters to evaluate which of the two instruments is the most appropriate to use in older adults in China. To answer the research question the authors use correlation analysis. Title #1. The title is incomplete because the screening instruments are not only compared with nutritional biochemical parameters, but also with BMI and with length of stay (LOS). Authorship of the manuscript #2. BMJ open follows the ICMJE rules for authorship. According to these rules, only four out of the 12 listed authors of the manuscript, should be listed as an author, namely JPM, XQQ, CTZ and HLZ. The other authors were only involved in the acquisition of data,

	and agreed to submit the manuscript for publication, which according to the ICMJE rules are not enough for authorship. The work of HZ, MY, LYS, QHG, GYZ, QJM, YXW, SGL should instead be acknowledged in the Acknowledgement section of the manuscript. Abstract #3. Objectives: The study aim is clearly stated, but the major hypothesis/research question is not. Please provide the main hypothesis of the study. #4. Primary and secondary outcome measure: The MNA and NRS-2002 do not assess nutritional status, only the risk of malnutrition as they are only screening instruments. Please avoid using the term nutritional status and instead use the term nutritional risk, or risk of malnutrition. Background #5. The authors refers to the original 18-items MNA which was developed and validated in the 1990s, and states that the instrument is too time consuming to use in clinical practice. However, two short forms of the MNA has been developed and validated since then, the most recently the revised MNA-SF by Kaiser et al 2009, which is nowadays the recommended version of the MNA for clinical use. This instrument only incorporates 6 of the original 18 items and takes approximately 5 minutes to perform. The authors should mention this in the introduction section and also use the original references by Guigoz and Vellas when referring to the 18-items MNA. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. J Nutr Health Aging 2009;13(9):782-8. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini NutritionalAssessment as part of the geriatric evaluation. Nutr Rev 1996;54(1 Pt 2):59-65. Vellas B, Guigoz Y, Garry PJ, Nourhashemi F, Bennahum D, Lauque S, et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999;15(2):116-22. #6. In the introduction the authors state that the MNA has not been compared to predict nutritional parameters. However, the original 18-items MNA was validated against a clinical evaluations of two geriatrics, which included biochemical parameters (albumin, transthyretin (prealbumin), retionol-binding protein, transferrin, ceruloplasmin,C-reactive protein, alpha 1-acid glycoprotein, cholesterol, vitamins A, D, E, B1, B2, B6, B12, folate, copper, zinc), and anthropometry (BMI, brachial circumference, calf circumference, skinfold width of the triceps and subscapular muscles), and also dietary components and functional assessment outcomes. This should be mentioned. Methods #7. The BMJ open request that all authors provide a statement in the methods section under the subheading Patient involvement. There is no such statement in the present manuscript. #8. There is methodological problems correlating the MNA and NRS-2002 with BMI, as this parameter (BMI) is already a part of

	the instruments, and therefore already correlated with the MNA and NRS-2002 assessment. Also, age is a part of the NRS-2002 and should therefore not be used as an outcome to correlate with the instrument. Hence, only the laboratory parameters (hemoglobin, albumin and prealbumin) should be used as outcome measures. If BMI and age are used, this should be discussed as a limitation. #9. The aim was also to compare the screening tools with each other and with age, BMI and laboratory parameters to assess which of the two instruments is the most appropriate to use in older adults. This is performed by correlation analysis. However, correlation analysis only indicates to which extent two variables are linearly related. Further, the correlation is highly affected by outliers. A more appropriate statistical method would be to use a multivariate regression analysis. That is the motivation for using correlation analysis instead of regression analysis? Study subjects #10. The authors conclude that the prevalence of malnutrition according to both screening instruments was high. However, was the data collected consecutively? Who acctually who participated in the study? Only 425 individuals who were admitted to 8 hospitals during two years met the inclusion criteria, that is approximately 26 patients/hospital/year. #11. How many participants was eligible for inclusion in the study, that is, how many patients >70 years were admitted to the 8 hospitals during the two years? #12. There is no information about the excluded patients and no flow-chart describing the recruitment process. Please prove a flow chart describing how many patients were excluded due to the three exclusion criteria 1. refusal to participate, 2. age <70, 3. unconscious or refused to participate in the study? A proper flow-chart enables the interpretation of the generasibility of the results. #13. What is the difference between exclusion criteria 1 and 3? Both states “refusal to participate”. #14. Who assessed the nutritional risk at the 8 hospitals? #15. How many health care professionals performed the MNA and NRS-2002 assessment? #16. Did the health care professionals receive any training in how to interpret the questions in the instruments and how to performed the measurements before the study started? #17. How was the weight and height measured at the hospital? #18. Was all the patients assessed with both the MNA and the NRS-2002? This should be mentioned in the methods section. #19. Please provide a heading in the manuscript describing the data collection procedure. Ethical considerations #20. Participants with a score ≥3 received a nutritional care plan. What did this plan include? Did the patients with a low MNA score receive the same nutritional care plan? Statistical analysis #21. To answer the question if MNA or NRS-2002 is the most appropriate tool to use to assess nutritional risk in older adults the authors uses correlation coefficients to compare the results from the MNA and NRS-2002 with BMI, serum parameters and length of stay. A more appropriate statistical method to answer the

	research question would be to perform a regression analysis. Why is not this done? Results #22. In the statistics the author writes that Spearmans rang correlation is performed. However when referring to Table 4, the Pearsson correlation is stated in the heading, but Spearmans (rs) in the table. Which statistics have been used? Please change to the correct method throughout the manuscript. Limitations #23. The authors write that because of a lack of a gold standard for diagnosing malnutrition, the nutritional screening tools were only compared with BMI and biochemical measurements. However, in 2015, the ESPEN proposed a consensus statement with diagnostic criteria for malnutrition. Why did not the authors compare the results from the screening instruments with these diagnostic criteria? Cederholm T, Bosaeus I, Barazzoni R, Bauer J, Van Gossum A, Klek S, et al. Diagnostic criteria for malnutrition - An ESPEN Consensus Statement. Clin Nutr. 2015;34(3): 335-40. #24. The authors write that the small sample of women may limit the power of data analysis. However it is not clear if a power calculation is done, and how many participants is needed in the study to answer the main research question. Please provide the power calculation of the study. If there is no power calculation done, this should be added as a limitation. #25. Another limitation is that only correlation analysis were performed, and no multivariate regression analyses to answer the research question. #26. There is a problem regarding the cross-classification of MNA with NRS-2002. Because MNA categorize patients in three nutritional screening groups (malnourished, at risk and well-nourished), and the NRS-2002 only categorize patients in two groups (at risk or well-nourished), there will be more patients categorized as at risk with the MNA if the two groups malnourished and at risk are combined. This is the reason to the low Kappa value between the two instruments, and this should be discussed as a limitation. #27. Further, the small sample size of women may have affected the generalizability of the results, and should be mentioned as a study limitation. Conclusion #28. The term nutritional status and diagnosis should not be used when referring to the results of the MNA and NRS-2002, because they are only screening tools which can't assess nutritional status. The term nutritional risk is more appropriate to use. #29. The authors conclude that both tools are a good predictor of length of hospitalization. However, no prediction model was constructed based on multivariate regression analysis. Please rephrase the sentence and avoid the word predictor, because a correlation is not a prediction measure.

REVIEWER	Irna Nykänen Institute of Public Health and Clinical Nutrition School of Medicine; University of Eastern Finland, Kuopio Campus, Finland
REVIEW RETURNED	20-Apr-2018

GENERAL COMMENTS	In this cross-sectional study, the authors report comparison of two malnutrition risk screening tools with nutritional biochemical parameters in Chinese geriatric inpatients: a multicenter, cross-sectional study. The results are presented accordingly and statistical analyses were well done. However, the article does not add substantially new. It is known that MNA and NRS2002 tests both are suitable to screen malnutrition risk. This is relevant among Chinese elderly inpatients. The article have a clear message and is well written. However, there are several issues that need to be addressed. There are no questions in this study, but the aims of the study are clearly defined and appropriately answered. Participants are adequately described and maybe were a representative sample of the Chinese population. Methods are mainly adequately described and the study is ethical. The following things need to be clarified: 1. The comorbidities and length of hospitalization were obtained from medical records. Who verified the diagnoses? 2. In this study, the cutoff value of BMI was set at 20.5 kg/m2 for malnutrition. Why? According to the epidemiological study (Dey et al. 2009), the optimal BMI for individuals over 70 is 24-29. Winter et al. (2014) found 32 study meta-analysis a greater mortality risk for those with a BMI of <23.0, which was not observed for the BMI in the WHO overweight range 25-30. Results answer the aims of the study and these are mainly well presented. The following things need to be clarified: Table 1 are height and weight measurements. Are they necessary to present? Since the gender differences. 1. Table 1 is showed NRS2002 and MNA test results as classified. Could them have been mentioned only in the text? 2. Line 50: The risk of under-nourished participants classified by… but in the table 1 under-nourished 3. Table 1 and 2: There are the means of Hb of all participants. It is would enough if men's and women's Hb means were mentioned. 4. All results in table 1 and table 2 percent one decimal. 5. Hb`s abbreviation be lacking in the table 2. 6. Figure 1a and b: Figures are good, but can the authors show the actual numbers of ALB et al. in three groups (Table)? Otherwise, it is not easy to understand the results in Results section. Interpretation and conclusions are mainly warranted. The following things need to be clarified: 1. In discussion page 12, line 45 the authors write: In the present study, prevalence of malnutrition detected by ALB is lower than MNA and NRS2002, which suggest that ALB was not suitable for assessing malnutrition in our patients. The authors should discuss why ALB was not suitable for assessing malnutrition in their patients. 2. Page 13, line the authors discuss: Our study revealed that NRS2002 and MNA, in moderate agreement with each other, were consistently associated with age, BMI…" This is a matter of course since BMI is included in both tests.

	The authors use the word elderly, is it better to use the word older people.

VERSION 1 – AUTHOR RESPONSE

Response to Reviewers' Comments
MS ID: bmjopen--2018-022993
MS TITLE: Comparison of two malnutrition risk screening tools with nutritional biochemical parameters, BMI and length of stay in Chinese geriatric inpatients: a multicenter, cross-sectional study

Detailed Responses to Reviewer #1
Q1: This paper analyzes a very interesting topic. The conclusions have practical implications. I need to indicate the sample size calculation.
Response:
We thank the reviewer for raising this important issue. We calculated the sample size as following formula: $N= Z\alpha/22\times P(1-P)/\delta 2$. All statistical tests were two-sided.
Parameter:
1. $\alpha = 0.05$, $Z\alpha/2= 1.96$;
2. $\delta = 0.1P$;
3. $P = 0.5$ (According to a nation-wide nutrition screening survey conducted on 10161 elderly patients in hospital using the MNA-SF by the Chinese Medical Association Nutrition Support Group for Geriatric Patients1, the risk of developing malnutrition by geriatric patients in hospital was high at 50.1%.)
4. N = sample size in one group;
$N = Z\alpha/22\times P(1-P)/\delta 2 = 385$. Thus, the sample size should be 385. In our study, the sample size was 428. Therefore, the sample size in our study was enough.

REFERENCE
1. Wei J, Chen W, Zhu M, et al. Guidelines for parenteral and enteral nutrition support in geriatric patients in China. Asia Pac J Clin Nutr. 2015;24:336-46.

Detailed Responses to Reviewer #2:
Q1: The title is incomplete because the screening instruments are not only compared with nutritional biochemical parameters, but also with BMI and with length of stay (LOS).
Response:
Thank you for this comment. The title has been changed as "Comparison of two malnutrition risk screening tools with nutritional biochemical parameters, BMI and length of stay in Chinese geriatric inpatients: a multicenter, cross-sectional study" in the revised manuscript.

Q2: BMJ open follows the ICMJE rules for authorship. According to these rules, only four out of the 12 listed authors of the manuscript, should be listed as an author, namely JPM, XQQ, CTZ and HLZ. The other authors were only involved in the acquisition of data, and agreed to submit the manuscript for publication, which according to the ICMJE rules are not enough for authorship. The work of HZ, MY, LYS, QHG, GYZ, QJM, YXW, SGL should instead be acknowledged in the Acknowledgement section of the manuscript.
Response:

We apologized for the error. HZ, MY, LYS, QHG, GYZ, QJM, YXW and SGL also contributed to the study conception. Besides, all the authors were involved in the analysis and interpretation of the data and gave the final approval. This has been emphasized in the revised manuscript.

Q3: Objectives: The study aim is clearly stated, but the major hypothesis/research question is not. Please provide the main hypothesis of the study.
Response:
We thank the reviewer for this suggestion. As suggested, the main hypothesis of the study has been added in the introduction section of the revised manuscript.

Q4: Primary and secondary outcome measure: The MNA and NRS-2002 do not assess nutritional status, only the risk of malnutrition as they are only screening instruments. Please avoid using the term nutritional status and instead use the term nutritional risk, or risk of malnutrition.
Response:
We are in full agreement with the Reviewer, and have carefully revised our manuscript accordingly. The term “nutritional status” has been replaced by “nutritional risk” in the revised manuscript.

Q5: The authors refers to the original 18-items MNA which was developed and validated in the 1990s, and states that the instrument is too time consuming to use in clinical practice. However, two short forms of the MNA has been developed and validated since then, the most recently the revised MNA-SF by Kaiser et al 2009, which is nowadays the recommended version of the MNA for clinical use. This instrument only incorporates 6 of the original 18 items and takes approximately 5 minutes to perform. The authors should mention this in the introduction section and also use the original references by Guigoz and Vellas when referring to the 18-items MNA.
Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, et al. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. J Nutr Health Aging 2009;13(9):782-8.
Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. Nutr Rev 1996;54(1 Pt 2):59-65.
Vellas B, Guigoz Y, Garry PJ, Nourhashemi F, Bennahum D, Lauque S, et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999;15(2):116-22.
Response:
We appreciate the reviewer’s valuable comments, and have carefully revised our manuscript accordingly. As suggested, a brief description of MNA-SF has been given in the introduction section. The original references by Guigoz and Vellas have been added in the revised manuscript.

Q6: In the introduction the authors state that the MNA has not been compared to predict nutritional parameters. However, the original 18-items MNA was validated against a clinical evaluations of two geriatrics, which included biochemical parameters (albumin, transthyretin (prealbumin), retionol-binding protein, transferrin, ceruloplasmin, C-reactive protein, alpha 1-acid glycoprotein, cholesterol, vitamins A, D, E, B1, B2, B6, B12, folate, copper, zinc), and anthropometry (BMI, brachial circumference, calf circumference, skinfold width of the triceps and subscapular muscles), and also dietary components and functional assessment outcomes. This should be mentioned.
Response:
We apologized for the confusion. As suggested, relevant modifications have been made in the introduction section of the revised manuscript.

Q7: The BMJ open request that all authors provide a statement in the methods section under the subheading Patient involvement. There is no such statement in the present manuscript.
Response:

We thank the reviewer for this important comment. Patient involvement has been added in the methods section of the revised manuscript.

Q8: There is methodological problems correlating the MNA and NRS-2002 with BMI, as this parameter (BMI) is already a part of the instruments, and therefore already correlated with the MNA and NRS-2002 assessment. Also, age is a part of the NRS-2002 and should therefore not be used as an outcome to correlate with the instrument. Hence, only the laboratory parameters (hemoglobin, albumin and prealbumin) should be used as outcome measures. If BMI and age are used, this should be discussed as a limitation.
Response:
We thank the reviewer for this important comment. We have discussed it as a limitation in the revised manuscript.

Q9: The aim was also to compare the screening tools with each other and with age, BMI and laboratory parameters to assess which of the two instruments is the most appropriate to use in older adults. This is performed by correlation analysis. However, correlation analysis only indicates to which extent two variables are linearly related. Further, the correlation is highly affected by outliers. A more appropriate statistical method would be to use a multivariate regression analysis. That is the motivation for using correlation analysis instead of regression analysis?
Response:
Thank you for this very good suggestion. As suggested, we have added a simple linear regression analysis of length of stay (LOS) in table 5, which found the linear relation between both instruments (MNA and NRS2002) and LOS ($P < 0.05$ and $P < 0.01$).
We didn't use multivariate regression analysis for some reasons. First, at the beginning of the study design, we read a lot of papers and found it more common to use the correlation analysis between the screening tools and the laboratory measures1-5. Besides, the regression analysis can be used to infer causal relationships between the independent and dependent variables, while correlation analysis does not prove causation. Our study was a cross-sectional study, there was no causal relationship between the screening tools and laboratory parameters. As a result, we only conducted correlation analysis. The screening tools may predict LOS, so we added a linear regression analysis of LOS in the revised manuscript. Next, we will conduct a further prospective study, using multivariate regression analysis.

Q10: The authors conclude that the prevalence of malnutrition according to both screening instruments was high. However, was the data collected consecutively? Who actually who participated in the study? Only 425 individuals who were admitted to 8 hospitals during two years met the inclusion criteria, that is approximately 26 patients/hospital/year.
Response:
Thank you for the comment. The data was collected consecutively. During the 18-month study period, 425 eligible patients were recruited. We have added the patient flow diagram in the revised manuscript (Figure 1).

Q11: How many participants was eligible for inclusion in the study, that is, how many patients >70 years were admitted to the 8 hospitals during the two years?
Response:
Thank you for your question. 1144 patients were eligible for inclusion in the study from December 2014 to May 2016. We have added the patient flow diagram in the revised manuscript (Figure 1).

Q12: There is no information about the excluded patients and no flow-chart describing the recruitment process. Please prove a flow chart describing how many patients were excluded due to the three exclusion criteria 1. refusal to participate, 2. age <70, 3. unconscious or refused to participate in the study? A proper flow-chart enables the interpretation of the generasibility of the results.

Response:
Thank you for raising this important issue. We have added the patient flow diagram in the revised manuscript (Figure 1).

Q13: What is the difference between exclusion criteria 1 and 3? Both states “refusal to participate”.
Response:
We apologized for the error about the criteria 3. It should be “(3) patients was unconscious or unable to answer the study questions". We have corrected it in the revised manuscript.

Q14: Who assessed the nutritional risk at the 8 hospitals?
Response:
Thank you for your comment. The nutritional risk was assessed by the researchers of the 8 hospitals, they were asked to be trained before the study started. All patients were evaluated with both MNA and NRS2002 assessment by two trained researchers. We have emphasized this in the methods section of the revised manuscript.

Q15: How many health care professionals performed the MNA and NRS-2002 assessment?
Response:
Thank you for your question. Each hospital had 2 researchers trained before the study started. 16 health care professionals performed the MNA and NRS-2002 assessment. We have emphasized this in the methods section of the revised manuscript.

Q16: Did the health care professionals receive any training in how to interpret the questions in the instruments and how to perform the measurements before the study started?
Response:
Thank you for your comment. All participating researchers were trained before the study started. This has been specified in the methods section of the revised manuscript.

Q17: How was the weight and height measured at the hospital?
Response:
Thank you for your question. Body weight and height was measured at 6-8 am within 24 hours after admission. Patients were asked to be fasting, only wearing ward clothes and taking off shoes before measurement. Height was measured with a calibrated scale (corrected to ± 0.5 cm). The actual body mass was measured with a calibrated scale (corrected to ± 0.2 kg). This has been specified in the methods section of the revised manuscript.

Q18: Was all the patients assessed with both the MNA and the NRS-2002? This should be mentioned in the methods section.
Response:
Thank you for your comment. All patients were assessed with both MNA and NRS2002. This has been specified in the methods section of the revised manuscript.

Q19: Please provide a heading in the manuscript describing the data collection procedure.
Response:
Thank you for your suggestion. “Data Collecting” has been added and specified in the methods section of the revised manuscript.

Q20: Participants with a score ≥3 received a nutritional care plan. What did this plan include? Did the patients with a low MNA score receive the same nutritional care plan?
Response:
Thanks for raising this important issue. The nutritional care plan was based on Guidelines for parenteral and enteral nutrition support in geriatric patients in China6. Malnutrition and high nutrition

risk are indications for enteral nutrition (EN) in geriatric patients (level A evidence)6. EN is the first choice if gastrointestinal function is normal (level A evidence)6. Thus, patients with a NRS2002 score ≥3 received a nutritional care plan, so did the patients with a MNA score <17. This has been specified in the methods section of the revised manuscript.

Q21: To answer the question if MNA or NRS-2002 is the most appropriate tool to use to assess nutritional risk in older adults the authors uses correlation coefficients to compare the results from the MNA and NRS-2002 with BMI, serum parameters and length of stay. A more appropriate statistical method to answer the research question would be to perform a regression analysis. Why is not this done?
Response:
Thank you for this very good suggestion. As suggested, we have added a simple linear regression analysis of length of stay (LOS) in table 5, which found the linear relation between both instruments (MNA and NRS2002) and LOS ($P < 0.05$ and $P < 0.01$).
We didn't use multivariate regression analysis for some reasons. First, at the beginning of the study design, we read a lot of papers and found it more common to use the correlation analysis between the screening tools and the laboratory measures1-5. Besides, the regression analysis can be used to infer causal relationships between the independent and dependent variables, while correlation analysis does not prove causation. Our study was a cross-sectional study, there was no causal relationship between the screening tools and laboratory parameters. As a result, we only conducted correlation analysis. The screening tools may predict LOS, so we added a linear regression analysis of LOS in the revised manuscript. Next, we will conduct a further prospective study, using multivariate regression analysis.

Q22: In the statistics the author writes that Spearmans rang correlation is performed. However when referring to Table 4, the Pearson correlation is stated in the heading, but Spearmans (rs) in the table. Which statistics have been used? Please change to the correct method throughout the manuscript.
Response:
We apologize for the error and have revised the manuscript accordingly. The Pearson correlation was performed in our study.

Q23: The authors write that because of a lack of a gold standard for diagnosing malnutrition, the nutritional screening tools were only compared with BMI and biochemical measurements. However, in 2015, the ESPEN proposed a consensus statement with diagnostic criteria for malnutrition. Why did not the authors compare the results from the screening instruments with these diagnostic criteria?
Cederholm T, Bosaeus I, Barazzoni R, Bauer J, Van Gossum A, Klek S, et al. Diagnostic criteria for malnutrition - An ESPEN Consensus Statement. Clin Nutr. 2015;34(3): 335-40.
Response:
Thanks for raising this important issue. In 2015, the ESPEN recommend the diagnostic criteria for malnutrition as follows: before diagnosis of malnutrition is considered it is mandatory to fulfil criteria for being "at risk" of malnutrition by any validated risk screening tool. Alternative 1: BMI <18.5 kg/m2; Alternative 2: Weight loss (unintentional) >10% indefinite of time, or >5% over the last 3 months combined with either BMI <20 kg/m2 if <70 years of age, or <22 kg/m2 if 70 years of age or fat free mass index (FFMI) <15 and 17 kg/m2 in women and men, respectively.7
Our study started in 2014, when the ESPEN Consensus Statement has not been published. Besides, some hospitals couldn't measure body composition. As a result, we didn't compare the results from the screening instruments with these diagnostic criteria. We have emphasized this in the limitation section of the revised manuscript.

Q24: The authors write that the small sample of women may limit the power of data analysis. However it is not clear if a power calculation is done, and how many participants is needed in the

study to answer the main research question. Please provide the power calculation of the study. If there is no power calculation done, this should be added as a limitation.
Response:
We thank the reviewer for raising this important issue. We calculated the sample size as following formula: $N= Z\alpha/22\times P(1-P)/\delta 2$. All statistical tests were two-sided.
Parameter:
1. $\alpha = 0.05$, $Z\alpha/2= 1.96$;
2. $\delta = 0.1P$;
3. $P = 0.5$ (According to a nation-wide nutrition screening survey conducted on 10161 elderly patients in hospital using the MNA-SF by the Chinese Medical Association Nutrition Support Group for Geriatric Patients6, the risk of developing malnutrition by geriatric patients in hospital was high at 50.1%.)
4. N = sample size in one group;
$N = Z\alpha/22\times P(1-P)/\delta 2 = 385$. Thus, the sample size should be 385. In our study, the sample size was 428. Therefore, the sample size in our study was enough.

Q25: Another limitation is that only correlation analysis were performed, and no multivariate regression analyses to answer the research question.
Response:
Thank you for your comment. As suggested, we have added a simple linear regression analysis of length of stay (LOS) in table 5, which found the linear relation between both instruments (MNA and NRS2002) and LOS ($P < 0.05$ and $P < 0.01$).
We didn't use multivariate regression analysis for some reasons. First, at the beginning of the study design, we read a lot of papers and found it more common to use the correlation analysis between the screening tools and the laboratory measures1-5. Besides, the regression analysis can be used to infer causal relationships between the independent and dependent variables, while correlation analysis does not prove causation. Our study was a cross-sectional study, there was no causal relationship between the screening tools and laboratory parameters. As a result, we only conduct correlation analysis. The screening tools may predict LOS, so we added a linear regression analysis of LOS in the revised manuscript. Next, we will conduct a further prospective study, using multivariate regression analysis.

Q26: There is a problem regarding the cross-classification of MNA with NRS-2002. Because MNA categorize patients in three nutritional screening groups (malnourished, at risk and well-nourished), and the NRS-2002 only categorize patients in two groups (at risk or well-nourished), there will be more patients categorized as at risk with the MNA if the two groups malnourished and at risk are combined. This is the reason to the low Kappa value between the two instruments, and this should be discussed as a limitation.
Response:
We appreciate the reviewer's valuable comments, and have carefully revised our manuscript accordingly. As suggested, this has been discussed as a limitation in the revised manuscript.

Q27: Further, the small sample size of women may have affected the generalizability of the results, and should be mentioned as a study limitation.
Response:
We agree with the Reviewer, and have carefully revised our manuscript accordingly. As suggested, this has been discussed as a limitation in the revised manuscript.

Q28: The term nutritional status and diagnosis should not be used when referring to the results of the MNA and NRS-2002, because they are only screening tools which can't assess nutritional status. The term nutritional risk is more appropriate to use.
Response:

Thanks for your suggestion. We have used the term “nutritional risk” instead of “diagnosis of nutritional status” in the revised manuscript.

Q29: The authors conclude that both tools are a good predictor of length of hospitalization. However, no prediction model was constructed based on multivariate regression analysis. Please rephrase the sentence and avoid the word predictor, because a correlation is not a prediction measure.
Response:
We agree with the Reviewer, and have carefully revised our manuscript accordingly. As suggested, a simple linear regression analysis of length of stay has been done in table 5, which found the linear relation between both instruments (MNA and NRS2002) and LOS ($P < 0.05$ and $P < 0.01$). Thus, both tools may be predictor of length of hospitalization.

REFERENCE

1. Kagansky N, Berner Y, Koren-Morag N, et al. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. Am J Clin Nutr. 2005;82:784-91; quiz 913-4.
2. Drescher T, Singler K, Ulrich A, et al. Comparison of two malnutrition risk screening methods (MNA and NRS 2002) and their association with markers of protein malnutrition in geriatric hospitalized patients. Eur J Clin Nutr. 2010;64:887-93.
3. Hsu MF, Ho SC, Kuo HP, et al. Mini-nutritional assessment (MNA) is useful for assessing the nutritional status of patients with chronic obstructive pulmonary disease: a cross-sectional study. COPD. 2014;11:325-32.
4. Zhou J, Wang M, Wang H, et al. Comparison of two nutrition assessment tools in surgical elderly inpatients in Northern China. Nutr J. 2015;14:68.
5. Koren-Hakim T, Weiss A, Hershkovitz A, et al. Comparing the adequacy of the MNA-SF, NRS-2002 and MUST nutritional tools in assessing malnutrition in hip fracture operated elderly patients. Clin Nutr. 2016;35:1053-8.
6. Wei J, Chen W, Zhu M, et al. Guidelines for parenteral and enteral nutrition support in geriatric patients in China. Asia Pac J Clin Nutr. 2015;24:336-46.
7. Cederholm T, Bosaeus I, Barazzoni R, et al. Diagnostic criteria for malnutrition - An ESPEN Consensus Statement. Clin Nutr. 2015;34:335-40.

Detailed Responses to Reviewer #3:
General comment:
In this cross-sectional study, the authors report comparison of two malnutrition risk screening tools with nutritional biochemical parameters in Chinese geriatric inpatients: a multicenter, cross-sectional study.
The results are presented accordingly and statistical analyses were well done. However, the article does not add substantially new. It is known that MNA and NRS2002 tests both are suitable to screen malnutrition risk. This is relevant among Chinese elderly inpatients. The article have a clear message and is well written. However, there are several issues that need to be addressed.
There are no questions in this study, but the aims of the study are clearly defined and appropriately answered. Participants are adequately described and maybe were a representative sample of the Chinese population.
Methods are mainly adequately described and the study is ethical.
Response:
We appreciate the reviewer’s positive comments. We have followed your suggestions and made every possible effort to address the concerns. Detailed responses are below.

Major comment:
Q1: The following things need to be clarified:

The comorbidities and length of hospitalization were obtained from medical records. Who verified the diagnoses?
Response:
We thank the reviewer for the question. The participants were diagnosed by their bedside clinicians and superior clinicians. Two trained researchers of each hospital verified the diagnoses and acquired data. We have emphasized this in the revised manuscript.

Q2: In this study, the cutoff value of BMI was set at 20.5 kg/m2 for malnutrition. Why? According to the epidemiological study (Dey et al. 2009), the optimal BMI for individuals over 70 is 24-29. Winter et al. (2014) found 32 study meta-analysis a greater mortality risk for those with a BMI of <23.0, which was not observed for the BMI in the WHO overweight range 25-30.
Response:
Thank you for your comment. The body size of the Chinese is smaller than the Europeans or the Americans. We chose 20.5 kg/m2 as the cutoff value of BMI according to the epidemiological study in China1 as well as a previous study2. We have emphasized this in the revised manuscript.

Q3: Results answer the aims of the study and these are mainly well presented. The following things need to be clarified:
Table 1 are height and weight measurements. Are they necessary to present? Since the gender differences.
Response:
We thank the reviewer for this question. The small sample size of women may limit the generalizability of the results, we have discussed it in the limitation section.

Q4: Table 1 is showed NRS2002 and MNA test results as classified. Could them have been mentioned only in the text?
Response:
Thank you for your suggestion. The data of NRS2002/MNA test results have been deleted in revised table 1, and only mentioned in the text.

Q5. Line 50: The risk of under-nourished participants classified by… but in the table 1 under-nourished.
Response:
We apologize for the confusion and have revised table 1 accordingly. The means of NRS2002 and MNA test results have been deleted in the revised manuscript.

Q6: Table 1 and 2: There are the means of Hb of all participants. It is would enough if men's and women's Hb means were mentioned.
Response:
Thank you for your suggestion. As suggested, the means of Hb of all participants in Table 1 and Table 2 have been deleted in the revised manuscript.

Q7: All results in table 1 and table 2 percent one decimal.
Response:
Thank you for your advice. We changed all the data in tables 1 and 2 accordingly in the revised manuscript.

Q8: Hb’s abbreviation be lacking in the table 2.
Response:
We apologize for the error. The abbreviation of Hb was emphasized in the revised manuscript.

Q9: Figure 1a and b: Figures are good, but can the authors show the actual numbers of ALB et al. in three groups (Table)? Otherwise, it is not easy to understand the results in Results section.
Response:
Thank you for your constructive suggestion. We have added a table (additional table 1) showing the actual number of the parameters (ALB, PAB, Hb, TLC) in the revised manuscript.

Q10: In discussion page 12, line 45 the authors write: In the present study, prevalence of malnutrition detected by ALB is lower than MNA and NRS2002, which suggest that ALB was not suitable for assessing malnutrition in our patients. The authors should discuss why ALB was not suitable for assessing malnutrition in their patients.
Response:
We are in full agreement with the Reviewer, and have carefully revised our manuscript accordingly. As suggested, we discussed why ALB was not suitable for assessing malnutrition in the revised manuscript.

Q11: Page 13, line the authors discuss: Our study revealed that NRS2002 and MNA, in moderate agreement with each other, were consistently associated with age, BMI…" This is a matter of course since BMI is included in both tests.
Response:
We are in full agreement with you. It was a limitation of our study since BMI is part of the tools. We have discussed it in limitation section of the revised manuscript.

Q12: The authors use the word elderly, is it better to use the word older people.
Response:
Thank you for your advice. We have carefully revised our manuscript accordingly.

REFERENCE
1. Cooperative Meta-Analysis Group of the Working Group on Obesity in China. International life sciences institute, focal point in China: the recommendation of Chinese adult body mass index classification. Zhonghua Yu Fang Yi Xue Za Zhi. 2001;35:349–50
2. Zhou J, Wang M, Wang H, et al. Comparison of two nutrition assessment tools in surgical elderly inpatients in Northern China. Nutr J. 2015;14:68.

VERSION 2 – REVIEW

REVIEWER	Lisa Söderström Centre for Clinical Research Västerås, Uppsala University, Sweden
REVIEW RETURNED	20-Jun-2018

GENERAL COMMENTS	Comparison of two malnutrition risk screening tools with nutritional biochemical parameters, BMI and length of stay in Chinese geriatric inpatients: a multicenter, cross-sectional study Summary This is an interesting study with the aim to evaluate the prevalence of malnutrition among older adults admitted to hospital in China with the two screening instruments, MNA and NRS-2002. The aim was also to compare the screening tools with each other and with age, BMI and laboratory parameters to evaluate which of the two instruments is the most appropriate to use in older adults in China.

	To answer the research question the authors use correlation analysis and a simple linear regression. Authorship of the manuscript #1. BMJ open follows the ICMJE rules for authorship. The author's contributions cannot be changed when the manuscript is already written. #2. Hypothesis: A hypothesis must be tested with a statistical test. Which statistical test measured the suitability of the two instruments? What was the definition of a suitable instrument? Statistical analysis #3. A multivariate linear regression analysis can be performed in a cross-sectional study and do not imply any causal relationship. A causal relationship between two variables cannot not even be determined in a prospective cohort study, only in a randomized controlled trail. Therefore, I still suggest that the authors perform a multivariate linear regression analysis to control for independent variables. Result #4 Although the simple linear regression between LOS and MNA and LOS and NRS-2002 is significant, the variable LOS only explain 1,2% of the variance in nutritional status in MNA and 3,2% of the variance in nutritional status in NRS-2002. This should be discussed as a limitation.

VERSION 2 – AUTHOR RESPONSE

Detailed Responses to Editorial Requests

Q1: We previously asked you to provide a completed copy of the STROBE checklist indicating the line/page numbers where the relevant information can be found (https://www.strobe-statement.org/index.php?id=strobe-home). This was not included in your revised submission. Please remember to provide a completed copy in your next revision

Response:

We thank the reviewer for raising this important issue. We have provided a completed copy of the STROBE checklist as part of the submission.

Q2: Please revise the patient and public involvements statement on pages 9-10. The Patient and Public Involvement statement should NOT contain details of participant recruitment, patient consent or ethics approval. This information should be included elsewhere in your methods section. Please see our recent blog for further information regarding PPI:
http://blogs.bmj.com/bmjopen/2018/03/23/new-requirements-for-patient-and-public-involvement-statements-in-bmj-open/

Inspired by the work of the patient partnership strategy at The BMJ (https://www.bmj.com/campaign/patient-partnership), BMJ Open is encouraging active patient involvement in setting the research agenda. BMJ Open now require authors of all submissions to the journal to include a Patient and Public Involvement statement. It should provide a brief description of any patient involvement in study design or conduct of the study, as well as any plans to disseminate the results to study participants. If patients and or public were not involved then please state this.

Response:

We appreciate the reviewer's valuable comments. According to the suggestion, relevant modifications have been made in the patient and public involvements statement of the revised manuscript.

Q3: The quality of English needs improving in places e.g. page 9: "..according to the epidemiological study in China" According to which epidemiology study? This isn't very clear. Also, is reference 35 a journal article? If so then please include the name of the journal in reference 35 of your reference list.

The quality of English also needs improving in the following sentence: "The reason may be its long half-life to make it insensitive to malnutrition" We recommend asking a native English-speaking colleague to assist you or to enlist the help of a professional copy-editing service.

Response:

We apologize for the form of our original submission. We have carefully revised our manuscript according to your suggestion and improved our English by utilizing an academic English editing company.

Reference 35 is a journal article. Cooperative Meta-Analysis Group of the Working Group on Obesity in China. International life sciences institute, focal point in China: the recommendation of Chinese adult body mass index classification. Zhonghua Yu Fang Yi Xue Za Zhi (Chinese Journal of Preventive Medicine). 2001;35:349–50. The reference article recommended the BMI classification in China. This classification was based on a two-part study. The first part was a Meta analysis of 13 epidemiological surveys on cardiovascular disease, diabetes, hypertension and nutrition including 21 provinces from 1991 to 2000. The second part was a prospective study, including four cohorts of 61900 adults, an average follow-up of 4.7-15 years. However, we also found this article was not included in the PubMed. Therefore, we have changed another reference using the same BMI classification. (Zhou J, Wang M, Wang H, et al. Comparison of two nutrition assessment tools in surgical elderly inpatients in Northern China. Nutr J. 2015;14:68.)

Q4: Can you please clarify/ explain why the small sample size of women limits the *generalisability* of your results?

Response:

Thank you for your question. Reviewer 2 put forward that the small size of women might have affected the generalizability of the results, and thus we added this sentence. To explain this question, we conducted a t-test between women and men. The results showed there existed no difference between them in MNA/NRS2002 scores, BMI, nutritional parameters and length of hospital stay ($P>0.05$). Therefore, we have deleted this sentence in the revised manuscript.

Table 1 Characteristic of study participants

Male (n=293) Female (n=132) P

BMI 23.26 ± 3.66 23.14 ± 3.90 0.700

NRS2002 2.47 ± 1.33 2.36 ± 1.37 0.920

MNA 20.97 ± 6.10 20.38 ± 5.58 0.390

ALB 37.33 ± 5.63 38.30 ± 4.68 0.054

PAB 192.05 ± 72.73 198.56 ± 56.91 0.212

HB 121.53 ± 20.51 118.88 ± 20.32 0.852

TLC 1.40 ± 0.85 1.52 ± 0.70 0.689

LOS 22.82 ± 12.08 19.62 ± 16.90 0.399

Values are mean ± standard deviation. BMI = Body mass index, NRS2002 = Nutritional Risk Screening 2002, MNA = Mini-Nutritional Assessment, ALB = albumin, PAB = prealbumin, Hb = hemoglobin, TLC = total lymphocyte count, LOS = length of hospital stay.

Detailed Responses to Reviewer #2

Comparison of two malnutrition risk screening tools with nutritional biochemical parameters, BMI and length of stay in Chinese geriatric inpatients: a multicenter, cross-sectional study

Summary

This is an interesting study with the aim to evaluate the prevalence of malnutrition among older adults admitted to hospital in China with the two screening instruments, MNA and NRS-2002. The aim was also to compare the screening tools with each other and with age, BMI and laboratory parameters to evaluate which of the two instruments is the most appropriate to use in older adults in China. To answer the research question the authors use correlation analysis and a simple linear regression.

Authorship of the manuscript

Q1: BMJ open follows the ICMJE rules for authorship. The author’s contributions cannot be changed when the manuscript is already written.

Response:

We apologize for the error in the original manuscript. HZ, MY, LYS, QHG, GYZ, QJM, YXW and SGL also contributed to the study conception. Besides, all the authors were involved in the analysis and interpretation of the data and gave the final approval, which has been emphasized in the revised manuscript. Our patients were recruited from eight hospitals, and if we delete the authors mentioned

above, we have to delete patients from those hospitals. As a result, only 55 participants were left and unable to complete the study.

Q2: Hypothesis: A hypothesis must be tested with a statistical test. Which statistical test measured the suitability of the two instruments? What was the definition of a suitable instrument?

Response:

We thank the reviewer for the important questions. A suitable instrument must have high sensitivity and specificity. We considered carefully and found the statistical tests conducted could not answer the question. To clarify this problem, the receiver operating characteristic (ROC) curves have been applied to compare MNA and NRS2002 with biochemical parameters separately (Figure 3). We found both MNA and NRS2002 can predict nutritional risk. The area under ROC curve (AUC) values for MNA (0.794, ALB; 0.704, PAB; 0.702, Hb; 0.581, TLC) and NRS2002 (0.761, ALB; 0.616, PAB; 0.677, Hb; 0.586, TLC). The suitable instrument refers to that with the larger AUC. The comparison between the AUC showed that NRS2002 was not different from MNA for predicting nutritional risk ($P>0.05$). Together with the correlation analysis and simple linear regression analysis, we concluded that both instruments were suitable to screen malnutrition risk among Chinese geriatric inpatients. This has been supplemented in the revised manuscript. Thank you very much for your question, which has improved our article.

Statistical analysis

Q3: A multivariate linear regression analysis can be performed in a cross-sectional study and do not imply any causal relationship. A causal relationship between two variables cannot not even be determined in a prospective cohort study, only in a randomized controlled trail. Therefore, I still suggest that the authors perform a multivariate linear regression analysis to control for independent variables.

Response:

We appreciate the reviewer's valuable comments. As suggested, a multivariate linear regression analysis was performed and listed below (Tables 2 and 3). We found both MNA and NRS2002 were associated with PAB, Hb and BMI ($P<0.05$).

As mentioned in previous question, the aim of this study was to find the high sensitivity and specificity instrument to access nutritional risk for Chinese geriatric patients. Therefore, we used the ROC curve to compare MNA and NRS2002 with biochemical parameters. The comparison between the area under ROC curve showed that NRS2002 was not different from MNA for predicting nutritional risk ($P>0.05$). As you can find, the ROC curve, the correlation analysis, the simple linear regression analysis and multivariate linear regression analysis drew the same conclusion in the comparison between MNA and NRS2002. Therefore, both instruments were suitable to screen malnutrition risk among Chinese geriatric inpatients.

The multivariate linear regression analysis aimed at determining which nutritional parameters can affect the instruments. We believe it may be more reasonable to compare both instruments using the ROC curve, and we have added it in the revised manuscript.

Table 2 Results of multivariate linear regression analysis performed to assess the association of the MNA scores with nutritional parameters.

B 95% CI P

ALB 0.077 -0.129 to 0.283 0.462

PAB 0.022 0.010 to 0.033 <0.001

Hb 0.053 0.013 to 0.093 0.010

TLC -0.168 -1.187 to 0.850 0.744

BMI 0.597 0.401 to 0.793 <0.001

MNA = Mini-Nutritional Assessment, CI = confidence interval, ALB = albumin, PAB = prealbumin, Hb = hemoglobin, TLC = total lymphocyte count, BMI = body mass index.

Table 3 Results of multivariate linear regression analysis performed to assess the association of the NRS2002 scores with nutritional parameters.

B 95% CI P

ALB -0.017 -0.045 to 0.011 0.246

PAB -0.004 -0.007 to 0.000 0.028

Hb -0.013 -0.020 to -0.006 0.001

TLC 0.045 -0.245 to 0.336 0.758

BMI -0.074 -0.111 to -0.036 <0.001

NRS2002=Nutritional Risk Screening 2002, CI = confidence interval, ALB = albumin, PAB = prealbumin, Hb = hemoglobin, TLC = total lymphocyte count, BMI = body mass index.

Result

Q4: Although the simple linear regression between LOS and MNA and LOS and NRS-2002 is significant, the variable LOS only explain 1,2% of the variance in nutritional status in MNA and 3,2% of the variance in nutritional status in NRS-2002. This should be discussed as a limitation.

Response:

We agree with the reviewer and have carefully revised the manuscript. In addition to nutritional status, LOS could also be influenced by age, financial situation, comorbidities and so on. This may explain the low R squares between both instruments and LOS. We have emphasized this in the discussion and limitation sections.

VERSION 3 – REVIEW

REVIEWER	Lisa Söderström Center for Clinical Research, Västerås, Sweden
REVIEW RETURNED	30-Aug-2018

GENERAL COMMENTS	I am not convinced that the authors contributions to the study were only forgotten in the manuscript, and that none of the 12 authors notised this mistake. In this final version of the manuscripts statement of contributions, all the authors were involved in the analysis and interpretation of the data and gave their final approval. Please be consistent when writing the name of the NRS, and chose one of the alternatives NRS2002 or NRS 2002.

VERSION 3 – AUTHOR RESPONSE

Detailed Responses to Reviewer #2
Q1: I am not convinced that the authors contributions to the study were only forgotten in the manuscript, and that none of the 12 authors notised this mistake. In this final version of the manuscripts statement of contributions, all the authors were involved in the analysis and interpretation of the data and gave their final approval.
Response:
We apologize for the error in the original manuscript. We all focused on the content of the manuscript and ignored the author's contribution. HZ, MY, LYS, QHG, GYZ, QJM, YXW and SGL contributed to the study conception, data analysis and interpretation, and gave the final approval. We apologize again for this, and we will not make such a mistake in the future.

Q2: Please be consistent when writing the name of the NRS, and chose one of the alternatives NRS2002 or NRS 2002.
Response:
We apologize for the error and have revised the manuscript accordingly.