

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Low back pain in emergency ambulance workers in tertiary hospitals in China and its risk factors among ambulance nurses: a cross-sectional study
AUTHORS	Zhang, Qiong; Dong, Hongyun; Zhu, Chunji; Liu, Guangzeng

VERSION 1 – REVIEW

REVIEWER	farideh sadeghian Center for Health Related Social and Behavioral Sciences Research, Shahroud University of Medical Sciences, Shahroud,Iran Department of occupational health engineering,school of public health,Shahroud University of Medical Sciences, Shahroud,Iran
REVIEW RETURNED	09-Feb-2019

GENERAL COMMENTS	This paper needs: 1- Revision on basis of all the suggestions on the manuscript 2- English revision 3-Rewrite the method section 4-Rewrite the discussion The reviewer also provided a marked copy with additional comments. Please contact the publisher for full details.
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REVIEWER	David McBride Preventive and Social Medicine Dunedin School of Medicine New Zealand
REVIEW RETURNED	29-May-2019

GENERAL COMMENTS	Thank you, I enjoyed reading your paper and have the following comments. 1. The sampling method is clear, but could you provide details of the total number of hospitals in Shandong, how the ambulance workers were approached, if the protocol was reviewed and if ethics approval had been received. 2. The questionnaire is of course critical. Later in the discussion you discuss patient handling as an issue, as it can indeed generate spinal forces. That being so, an ergonomic assessment would have been ideal, but time consuming, so the you used the DMG. You appear (table 2) to have used walking, bending the trunk, heavy/awkward lifting (which seems to combine two questions), neck movements and shoulder abduction. Why were the latter two chosen, there seem to be other domains such as 'work with a load that is hard to hold' which seem appropriate.
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	<p>3. You should also say how you decided on the items from the Karasek job content questionnaire.</p> <p>4. I don't quite understand why you chose annual prevalence and chronic low back pain as the outcome variable, additional insights would have been given by looking at frequency, severity or duration in more recent periods. Can you explain your logic here?</p> <p>5. You also do not provide a definition of chronic low back pain, there seem to be 498 in this group of nurses.</p> <p>6. The choice of analysis of nurses only needs to be justified. This would need an explanation of the role of each of your groups: who does the lifting?</p> <p>7. The use of an internal comparison would have strengthened the findings, and you have doctors and drivers. Were the ergonomics of these groups different?</p> <p>8. The discussion should ideally be structured as main findings, strengths and weaknesses, (with discussion of bias and confounding), comparison with other studies and finally the occupational implications.</p>
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VERSION 1 – AUTHOR RESPONSE

To Reviewer: 1

Reviewer Name: Farideh Sadeghian

Comments: This paper needs:

1- Revision on basis of all the suggestions on the manuscript

Thank you very much for your suggestions, all of which were very valuable and helpful to us. We have studied the comments carefully and revised our manuscript based on them. Thank you.

2- English revision

The language of the manuscript has been edited by American Journal Experts.

3-Rewrite the method section

The method section has been rewritten. Thank you very much for your valuable suggestions.

4-Rewrite the discussion

The discussion has been rewritten. Special thanks to you for your valuable comments to the manuscript.

To Reviewer: 2

Reviewer Name: David McBride

Comments: Thank you, I enjoyed reading your paper and have the following comments.

1. The sampling method is clear, but could you provide details of the total number of hospitals in Shandong, how the ambulance workers were approached, if the protocol was reviewed and if ethics approval had been received.

There were 182 tertiary-level hospitals in Shandong province, China when the study was conducted in September, 2018 (Methods section, line 12, page 6). In Mainland China, hospitals were divided into three levels by the National Health Administrations of China based on numerous indicators such as the scales, functions, facilities and technical strength. The first-class or primary hospital provides medical, preventive, rehabilitation and health care services directly to the community, and it is also a primary health care institution. The tertiary hospital is a cross-regional, provincial, municipal or nationwide comprehensive hospital providing medical and health services. In Mainland China, with the development of economy, the improvement of people's spending power and trust in general hospitals built for decades, more and more patients would be inclined to go to large hospitals (secondary or tertiary hospitals) to seek medical service for their first visit. Therefore, emergency ambulance workers in tertiary hospital might be more likely to suffer from LBP than those in primary

and secondary hospitals. The study was focused on emergency ambulance workers in tertiary hospitals.

Of the 38 tertiary hospitals selected, we contacted with the management department such as the Human Resources Department or the Medical Matters Section first. They helped us inform the director of Emergency department of their hospitals. Then the written informed consent and the questionnaire were distributed and collected with help of the director of Emergency department and management department (Methods section, line 14-16, page 6). The study including the protocol and the written informed consent had been reviewed and approved by the Ethics Committee of Shouguang People's Hospital before the study commenced (Methods section, line 6-7, page 6).

2. The questionnaire is of course critical. Later in the discussion you discuss patient handling as an issue, as it can indeed generate spinal forces. That being so, an ergonomic assessment would have been ideal, but time consuming, so the you used the DMG. You appear (table 2) to have used walking, bending the trunk, heavy/awkward lifting (which seems to combine two questions), neck movements and shoulder abduction. Why were the latter two chosen, there seem to be other domains such as 'work with a load that is hard to hold' which seem appropriate.

A very good comment. Thank you. There were many ergonomic factors which might be associated with chronic low back pain. And in our study, we of course included the factor 'work with a load that is hard to hold'. But this factor 'work with a load that is hard to hold' was not statistically significant between chronic LBP group and non-chronic-LBP group, and was not statistically associated with chronic LBP among ambulance nurses in the study. Therefore, we did not present the factor in Table 2 although it was collected and studied. As to the ergonomic factor of "heavy or awkward lifting", which was derived from the Chinese version of DMQ, was modified by us in the study. Thank you.

3. You should also say how you decided on the items from the Karasek job content questionnaire.

The Job Content Questionnaire (JCQ) has been systematically translated into the Chinese language and been widely used in different groups of numerous Chinese studies. The Chinese version of JCQ was a dominant tool in the research field of job stress in Mainland China. In our study, we only chose 22 items of the original job content questionnaire, whose content validity indices were all above 0.80. These 22 items have been shown good reliability and validity. In this study, Cronbach's α coefficients for the psychological job demand, job control and workplace social support were 0.79, 0.87 and 0.90 respectively (Methods section, line 5-16, page 8). Those items which we did not select in the study, were either unreliable or not validated, or not suitable for the Chinese population [Li J, Yang W, Liu P, Xu Z, Cho SI. Psychometric evaluation of the Chinese (mainland) version of Job Content Questionnaire: a study in university hospitals. *Ind Health*. 2004 Apr;42(2):260-7. Li W, Zhang JQ, Sun J, Tan PF, Wang S. Reliability and validity of Job Content Questionnaire in Chinese petrochemical employees. *Psychol Rep*. 2007 Feb;100(1):35-46.]. Thank you.

4. I don't quite understand why you chose annual prevalence and chronic low back pain as the outcome variable, additional insights would have been given by looking at frequency, severity or duration in more recent periods. Can you explain your logic here?

There were several reasons for us to choose annual prevalence and chronic low back pain as the outcome variable. As reported, most individuals suffer from short-term or minor LBP at some point in their lives (Scott NA, Moga C, Harstall C. Managing low back pain in the primary care setting: the know-do gap. *Pain Res Manag* 2010;15(6):392-400.), and most acute LBP is a self-limiting symptom with a recovery rate of 90% within six weeks [European guidelines for the management of low back pain. *Acta Orthop Scand Suppl* 2002;73(305):20-5.; van Tulder M, Becker A, Bekkering T, et al. Chapter 3. European guidelines for the management of acute nonspecific low back pain in primary care. *Eur Spine J* 2006;15 Suppl 2:S169-91. doi: 10.1007/s00586-006-1071-2; Indahl A (2004) Low back pain: diagnosis, treatment, and prognosis. *Scand J Rheumatol* 33:199-209]. Serious or chronic LBP was caused mainly by work and other factors. (Discussion section, line 7-10, page 17).

Therefore, choosing chronic LBP and analyzing its risk factors might be more meaningful, than short-term/acute LBP and other variables. Besides, many studies on LBP around the world also choose annual prevalence. Choosing the same time period with other studies could let our study have the comparability with them. A twelve-month period was also suitable for chronic LBP (lasting for at least three months) and one's recall period.

5. You also do not provide a definition of chronic low back pain, there seem to be 498 in this group of nurses.

If a participant reported LBP lasting for at least three months in the past twelve months, he or she was considered to have chronic LBP (Methods section, line 13-14, page 7). There were 498 ambulance nurses in this study. The following literature might better explain why we define chronic LBP as lasting for at least three months.

Acute low back pain is usually defined as the duration of an episode of low back pain persisting for less than 6 weeks; sub-acute low back pain as low back pain persisting between 6 and 12 weeks; chronic low back pain as low back pain persisting for 12 weeks or more. (Chapter 3. European guidelines for the management of acute nonspecific low back pain in primary care. *Eur Spine J.* 2006 Mar;15 Suppl 2:S169-91.)

Low Back Pain is a pain syndrome in the lower back region and may be classified by duration as acute (pain lasting less than 6 weeks), sub-chronic (6-12 weeks), or chronic (more than 12 weeks) [Gemma Mansell, Kjersti Storheim, Ida Løchting, Margreth Grotle. Identification of Indirect Effects in a Cognitive Patient Education (COPE) Intervention for Low Back Pain. *Phys Ther* 97(12):1138-11460]. Chronic LBP is a common health problem, and is also considered to be one of the most expensive medical conditions [Stephane Genevay, Federico Balagué. Diagnosis and prognosis of low back pain: Contribution and limitations of the clinical approach. *Rev Med Suisse.* 2017 Jun 21;13(568):1283-1288.]

Concerning chronic non-specific LBP, the definition of the diagnosis "chronic non-specific low back pain" is not defined as a clinical entity and diagnosis, but rather a symptom in patients with very different stages of impairment and disability without knowing the specific causes of the pain. (Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, KlüberMoffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanoli G (2006) Chapter 4. European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J* 15(Suppl 2):S192–S300; Keller A1, Hayden J, Bombardier C, van Tulder M. Effect sizes of non-surgical treatments of non-specific low-back pain. *Eur Spine J.* 2007 Nov;16(11):1776-88.)

Eighty five percent of chronic low back pain disorders have no known diagnosis leading to a classification of 'non-specific Chronic LBP' that leaves a diagnostic and management vacuum. (O'Sullivan, P. 2005, "Diagnosis and classification of chronic low back pain disorders: maladaptive movement and motor control impairments as underlying mechanism", *Man.Ther.*, vol. 10, no. 4, pp. 242-255.)

6. The choice of analysis of nurses only needs to be justified. This would need an explanation of the role of each of your groups: who does the lifting?

In this study, we found ambulance nurses had a statistically higher prevalence of low back pain than ambulance doctors and drivers. Studies around the world also showed that low back pain was common among nurses. Besides, although nurses, doctors and drivers all belong to the ambulance workers, they belong to different groups because their working role was different. Therefore, we only analyzed the risk factors of ambulance nurses in our previous manuscript. In our revised manuscript, we have analyzed the risk factors for ambulance doctors and drivers (Results section, line 30-34, page 14). The ambulance doctors are responsible for the whole process of diagnosis and treatment of patients from receiving patients until the patients were sent to the emergency center of a hospital. The ambulance nurses are response for the implementation of the treatment and carrying out ambulance doctors' instructions. The ambulance drivers are responsible for driving the ambulance vehicle. Most

often, ambulance nurse needs to do the lifting, sometimes with the help of ambulance doctor. Thank you for your comment.

7. The use of an internal comparison would have strengthened the findings, and you have doctors and drivers. Were the ergonomics of these groups different?
 A good suggestion. Thank you. We have analyzed ambulance doctors' chronic LBP and ambulance drivers' chronic LBP separately using multivariate logistic regression analysis (Results section, line 30-34, page 14). The ergonomic factors for chronic LBP among ambulance doctors were "bending the trunk frequently" and among drivers were "sitting for long periods of time", different from ambulance nurses' ergonomic risk factors for chronic LBP (Discussion section, line 18-20, page 17).

8. The discussion should ideally be structured as main findings, strengths and weaknesses, (with discussion of bias and confounding), comparison with other studies and finally the occupational implications.

Thank you very much for your suggestion. We have rewritten the discussion section. Thanks again for your time.

VERSION 2 – REVIEW

REVIEWER	farideh sadeghian Shahroud university of medical sciences,Shahroud, Iran
REVIEW RETURNED	09-Jul-2019

GENERAL COMMENTS	In this stage this paper is better than before but revision is necessary for structure and context of each paragraph of discussion and methods.Grammatically is better than before but still revision is needed. other comments is suggested in the attached manuscript. The reviewer also provided a marked copy with additional comments. Please contact the publisher for full details.
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REVIEWER	David McBride Preventive and Social Medicine Dunedin School of Medicine University of Otago New Zealand
REVIEW RETURNED	10-Jul-2019

GENERAL COMMENTS	Thank you, I enjoyed reading your paper and have the following comments. 1. The sampling method is clear, but could you provide details of the total number of hospitals in Shandong, how the ambulance workers were approached, if the protocol was reviewed and if ethics approval had been received. Thank you for this clarification 2. The questionnaire is of course critical. Later in the discussion you discuss patient handling as an issue, as it can indeed generate spinal forces. That being so, an ergonomic assessment would have been ideal, but time consuming, so the you used the DMG. You appear (table 2) to have used walking, bending the trunk, heavy/awkward lifting (which seems to combine two questions), neck movements and shoulder abduction. Why were the latter two chosen, there seem to be other domains such as 'work with a load that is hard to hold' which seem appropriate. Thank you for the explanation, however you still need to say whether you administered the complete 63 question instrument, or whether you selected the items from the factor analysis in the
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	<p>DMG paper (ref 14) likely to be relevant to ambulance workers (e.g. force and dynamic loads and ergonomic environment.</p> <p>3. You should also say how you decided on the items from the Karasek job content questionnaire. Validity above 0.80, thank you, do you have a reference? That would be helpful.</p> <p>4. I don't quite understand why you chose annual prevalence and chronic low back pain as the outcome variable, additional insights would have been given by looking at frequency, severity or duration in more recent periods. Can you explain your logic here? Thank you for the explanation</p> <p>5. You also do not provide a definition of chronic low back pain, there seem to be 498 in this group of nurses. Yes, my fault for mis-reading.</p> <p>6. The choice of analysis of nurses only needs to be justified. This would need an explanation of the role of each of your groups: who does the lifting?</p> <p>7. The use of an internal comparison would have strengthened the findings, and you have doctors and drivers. Were the ergonomics of these groups different? 7 and 8. Thank you for the explanation that the ambulance nurses do most of the lifting (could you mention this in the introduction) and for the separate analysis of doctors and drivers (could you mention this in the methods).</p> <p>8. The discussion should ideally be structured as main findings, strengths and weaknesses, (with discussion of bias and confounding), comparison with other studies and finally the occupational implications. The implications are important. How feasible is it to avoid frequent bending of the trunk and heavy or awkward lifting in nurses?</p>
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VERSION 2 – AUTHOR RESPONSE

To Reviewer: 1

Reviewer Name: Farideh Sadeghian

Thank you very much for your suggestions, all of which were very valuable and helpful to us. We have studied the comments carefully and revised our manuscript based on them. Thank you. And there is something we would like to say.

1. The "Patient and public involvement" section has not been deleted because the journal of BMJ Open requires it.

2. As to the older references in our previous manuscript, only a few have been replaced because we did not find more suitable ones. Thank you very much for your time.

To Reviewer: 2

Reviewer Name: David McBride

Comments

Thank you for the explanation, however you still need to say whether you administered the complete 63 question instrument, or whether you selected the items from the factor analysis in the DMG paper (ref 14) likely to be relevant to ambulance workers (e.g. force and dynamic loads and ergonomic environment).

Responses

Thank you very much for your valuable comments. We did not administer the complete 63 question instrument, nor did we select items directly from the original complete 63 question instrument. As the Chinese version of Dutch Musculoskeletal Questionnaire has been validated (Du WW, Wang S, Wang JX, et al. [The assessment of reliability and validity of musculoskeletal questionnaire]. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi* 2012;30(5):335-8.) and been used in many Chinese studies, we selected items likely to be relevant to ambulance workers directly from the Chinese version of Dutch Musculoskeletal Questionnaire (Yang L, Hildebrand V, Yu S, et al. The introduction of a musculoskeletal disorders questionnaire-the questionnaire attached. *Industrial health and occupational diseases* 2009;1:25-31.). Thank you. (Methods section, line 2-3, page 8)

Validity above 0.80, thank you, do you have a reference? That would be helpful.

The content validity of the 22-item Chinese version Job Content Questionnaire has been confirmed in several Chinese studies (Li J, Yang W, Liu P, et al. Psychometric evaluation of the Chinese (mainland) version of Job Content Questionnaire: a study in university hospitals. *Ind Health* 2004;42(2):260-7; SHA Yan, LIU Ping, LI Jian, et al. The validation of Chinese Version of Job Content Questionnaire in Health Professionals. *Chinese Occupational Medicine* 2003;30(3):24-6; WANG LI, LI Hua, GAO Hong Ping, et al. A Reliability and Validity Analysis of Chinese Version of Job Content Questionnaire for Health Professionals. *JOURNAL OF BAOTOU MEDICAL COLLEGE* 2010;26(5):20-2). The expression in our previous revised manuscript may not be that precise and we have rewritten this sentence (Methods section, line 22, page 8 to line 1, page 9). Thank you very much for your comments.

7 and 8. Thank you for the explanation that the ambulance nurses do most of the lifting (could you mention this in the introduction) and for the separate analysis of doctors and drivers (could you mention this in the methods).

Thank you for your suggestions. The role of ambulance workers and separate analysis of ambulance doctors and drivers have been included in the revised manuscript (Introduction, line 22, page 5 to line 1-6, page 6; Methods, line 17-18, page 9).

The implications are important. How feasible is it to avoid frequent bending of the trunk and heavy or awkward lifting in nurses?

A very good question. Musculoskeletal loads and injuries resulting from patient-handling tasks need to be reduced and might be reduced by efficient and cost-effective ergonomic intervention measures, including sharing LBP knowledge, transferring equipment, lifting teams and training in safe patient-transfer techniques reported by previous studies (Hodder JN, MacKinnon SN, Ralhan A, et al. Effects of training and experience on patient transfer biomechanics. *International Journal of Industrial Ergonomics* 2010;40(3):282-88.). To achieve the aim of decreasing chronic LBP in ambulance nurses, multi-component comprehensive measures might be considered in the future. (Discussion, line 19-21, page 17; Discussion, line 15-18, page 19) Thank you very much for your time.