PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	A Scoping Review on the Use of Socially Assistive Robot Technology in Elderly Care
AUTHORS	Abdi, Jordan; Al-Hindawi, Ahmed; Ng, Tiffany; Vizcaychipi, M

VERSION 1 – REVIEW

REVIEWER	Lorraine Mion Ohio State University USA
REVIEW RETURNED	22-Aug-2017

GENERAL COMMENTS	This is a manuscript providing a systematic review on the use of socially assistive robot technology in elder care. There are a number of strengths to the systematic review and the authors are to be commended, but it does requires major revision prior to publication. Major concern: The Results Section lacks synthesis of important information. 1. Participants and Settings: a. the authors simply state that details of robot systems can be found in Table 2. At the very least, need to indicate the number of studies that used closed-loop robotic architecture (e.g., Paro) versus open-loop architecture capable of learning responses (e.g., NAO). The type of robotic architecture may be an important consideration depending upon the need of the older adult. For example, persons with moderately to severe dementia may interact very well with Paro, but not NAO. Similarly, persons with normal to only mild cognitive impairment may shun Paro, but interact with NAO. We do not know this as of yet, but the systematic review may well help us determine the best type of robotic architecture for targeted populations. b. responses to robots are influenced by a number of individual characteristics including cognitive impairment. The proportion of those with dementia and/or range of dementia is an important element. 2. Within each theme, authors provided a paragraph describing each study. Rather, results need to be synthesized. One suggestion is to group the intervention studies that improved affective mood states and contrast to the studies that did not impact affect. To what extent is it the level of dementia? Or length of the intervention? Or type of robot? Or intensity of intervention? Could it be the quality of the studies? It isn't until the Discussion that the authors explicitly state the quality of studies including problems with design and measurement.

	One suggestion is to modify Table 1 to include a quality measure for the study (see Pussegoda Systematic Reviews 2017; 6:117) 2. Discussion Discussion needs to reflect the aim, methods and results and indications for future research based on the gaps. Some of the material is not supported, for example, ethical considerations seems out of place unless the authors are suggesting future studies on ethical issues are warranted. Minor concern: Table 1, add type of study design and quality measure. Table 3-5, difficult to determine import of changes. Is it possible to add the potential range of scales with the anchors? For example, MMSE 0 (severe cognitive impairment) - 30 (normal cognition). Also, Table 4, study 22, MMSE only ranges from 0 - 30 but you've indicated scores in 90s. Is the outcome scale correctly identified here?

REVIEWER	Cynthia Chen National University of Singapore, Singapore
REVIEW RETURNED	30-Aug-2017

GENERAL COMMENTS	This study reviewed studies using socially assistive robots in elderly care. It finds roles of SAR in five areas - affective therapy, cognitive training, social facilitator, companionship and physiological therapy. The study is very researched and has important merit for understanding future roles of SAR in elderly. As the authors mentioned, while there are many improvements, large proportion have methodological issues. However similar study seems to exist. Can the authors discuss the aims and results in light of the article below? "Socially assistive robots in elderly care: a systematic review into effects and effectiveness" https://www.ncbi.nlm.nih.gov/pubmed/21450215. The objective aims "to establish the roles SAR may play in the future". It is not clear to me how the study establishes roles that SAR may play in the future. Minor comments: In the abstract, it may be informative to include the percentage of studies who found positive in SAR. Tables 3, 4, and 5 are hard to interpret. For example in Table 4, why do results from study 21 differ? Description in the manuscript does not adequately explain these tables. Table should also be standalone, superscript a-d should be reported after each Table, instead of footnote in Table 5 only.

VERSION 1 – AUTHOR RESPONSE

With regards to the comments/ requests from Lorraine Mion, the first reviewer, below are the responses to each point in turn.

1. We are very grateful for your detailed and constructive advice, especially for the results section, where we have made major revisions.
a. Specifically, we have expanded on the robots used in the 'participants and settings' section, to better orientate the reader when we describe how different robot systems have been used in different contexts, and their results.
b. In lieu with the response in part a, we have explained in greater detail the context in which certain robot systems work and don't work.
• We were particularly grateful for this point, and we have completely revised the results section to better explain the results in a more synthesised way. We hope it is in line with what you were expecting. With specific reference to your point on the quality of studies, we found that the tools available in the paper you suggested address the quality of a systematic review rather than of the papers within the review. There is other literature to suggest that the impact factor of the journal that the paper is published in could be used as a surrogate marker for quality. As this is a relatively new field and our review was aimed at getting a breadth of available clinical applicability of SAR technology, we felt that excluding papers based on quality doesn't necessarily invalidate the question of clinical usefulness. Hence, no formal quality assessment was made. Nonetheless, we have improved how we have reported the quality of the studies and sets of studies in the results and discussion sections.

2. We have revised to discussion in line with your recommendations; specifically, we agreed with your point regarding the 'ethical section' and have removed it. We have also explained in greater detail the quality of data in the selected studies, outlining specific ways future studies can improve on the current set of studies.

3. We have included the study design in Table 1, and renamed the column 'Intervention/ study design'. We have not included a quality measure in the Table 1 for the reasons outlined in part 2 of our response.

4. This is a very astute observation that we unintentionally failed to notice in our original submission. We have now properly explained the tables in the methodology, results and discussion sections. Essentially, because many of the studies used different validated scales for outcome measures, it would be a difficult table to interpret if we inputted all the data in raw form. Following the advice of a senior statistician, we converted the scores into a non-unit 0-100 scale for comparative purposes. There are limitations of doing this, which we have outlined in the discussion, however this was a clearer way to show population baseline scores and changes in a more comparative way. With regard to the specific point you raise, the score in 90s represents the MMSE score once it has been converted to a standardised 0-100 score.

With regards to the comments/ requests from Cynthia Chen, the second reviewer, below are the responses to each point in turn.

• Thank you for your constructive feedback; we have tried to best amend our paper in line with your recommendations. The study you mention does have some similarities to our paper in that it has reported the studies as of 2012 that assessed SAR in elderly populations, but it's aim is very different. Our paper has categorised the data into 5 discrete clinical applications and has discussed the evidence for each. We aim to guide future research in the field by highlighting common methodological problems and questions that have not adequately been answered. By comparison, the study you raise has simply reported each of the studies as they were published in order to compile all the studies assessing SAR in elderly populations as of 2012.

• We have amended our introduction, specifically the final paragraph, to better explain our aim. We have also improved our results section to include a greater discussion of clinical applicability of SAR. Our aim is to establish what uses of SAR have been researched and what the evidence base is for each use. By amalgamating these outcomes, we can infer future value of SAR technology. Our aim was not to restrict future development of SAR technology but to inform readers of what has been demonstrated to be clinically useful and what has not.

• Thank you for this particularly astute observation; we unintentionally failed to notice this in our original submission. We have now properly explained the tables in the methodology, results and discussion sections. Essentially, because many of the studies used different validated scales for outcome measures, it would be a difficult table to interpret if we inputted all the data in raw form. Following the advice of a senior statistician, we converted the scores into a non-unit 0-100 scale for comparative purposes. There are limitations of doing this, which we have outlined in the discussion, however this was a clearer way to show population baseline scores and changes in a more comparative way. With regard to the specific point you raise, the paper reference actually describes two separate studies with two different interventions and sets of participants. As such there are 2 sets of separate data. We have now highlighted this in our explanation and edited the table to highlight the 2 separate phases of the study.
• We thank you for this clear point, and we have now addressed this by giving each table a separate footnote, so the tables can be fully standalone.

VERSION 2 – REVIEW

REVIEWER	Cynthia Chen National University of Singapore
REVIEW RETURNED	10-Nov-2017

GENERAL COMMENTS	I thought the group did a really thorough job addressing our comments, concerns, and questions. There is still a few editorial things that might get picked up in the next stage but overall nicely done - not sure if it is possible to summarise Table 1 further and if some info can be available online only.

VERSION 2 – AUTHOR RESPONSE

We would like to thank the editorial team and reviewers for considering our paper for publication and taking the time to provide constructive feedback. We have revised our paper in line with your comments.