PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	The impact of social relationships on income-laughter relationships among older people: The JAGES cross-sectional study
AUTHORS	Nagai, Masato; Imai, Yurika; Ohira, Tetsuya; Shirai, Kokoro; Kondo, Naoki; Kondo, Katsunori

VERSION 1 – REVIEW

REVIEWER	Nilgun KURU Mustafa Kemal University , TURKEY
REVIEW RETURNED	24-Aug-2017

| GENERAL COMMENTS | Is the research question or study objective clearly defined?
• P7-line 141-142-143:" In the present study, therefore, we examined the relationship between equivalized income and frequency of laughter among men and women aged 65 years and older in Japan" but P4-LÍne 89 you say "Present study described the association between equivalent income, frequency of laughter and social relationship-related factor" which is correct? Please right clearly.

Is the abstract accurate, balanced and complete?
• Abstract and main text is not match up with. Because, in abstract you say, your aim: "In the present study, we examined the relationship between equivalent income and frequency of laughter by a cross-sectional study." But in main text you search another related factor.

• In abstract, we can see P1-Line 2-3: Laughter associated with income among older Japanese people: The JAGES project cross-sectional study. But your keywords not income, you say Equivalized income. Which one is correct ? It must be clear.

• In abstract your objective and your outcomes compatible.

Is the study design appropriate to answer the research question?

• (P5-Line 115: please add new data. how about 2017?)

• (P6-Line 129: you need a connecting sentence. Because Line 128 you say laughter therapy affects but under Line 129 you say socioeconomic status on health.)

• Text need to clearly writing. Your design and answers research question are not consistent.
(P7-line 145: please right further hypothesized clearly |

• P7- line 156: when did you conduct this research? How many day does it take?
• P7-line 161: "we use one of these modules, which included questions about frequency of laughter" how about other modules. What are they including?
• P7-line 162: your study group 20.006 or 139.293? which one is correct. Here is not clear.
• P8-line 174: maybe people don't remember frequency of laughter. How can you be sure these frequency?
• P8-line 180: for Equivalized income you must Show a references.

Are the outcomes clearly defined?
• Your outcomes need support references. And also, your outcomes may be effecting another factors. Maybe the conducting studies dates, older adults may be watched comic videos or stg. Else. Because I know many factor effects laughter and laughter frequency. How you can say directly income and laughter frequently have a relationship. Please explain here more.

• (P7-Line 139: You say only depression and income. Please add here which studies conducted with income. Maybe income affect different emotions in older adults)

Are the references up-to-date and appropriate?
• This manuscript needs recently published articles.
Are the discussion and conclusions justified by the results?
• Discussion needs more research, other countries and japan studies. It is too infertile.

Is the standard of written English acceptable for publication?
• No, because study design, outcomes and discussion and other main things are not suitable for this journal. And also this manuscript need to English editing.
(P5-Line 103: please control "equivalized income," It must be "equivalised income,")

REVIEWER	Pedro C Marijuán IACS
REVIEW RETURNED	23-Oct-2017

GENERAL COMMENTS	It is an interesting study on the social aspects of laughter, how the differences in social class influence the frequency of laughter of older people. Perhaps the outcome was rather obvious: economic difficulties make life harder and less amenable to humor and laughter, and diminished happiness in general. But it is good to have made rigorous statistics about that. We suggest the following minor changes: - In the abstract, there are several acronyms that are not defined previously (P, PRs, Q4, Q1) for multidisciplinar audience. - In the discussion, or perhaps better in the introduction, a deeper consideration of the laughter phenomenon in itself would benefit. (For instance we recommend: Navarro et al. "Laughing bonds: a multidisciplinary inquiry into the social information processes of human laughter." Kybernetes 2016, 45:8; also the book by S. Weems (2014) "Ha! The science of when we laugh and why", Basic Books)

	- Another reference that should be included in the discussion on the biomedical diagnostic power of laughter is Hasan, H. (2009). "Laugh Yourself into a Healthier Person: A Cross Cultural Analysis of the Effects of Varying Levels of Laughter on Health." International Journal of Medical Sciences, p.200. - The reference to Smoski and Bachorowski 2003, has the authors misspelled-- should be corrected. - In the discussion about the types of laughter the works of Diana Szameitat should be considered and cited. For instance: Wildgruber et al., "Different Types of Laughter Modulate Connectivity within Distinct Parts of the Laughter Perception Network" https://doi.org/10.1371/journal.pone.0063441

REVIEWER	Dr. Yvan I. Russell Middlesex University London United Kingdom
REVIEW RETURNED	09-Nov-2017

GENERAL COMMENTS	This is an interesting an important topic for study. The role of laughter in health, well-being, and social cohesion has not received enough research attention, and I find the overall results convincing. I would just like to highlight two problems, which should be resolved before publication. Firstly, I am uncomfortable with a couple of the journals cited in the introduction. In my opinion, the journals titled "Evidence-Based Complementary and Alternative Medicine" and "Alternative Therapies In Health And Medicine" do not have a good reputation. This is a pity because the actual studies cited might be good - but tainted due to the journal they appear in. I think that the authors can remove these citations from the introduction. However, I feel that the authors can make arguments for the inclusion of these papers based on an argument in favour of each paper individually. That said, my own preference would be to remove them. The second issue is about the statistical analysis. I can see that they have used procedures consistent with other papers in medical journals. I like their usage of prevalence ratios and I think that analysing a trend categorically was the right decision. However, I am unsure about which exact test they used for the categorical trend analysis. In table 2, for example, only p-values are reported with little other information. Which test was used? Was it the Cochran-Armitage test for trend? If so, then the table might also report test statistics (such as a Z-score). If it is not the Cochran-Armitage test, then please tell us more about the test and report pertinent test statistics. Other aspects of the statistical analysis seem fine. There is a lot of basic data reported in tables and figures. This may seem excessive to some - but I think that, space permitting, it is good to report these numbers in order to make the overall results clear. The introduction and discussion are nicely written and I do not see any errors in English grammar. The limitations of non-causal data are appropriately discussed. Overall, this is an interesting work, with important implications for care of gerontological populations, and will be publishable in BMJ Open after some small adjustments.

VERSION 1 – AUTHOR RESPONSE

COMMENTS OF THE REVIEWERS AND AUTHORS' REPLIES

Comments from Editor:

1. Please edit your title so that it is not declarative.

[Authors' reply]
Thank you very much for your comment.
We changed title so that it is not declarative.

[Changes in the revised manuscript]
~~Laughter associated with income among older Japanese people: The JAGES project cross-sectional study~~
→The impact of social relationships on income-laughter relationships among older people: The JAGES cross-sectional study

2. Please ensure that your manuscript is proofread by a native English speaker prior to resubmission, to check for any errors in language.

[Authors' reply]
Thank you very much for your comment.
The manuscript was proofread by a native English speaker using the Edanz which is recommended by BMJ Open.

3. We do not require the article summary section - please remove. We only require the Strengths and Limitations section.

[Authors' reply]
Thank you very much for your comment.
We deleted the article summary section.

Comments from Reviewer #1:

1. Is the research question or study objective clearly defined?
    P7-line 141-142-143:" In the present study, therefore, we examined the relationship between equivalized income and frequency of laughter among men and women aged 65 years and older in Japan" but P4-Lİne 89 you say "Present study described the association between equivalent income, frequency of laughter and social relationship-related factor" which is correct? Please right clearly.

[Authors' reply]
Thank you very much for your comment.
We studied the association between equivalised income and frequency of laughter. Additionally, the impact of social relationship-related factors on this association.
 So, we added "social relationship-related factor" in P7-line 147.

[Changes in the revised manuscript]
[P7, Lines 147-151]
In the present study, therefore, we examined the relationship between equivalised income and frequency of laughter. In addition, we examined the impact of social relationship-related factors on this relationship association among men and women aged 65 years and older in Japan.

2. Is the abstract accurate, balanced and complete?
2-1. Abstract and main text is not match up with. Because, in abstract you say, your aim: "In the present study, we examined the relationship between equivalent income and frequency of laughter by a cross-sectional study." But in main text you search another related factor.

[Authors' reply]
Thank you very much for your comment.
We added "social relationship-related factor" in objective of abstract.

[Changes in the revised manuscript]
[P3, Lines 63- 69]
However, it is unknown whether social relationship-related factors modify the association between equivalised income and laughter among older people. In the present study, we examined the relationship between equivalised income and the frequency of laughter. In addition, we examined the impact of social relationship-related factors on the association between equivalised income and frequency of laughter using a cross-sectional study design.

2-2. In abstract, we can see P1-Line 2-3: Laughter associated with income among older Japanese people: The JAGES project cross-sectional study. But your keywords not income, you say Equivalized income. Which one is correct ? It must be clear.

[Authors' reply]
Thank you very much for your comment.
We demonstrated the association between equivalent income and frequency of laughter. We changed to equivalised income from income at title.

[Changes in the revised manuscript]
[P1, Line 2- 3]
~~Laughter associated with income among older Japanese people: The JAGES project cross-sectional study~~
→The impact of social relationships on income-laughter relationships among older people: The JAGES cross-sectional study

2-3. In abstract your objective and your outcomes compatible.

[Authors' reply]
Thank you very much for your comment.
Sorry for the confusing explanation. Our objective was examination of the association between equivalised income and frequency of laughter. One other objective was examination of the impact of social relationship-related factors on the association between equivalised income and frequency of laughter. Our conclusion was that there was significant relationship between equivalent income and frequency of laughter. Additionaly, social relationship-related factor modified these association.

[Changes in the revised manuscript]
[P3, Line 63- 69]
However, it is unknown whether social relationship-related factors modify the association between equivalised income and laughter among older people. In the present study, we examined the relationship between equivalised income and the frequency of laughter. In addition, we examined the impact of social relationship-related factors on the association between equivalised income and frequency of laughter using a cross-sectional study design.

3. Is the study design appropriate to answer the research question?
3-1. P5-Line 115: please add new data. how about 2017?

[Author's reply]

Thank you very much for your comment.
The result about 2017 has not been yet announced. The newest data is 2015.
In 2015, population aging was 26.7%.

[Changes in the revised manuscript]
[P5, Line 106, 107]
Japan is experiencing the most rapidly aging population (19.0% in 2003; 26.7% in 2015).

3-2. P6-Line 129: you need a connecting sentence. Because Line 128 you say laughter therapy affects but under Line 129 you say socioeconomic status on health.

[Author's reply]
Thank you very much for your comment.
We put an interpretation about laughing on head of the second paragraph. Line 118 we say laughter therapy affects. Under Line 120 we say when we laughing and the relationship between social economic status and emotion.

[Changes in the revised manuscript]
[P6, Line 121-126]
Laughter is reported to occur most frequently during casual conversation[18]. Surprise is an important element in humor because laughter usually occurs when one encounters a meaningful interpretation of some stimulus or event that differs from the meaning that was initially assumed[19]. An individual's emotions are influenced by their character and social background,

3-3. Text need to clearly writing. Your design and answers research question are not consistent. P7-line 145: please right further hypothesized clearly

[Author's reply]
Thank you very much for your comment.
Sorry for the confusing explanation. The more closer personal relationship we have, the more frequently we laugh. Meanwhile, living alone reduced psychological well-being. So, we considered that social relationships and family structure would effect on laughter and modify the association between equivalised income and laughetr for older people.

[Changes in the revised manuscript]
[P7, Line 144-146]
Closer personal relationships are associated with more frequent laughter,[23] and living alone has been correlated with reduced psychological well-being.[24]

3-4. P7- line 156: when did you conduct this research? How many day does it take?

[Author's reply]
Thank you very much for your comment.
The 2013 wave of JAGES, which was obtained from self-reported questionnaires mailed among 1 October 2013 to 2 December 2013.

[Changes in the revised manuscript]
[P7, line 158-161]
We used the 2013 wave of JAGES, which was obtained from self-reported questionnaires mailed to a source population of 195,290 community-dwelling individuals between 1 October and 2 December 2013.

3-5. P7-line 161: "we use one of these modules, which included questions about frequency of laughter" how about other modules. What are they including?

[Author's reply]

Thank you very much for your comment.
In addition to basic questions, there were five modules.
module A: nursing care, medical care, and lifestyles
module B: oral hygiene, optimism, subjective health
module C: social capital, history of abuse
module D: subjective quality of life, sleep, cognitive function
module E: physical activity.
We used module B, which includes questions about laughter.

[Changes in the revised manuscript]
[P8, Line 164-173]
In addition to basic questions, there were five modules in the survey covering different topics[26] — module A: nursing care, medical care, and lifestyles; module B: oral hygiene, optimism, subjective health; module C: social capital, history of abuse; module D: subjective quality of life, sleep, cognitive function; and module E: physical activity. We examined data from module B, which included questions about laughter.

3-6. P7-line 162: your study group 20.006 or 139.293? which one is correct. Here is not clear.

[Author's reply]
Thank you very much for your comment. Sorry for the confusing explanation.
Self-reported questionnaires were mailed to source population, 195,290 individuals. Of these, 138,293 individuals responded to the survey. Questionnaires consisted of basic questions and any one of five modules. Therefore, study participants were 26,368 who responded basic questions and module B including questions about frequency of laughter in 138,293. We ultimately analyzed a total of 20,006 participants after excluding 6,362 participants with missing data.

[Changes in the revised manuscript]
[P8, Line 170-173]
Of the 138,293 respondents, the current study examined the data of 26,368 individuals who responded to the JAGES basic questions as well as module B, including questions about the frequency of laughter.

3-7. P8-line 174: maybe people don't remember frequency of laughter. How can you be sure these frequency?

[Author's reply]
Thank you very much for your comment.
The item of laughter has been used in previous epidemiological studies in Japan.[14][26] The daily frequency of laughter was assessed using a single item question: "How often do you laugh out loud?" Four response options were provided: almost every day, 1–5 days per week, 1–3 days per month, and almost never. Participants chose one of these options. The 1-year test–retest reliability of the item was assessed in a previous study in 2680 men and women aged 30–74 years using the Spearman correlation coefficient, which was found to be 0.61 ($p < 0.001$).(Partial Research Report of Health and Labour Science Research. http://www.fmu.ac.jp/home/epi/report/images/pdf/2014/pdf2-8.pdf, in Japanese).

14. Hayashi, et al. (2016). Laughter is the best medicine? A cross-sectional study of cardiovascular disease among older Japanese adults. The Journal of Epidemiology, 26(10), 546–552.

26. Hayashi, K., et al. (2015). Laughter and subjective health among community-dwelling older people in Japan: Cross-sectional analysis of the Japan gerontological evaluation study cohort data. The Journal of Nervous and Mental Disease, 203(12), 934–942.

[Changes in the revised manuscript]
[P25, Line 424-431]
Third, it might be that people might not remember frequency of laughter correctly. However, the item of laughter has been used in previous epidemiological studies in Japan.14 26 The 1-year test–retest reliability of the item was assessed in a previous study in 2,680 men and women aged 30–74 years, though the lowest category in frequency of laughter is different between that study (almost never) and current study (<1 day/month). The Spearman correlation coefficient was found to be 0.61 (p < 0.001).[42]

3-8. P8-line 180: for Equivalized income you must Show a references.

[Author's reply]
Thank you very much for your comment.
Equivalent income is an income concept by which incomes of households of different types are made comparable by taking account of shared consumption benefits.
Equivalent income = the household's income divided by the number of consumption units in the household.
  Fleurbaey M, 2016. "Equivalent Income." In M.D. Adler and M. Fleurbaey, eds., Oxford Handbook of Well-Being and Public Policy. Oxford: Oxford University Press. DOI: 10.1093/oxfordhb/9780199325818.013.15

4.   Are the outcomes clearly defined?
4-1. Your outcomes need support references. And also, your outcomes may be effecting another factors. Maybe the conducting studies dates, older adults may be watched comic videos or stg. Else. Because I know many factor effects laughter and laughter frequency. How you can say directly income and laughter frequently have a relationship. Please explain here more.

[Author's reply]
Thank you very much for your comment.
As you pointed out, we couldn't hastily conclude the direct effect from income to laughter frequency. It might be that there is residual confounders such as your suggestion (watching comic videos or stg.). But we have no data about further confounders.
Additionally, we described in limitation (p24, line 413-415) that present study was conducted by cross-sectional study. Then, we could not mention about causality, direct effect of equivalent income on frequency of laughter. We added limitation in this manuscript.

[Changes in the revised manuscript]
[P25, Line 421-424]
Second, the results may have been affected by residual confounders such as the rates of watching television, reading books, or other potential confounding factors for which we did not collect data.

4-2. P7-Line 139: You say only depression and income. Please add here which studies conducted with income. Maybe income affect different emotions in older adults.

[Author's reply]
Thank you very much for your comment.
Income affect not only depression, but also emotional well-being. Income has a positive dose-response relationship with positive emotion up to $75,000 per year.

[Changes in the revised manuscript]
[P6, Line 127-132]
In addition, The threshold association between income and positive emotion (emotional well-being) has been reported.[21] In another study, income was found to have a positive dose-response relationship with positive emotion, up to an annual income of $75,000, whereas insufficient income was a significant predictor for depression.[20]

5.   Are the references up-to-date and appropriate?
   This manuscript needs recently published articles.

[Author's reply]
Thank you very much for your comment.
We deleted the old references and replaced it in new articles.

6. Are the discussion and conclusions justified by the results?
   Discussion needs more research, other countries and japan studies. It is too infertile.

[Author's reply]
Thank you very much for your comment. We renewed a discussion based on the opinion of the reviewers.

[Changes in the revised manuscript]
[P22, Lines 358-359]
Laughter has been found to occur most frequently during casual conversation.[18]

[P22, Lines 384-387]
In the evolution of human societies, laughing is thought to function as an essential behavioral mechanism not only for expression of emotion, but also for the maintenance of social bonds.[25].

[P25, Lines 434- P26, Lines 438]
We consider these biases to represent cases of non-differential misclassification, which would not be expected to be dependent upon each other. However, this misclassification weakens the true association, biasing the data towards the null hypothesis.

[P25, Lines 438-441]
Fifth, we did not take the diversity of types of laughter into account. There are many different types of laughter (e.g., laughter related to joy, taunting, or tickling), each of which are thought to play distinct roles in social cognition.[43 44]

7. Is the standard of written English acceptable for publication?
   No, because study design, outcomes and discussion and other main things are not suitable for this journal. And also this manuscript need to English editing.
   (P5-Line 103: please control "equivalized income," It must be "equivalised income,")

[Author's reply]
Thank you very much for your comment.
The manuscript was proofread by a native English speaker.
In addition, we changed "equivalized income" to "equivalised income" in the manuscript.

Comments from Reviewer #2:

1. In the abstract, there are several acronyms that are not defined previously (P, PRs, Q4, Q1) for multidisciplinar audience..

[Authors' reply]
Thank you very much for your comment.
We defined (P, PRs, Q4, Q1) previously in abstract.

[Changes in the revised manuscript]
[P4, Lines 76-80]
Prevalence ratios (PRs) for laughing almost every day were calculated according to quartile equivalised income (quartile) after adjusting for age, instrumental activities of daily living (IADL), depression, frequency of meeting friends, number of social groups, and family structure.

2. In the discussion, or perhaps better in the introduction, a deeper consideration of the laughter phenomenon in itself would benefit. (For instance we recommend: Navarro et al. "Laughing

bonds: a multidisciplinary inquiry into the social information processes of human laughter."
Kybernetes 2016, 45:8; also the book by S. Weems (2014) "Ha! The science of when we laugh
and why", Basic Books)

[Authors' reply]
Thank you very much for your comment.
We listed the article that had you recommend as references.

[Changes in the revised manuscript]
[P6, Lines 121-126]
Laughter is reported to occur most frequently during casual conversation.[18] Surprise is an important
element in humor because laughter usually occurs when one encounters a meaningful interpretation
of some stimulus or event that differs from the meaning that was initially assumed.[19] An individual's
emotions are influenced by their character and social background,

[P7, Lines 146-147]
Laughter is not only involved in the expression of emotion, but also in the maintenance of social
bonds.[25]

3. Another reference that should be included in the discussion on the biomedical diagnostic power of
laughter is Hasan, H. (2009). "Laugh Yourself into a Healthier Person: A Cross Cultural Analysis
of the Effects of Varying Levels of Laughter on Health." International Journal of Medical Sciences,
p.200.

[Authors' reply]
Thank you very much for your comment. We listed this article as reference of "benefit of laughing for
health."

4. The reference to Smoski and Bachorowski 2003, has the authors misspelled-- should be
corrected.

[Authors' reply]
Thank you very much for your comment. We corrected writing error.

[Changes in the revised manuscript]
[reference]
~~Smoskia~~ → Smoski

5. In the discussion about the types of laughter the works of Diana Szameitat should be considered
and cited. For instance: Wildgruber et al., "Different Types of Laughter Modulate Connectivity
within Distinct Parts of the Laughter Perception Network"
https://doi.org/10.1371/journal.pone.0063441

[Authors' reply]
Thank you very much for your comment. We listed this article as reference. We added explanation of
"different types of laughter."

[Changes in the revised manuscript]
[P25, Lines 439-441]
There are many different types of laughter (e.g., laughter related to joy, taunting, or tickling), each of
which are thought to play distinct roles in social cognition.[43 44]

Comments from Reviewer #3:

1. Firstly, I am uncomfortable with a couple of the journals cited in the introduction. In my opinion,

the journals titled "Evidence-Based Complementary and Alternative Medicine" and "Alternative Therapies In Health And Medicine" do not have a good reputation. This is a pity because the actual studies cited might be good - but tainted due to the journal they appear in. I think that the authors can remove these citations from the introduction.

[Authors' reply]
Thank you very much for your comment. We removed the journals titled "Evidence-Based Complementary and Alternative Medicine" and "Alternative Therapies In Health And Medicine."

2. The second issue is about the statistical analysis. I can see that they have used procedures consistent with other papers in medical journals. I like their usage of prevalence ratios and I think that analysing a trend categorically was the right decision. However, I am unsure about which exact test they used for the categorical trend analysis. In table 2, for example, only p-values are reported with little other information. Which test was used? Was it the Cochran-Armitage test for trend? If so, then the table might also report test statistics (such as a Z-score). If it is not the Cochran-Armitage test, then please tell us more about the test and report pertinent test statistics.

[Authors' reply]
Thank you very much for your comment.
The p value for the trend was calculated by categorical variables conducted from binomial regression model.

[Changes in the revised manuscript]
[P12, Lines 260-262]
The p value for the trend was calculated by categorical variables conducted from binomial regression model adjusting above covariates.

VERSION 2 – REVIEW

REVIEWER	Dr. Yvan I. Russell Middlesex University London
REVIEW RETURNED	05-Mar-2018

GENERAL COMMENTS	The authors have addressed the reviewer comments. Please fix mispelling of "Fourth" on line 431.