Title: Gender differences in the association of social support and social network with self-rated health status among older adults: a population-based study

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Author's response to reviews: see over
Dear Ms. Emily Crow,

We should be grateful if you would consider the revised version of our article entitled “Gender differences in the association of perceived social support and social network with self-rated health status among older adults: a population-based study” for publication in the BMC Geriatrics.

This is original research that is not presently under consideration for publication elsewhere. It is free of conflict of interest and was conducted applying the highest ethical principles on human subjects.

We thank for the editor comments and we have responded to all items.

Yours sincerely,

Dr. Cosme Marcelo Furtado Passos da Silva
The Editors comments are as follows:

1. Results, Abstract: Please rephrase "Older men without social networks." I do not feel comfortable with "without social networks." Also, I did not see to whom these older men without social networks are comparing to. Related to this, in Method Section, please clearly define the classification (i.e., categories) of social supports and social networks.

   **Answer:** The first sentence of the results in the abstract was rephrased according to editor’s suggestion.

   **# Abstract, lines 18-19**
   **Removed:** “Older men without social networks were more likely to report poor SRH, …”
   **Added:** “Older men without participation in group activities were more likely to report poor SRH than those reporting participation in group activities, …”.

The categories of social support and social networks measures were defined in the paragraphs 9 and 10 in the Method section.

   **# Methods, paragraph 9, lines 5-6**
   **Removed:** “This was assessed through the following question: ‘With whom do you live? (alone/with partner or family).’”
   **Added:** “This was assessed through the following question: ‘With whom do you live? (categories: a) alone / b) with partner or family).’”

   **# Methods, paragraph 9, lines 9-11**
   **Removed:** “The question assessing functional social support was ‘Are there any people you can count on or whom you can ask for help? (Yes/No).’”
   **Added:** “The question assessing functional social support was ‘Are there any people you can count on or whom you can ask for help? (categories: a) Yes/ b) No).’”

   **# Methods, paragraph 10, lines 4-7**
   **Removed:** “… social network: ‘How often did you receive visits or visit someone else? (None in the last 30 days/Once a month/Once every 15 days/One to three times a week/Almost every day)’…”
   **Added:** “… social network: ‘How often did you receive visits or visit someone else? (categories: a) None in the last 30 days / b) Once a month / c) Once every 15 days / d) One to three times a week / e) Almost every day)’…”

   **# Methods, paragraph 10, lines 7-9**
   **Removed:** “…and ‘Did you attend any group activities such as religious groups, community associations, clubs, or games with friends, relatives, or acquaintances in the last 30 days? (Yes/No).’”
   **Added:** “…and ‘Did you attend any group activities such as religious groups, community associations, clubs, or games with friends, relatives, or acquaintances in the last 30 days? (categories: a) Yes / b) No).’”
2. Social relationships and health: it is not correct to define social support as "the web of social relationship." It seems to me this definition should be applied to social network (as authors defined in Method Section). Social support is a support obtained through that web. Please double check.

**Answer:** The first sentence of the section ‘Social relationships and health’ was changed according to editor’s suggestion.

### Background, Social relationships and health, lines 1-5

**Removed:** “Social support and social networks are interconnected terms; the former is broadly defined as the web of social relationships and social ties with friends, family, and neighbours while the latter is defined as other connections originating from the social environment in which people live [3].”

**Added:** “Social support and social networks are interconnected terms; the former is broadly defined in terms of existence and availability of interpersonal relationships and supportive persons while the latter is defined as the web of social relationships including friends, family, neighbours other connections originating from the social environment in which people live. Social networks are the structure through which social support is provided [3].”

3. Statistical analysis: Why did not use ordinal regression as SRH is an ordinal variable? Have you ever tried other options of classifications for SRH? You need to note that and tell readers about the results from other categorization.

**Answer:** The decision for using logistic regression instead of ordinal regression was due to low frequency of men and women within the ‘poor’ and ‘very poor’ SRH categories. In women these frequencies were 2.4% (poor) and 0.8% (very poor) while in men they were 0.9% (poor) and 0.8% (very poor). When ‘very poor’, ‘poor’ and ‘regular’ categories were grouped, the frequency of the outcome “poor SRH” used in the study raised up to 24.6% and 19.9% in women and men, respectively.

Nevertheless, the data were re-analyzed using ordinal regression considering the 5 categories of SRH as suggested by the editor. The findings regarding the main objective were very similar. Using ordinal regression, low social network involvement was associated with higher odds of moving into a higher category of poor SRH in men [adjusted OR = 1.30 95%CI: 1.21 – 2.24] after adjustment for covariates with P<0.20 in bivariate analysis using the 5 categories of SHR: years of schooling, family income, employment status, physical activity, functional status, depression and age. In addition, low perceived social support increased the likelihood of moving into a higher category of poor SRH in women [adjusted OR = 1.47 95%CI: 1.16 – 1.86], after adjustment for years of schooling, family income, employment status, physical activity, functional status, joint diseases, depression, hypertension and age.

We decided to maintain the results of the logistic regression because of the low frequency of older adults within the ‘poor’ and ‘very poor’ SRH groups. Furthermore, this method allowed more appropriate comparison between ours findings and those originated from previous studies since SRH outcome has been usually considered as a binary variable.

The aspects above mentioned were inserted in the Discussion section to provide readers the findings of other categorization and the reasons for our choice.
In the present study, the results on the association of perceived social support and social network with SRH among older adults were presented using logistic regression instead of ordinal regression, though SRH was assessed using a 5-point ordinal scale. The former statistical procedure was chosen because few women and few men considered their health as “poor” (women: 2.4%; men: 0.9%) and “very poor” (women and men: 0.8%). The frequency of the outcome “poor SRH” rose up to 24.6% and 19.9% in women and men, respectively, when the categories ‘very poor’, ‘poor’ and ‘regular’ were grouped. In addition, SRH has been frequently assessed as a binary outcome in previous studies on social interactions and SRH [16,23,24]. Notwithstanding, logistic and ordinal regression models provided similar findings. Low perceived social support was associated with poor SRH in women using logistic regression (adjusted OR = 1.65; 95% CI: 1.16 - 2.36) and ordinal regression (adjusted OR = 1.47; 95% CI: 1.16 – 1.86). In addition, low social network involvement increased the likelihood of poor SRH in men when logistic (adjusted OR = 1.57 95% CI: 1.11 – 2.22) and ordinal regression (adjusted OR = 1.30 95% CI: 1.21 – 2.24) were used.

4. Same section: In my understanding, the word "hierarchical" is not appropriate for this research, which normally refers to multilevel analysis. The models are either sequential or nested model.

Answer: The word “hierarchical” was replaced by “nested” through the text.
5. Same section: It needs a justification for inclusion of health service in all models. I believe many other variables are also important predictors of SRH.

**Answer:** The inclusion of health services in all models was suggested by the reviewer S Kumar during the first revision of the paper. ‘Item 8. Health insurance and usage of health services are important predictor of SRH model 6 should always include these variables.’ In that occasion, we accepted his/her suggestion and included health services in all models. As there is no justification for inclusion this variable in all models, it was removed when did not achieve statistical significance through the nested modeling.

**# Methods, Statistical analysis, paragraph 3, lines 15-16**

**Removed:** “Variables pertaining to use of health services (4th block) were maintained in all models because they are important predictors of SRH.”

6. Same section (Tables 3 and 4): It seems to me that education should be included in all models, (although it is not significant).

**Answer:** As suggested by the editor, education (variable ‘Years of schooling’) was maintained in all statistical models. The multivariate logistic regression was performed again.

**# Abstracts, lines 21-28**

**Removed:** “(OR = 1.55; 95% CI = 1.08–2.23), while lack of perceived social support increased the probability of poor SRH in older women (OR = 1.65; 95% CI = 1.21–2.24). Poor SRH continued to be associated with low income, employment status (not working), poor functional capacity, and depression in both men and women. Absence of health insurance and number of somatic health problems and joint diseases were also associated with poor SRH in women while regular physical activity and age continued to be associated with poor SRH in men.”

**Added:** “(OR = 1.57; 95% CI = 1.11–2.22), while lack of perceived social support increased the probability of poor SRH in older women (OR = 1.65; 95% CI = 1.16–2.36). Poor SRH continued to be associated with low income, employment status (not working), poor functional capacity, and depression in both men and women. Number of somatic health problems was also associated with poor SRH in women while age continued to be associated with poor SRH in men.”

**# Methods, Statistical analysis, paragraph 3, lines 15-16**

**Added:** “The variable used to assess education (years of schooling) was maintained in all models because it can be considered an important predictor of SRH.”

**# Results, paragraph 3, lines 10-15**

**Removed:** “In the final model (Model 6), women without perceived social support continued to have higher probability of poor SRH (OR = 1.65; 95% CI = 1.21–2.24). Other characteristics associated with poor SRH in women were low income, lack of current employment, absence of health insurance, low independence in daily activities, greater number of somatic health problems, joint diseases, and depression (Table 3).”

**Added:** “In the final model (Model 6), women without perceived social support continued to have higher probability of poor SRH (OR = 1.65; 95% CI = 1.16–2.36). Other characteristics associated with poor SRH in women were low income, lack of current employment, low independence in daily activities, greater number of somatic health problems, and depression (Table 3).”
# Results, paragraph 4, lines 7-12

**Removed:** “In the fully adjusted model (Model 6), men without participation in group activities were 1.55 times more likely to report poor SRH than those reporting participation in group activities (95% CI = 1.08–2.23). Furthermore, the odds of poor SRH were significantly higher for men with low income, lack of current employment, no regular physical activity, low independence in daily activities, and depression.”

**Added:** “In the fully adjusted model (Model 6), men without participation in group activities were 1.57 times more likely to report poor SRH than those reporting participation in group activities (95% CI = 1.11–2.22). Furthermore, the odds of poor SRH were significantly higher for men with low income, lack of current employment, low independence in daily activities, and depression.”

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7. Discussion: paragraphs 3-4: Some writing styles are not well fit to Discussion Section. Many sentences are written in a style that is usually used in Background/Introduction Section. After authors present their major findings, they need to provide speculations/interpretations to their findings, that is, to borrow evidence from previous studies to support their findings. In the current style in this two paragraphs, authors just introduce other's findings, a style should be avoided in discussion. I am aware that all the materials are there, yet you need to re-phrasing using an appropriate style.

**Answer:** The paragraphs 3 and 4 of the Discussion section were re-phrased according to editor’s suggestion. In this sense, speculations and interpretations to our findings were incorporated into the text.

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# Discussion, paragraphs 3-4

**Removed:** “There are several studies highlighting the association between social connectedness and SRH [16–21,23,24]. A relationship between inclusion or exclusion from formal and informal networks and SRH was observed in a Russian sample of individuals aged 18 and above [17,24]. In adults in Finland and Sweden, good SRH was significantly associated with the number of friends perceived to be willing to help and membership in a religious group [16]. Men and women with low levels of social support from friends had a higher likelihood of poor SRH than did those with high levels of the same [16,21,23]. In addition, a large-scale study involving 139 low-, middle-, and high-income countries showed that social participation, in terms of volunteering for an organisation, was associated with positive self-perceptions of health in older adults [23]. Similar findings were reported in a cross-sectional study in Brazil [20]. In the current study, perceived level of social support was associated with poor SRH in women but not in men. A similar gender difference was found in other studies where social network size was not associated with SRH in women [16,24]. On the other hand, having a small social network was associated with poor SRH in men in our study as well as in others [16,24]. A positive relationship was observed in a previous study between low participation in religious activities and poor SRH in men [16]. In contrast, we found that a lack of participation in group activities increased the odds for poor SRH in men. To our knowledge, however, ours is the first study to provide evidence of the differing influence of perceived social support and social network size on SRH between elderly men and women in a single study.

We identify some potential mechanisms whereby health benefits can accrue from social connectedness and support from relatives in the elderly population. From the perspective of social epidemiology, perceived social support and social network size are intrinsically associated with social integration and psychological well-being. They can provide beneficial health effects, as they foster trust, self-esteem, and cooperation [46]. Social relationships are important mechanisms in dissemination of health information. The quality and extent of ties and social norms originating in social groups can also influence health through health-related behaviours such as physical activity, binge drinking, functional capacity, cost-related medication non-adherence, and access to and use of medical care [12–15,29,47]. The
physiological basis for the effects of poor social connectedness on the health of older adults pertains to the influence of social isolation on mechanisms related to stress. In older adults, social support may be helpful in coping with the stress of a chronic illness and stressful life events that affect immune function and increase neuroendocrine and cardiovascular activity [3,21,48].”

Added: “Our findings are supported by several studies highlighting the association between social connectedness and SRH [16–21,23,24]. The relationship between low levels of social support and poor SRH lend support to some studies involving adults [17] and older adults [21]. Likewise, a large-scale study involving 139 low-, middle-, and high-income countries showed that good SRH was associated with having social support from friends and relatives in adults [23]. There are some potential mechanisms whereby health benefits can accrue from social support from relatives in the elderly population. The physiological basis for the effects of poor social connectedness on the health of older adults pertains to the influence of social isolation on mechanisms related to stress [21]. In older adults, social support may be helpful in coping with the stress of a chronic illness and stressful life events that affect immune function and increase neuroendocrine and cardiovascular activity [3,21,30,48]. However, the possible influence of social connectedness on SRH in women was not found in Finland [16] and Russia [24]. This might suggest that women may not derive the same health benefits from social relationships as men. The different gender roles in the society, socializing patterns and cross-cultural variations between countries may explain such discrepancies.

Having a small social network increased the likelihood for a poor SRH in our study as well as in others [16,17,23,24]. Such association is supported by the fact that social network size is intrinsically associated with social integration and psychological well-being. Different types of formal and informal social networks have been associated with poor SRH in terms of membership in a religious group, associations, volunteering for an organisation and voluntary worker [16,20,23]. They can provide beneficial health effects, as they foster trust, self-esteem, and cooperation [46]. The quality and extent of ties and social norms originating in social groups can also influence health through health-related behaviours such as physical activity, binge drinking, functional capacity, cost-related medication non-adherence, and access to and use of medical care [12–15,29,47]. However, it seems the positive effect of social networks on health is more relevant for men than women since similar gender difference was found in other studies where social network size was associated with SRH in men but not in women [16,24]. To our knowledge, however, ours is the first study to provide evidence of the differing influence of perceived social support and social network size on SRH between elderly men and women in a single study.”
8. A review of existing framework and providing the rationale of proposed framework are needed including the justifications for inclusion of each component in the framework. The justification for inclusion of each component could be presented in Method Section.

Answer: The rationale of framework was reviewed and expanded. Figure 1 was replaced by a simpler one. We used the following article published at BMC Geriatrics as a guide for this review: Bøen H, Dalgard OS, Johansen R, Nord E: A randomized controlled trial of a senior centre group programme for increasing social support and preventing depression in elderly people living at home in Norway. BMC Geriatr 2012, 12:20.

The role of each component was justified on the description of the conceptual model of the relationship between social connectedness and SRH. Likewise Bøen and coworkers study, the justification of inclusion of each component was not presented in the Methods Section to avoid unnecessary repetition of the same content.

# Background, Conceptual modelling of social relationships using SRH, paragraph 1, lines 2-15

Removed: “The effect of social determinants—including socioeconomic characteristics, perceived social support, and social network—on SRH could be mediated by different factors, such as health-related behaviours, use of health care services, functional status, and somatic health problems. There is a hierarchy between the proposed mediators: the strength of the relationship of perceived social support and social network with SRH is dependent upon the type of health care services received. In addition, social integration and material circumstances (Block 1) shape the pattern of influence of health-related behaviours, recognised as determinants of functional status and chronic disease, on SRH.”

Added: “The indirect effect of perceived social support and social network on SRH is expected to be mediated by use of health services, functional status, somatic health problems and health-related behaviours. Low social support and reduced social network result in decreased use of health services, poor functional capacity, more somatic health problems and unhealthy behaviours. We expect use of health services, functional status, somatic health problems and health-related behaviours act as moderators on the relationship of social support and social network with SRH, which means the strength of the relationship between social connectedness and SRH is dependent on these characteristics. It is also expected that demographic factors such as age and sex will act as mediators between social support and social network and SRH since demographic factors affect social relationships, and demographic factors affect SRH. In addition, low socioeconomic factors are associated with low use of health services and poor social relationships.”