Tensions and antagonistic interactions of risks and ethics of using robotics and autonomous systems in long-term care

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**Supplementary Data**

**Critical appraisal of included studies**

|  |  |
| --- | --- |
| **Category items** | **Scores** |
| Pfadenhauer and Dukat, 2015 | Rantanen et al., 2018a | Rantanen et al., 2018b | Scheutz, 2013 | Jenkins and Draper, 2015 | Laitinen et al., 2016 | Moyle et al., 2016 | O’Brolchain, 2017 | Ienca et al., 2018 | Fosch-Villaronga and Virk, 2017 | Jenkins and Draper, 2014 | Draper et al., 2014 | Draper and Sorell, 2017 | Frennert and Östlund, 2014 | Metzler et al., 2015 | (Etzioni and Etzioni, 2017 |
| 1) Preliminaries | 5 | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2) Introduction | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 3) Design | 5 | 5 | 5 | 3 | 5 | 3 | 4 | 3 | 5 | 3 | 5 | 5 | 5 | 5 | 3 | 0 |
| 4) Sampling | 4 | 4 | 4 | 0 | 4 | 0 | 3 | 0 | 5 | 3 | 4 | 3 | 4 | 5 | 0 | 0 |
| 5) Data Collection | 5 | 5 | 5 | 0 | 5 | 3 | 4 | 0 | 5 | 2 | 5 | 5 | 5 | 5 | 0 | 0 |
| 6) Ethical matters (participant ethics and researcher ethics) | 0 | 5 | 5 | 0 | 3 | 0 | 0 | 3 | 3 | 0 | 3 | 3 | 3 | 4 | 0 | 0 |
| 7) Results | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| 8) Discussion | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 2 | 2 | 4 | 4 | 4 | 3 |
| 9) Aggregate Scores (/40) | 33 | 38\* | 38\* | 17 | 36\* | 25 | 30 | 25 | 38\* | 27 | 34 | 32 | 36\* | 38\* | 22 | 18 |

**Critical appraisal of included studies**

|  |  |
| --- | --- |
| **Category items** | **Scores** |
| Ienca et al., 2016 | Chou et al., 2018 | Fosch-Villaronga and Roig, 2017 | Khaksar et al., 2016 | Vandemeulebroucke et al., 2018 | Sorell and Draper, 2014 | Matsuzaki and Lindermann, 2016 | Sharkey and Sharkey, 2012 | Moro et al. 2018 | Sedenberg et al. 2016 | Sharkey 2014 | Royakkers and van Est 2015 | Stahl and Coeckelbergh 2016 | Salvini et al. 2010 | Decker 2008 | Bedaf et al. 2016 | Nambu 2016 |
| 1) Preliminaries | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2) Introduction | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 3) Design | 3 | 3 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 4) Sampling | 3 | 2 | 4 | 5 | 5 | 2 | 4 | 4 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 5) Data Collection | 3 | 2 | 5 | 5 | 5 | 2 | 4 | 4 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 6) Ethical matters (participant ethics and researcher ethics) | 5 | 0 | 0 | 0 | 4 | 3 | 3 | 0 | 3 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 |
| 7) Results | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 8) Discussion | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 9) Aggregate Scores (/40) | 33 | 25 | 33 | 34 | 38\* | 30 | 34 | 31 | 37\* | 32 | 31 | 31 | 34 | 31 | 31 | 37\* | 31 |

**Crowe Critical Appraisal Tool (CCAT) form**

|  |  |  |  |
| --- | --- | --- | --- |
| **Category item** | **Item descriptors** | **Description** | **Score (1-5)** |
| **1. Preliminaries** |
| Title | 1. Includes study aims and designs |  |  |
| Abstract | 1. Key information2. Balanced and informative |  |  |
| Last | 1. Sufficient detail others could reproduce2. Clear/concise writing, table(s), diagram(s) and figure(s) |  |  |
| **Preliminaries ( /5)** |  |
| **2. Introduction** |
| Background | 1. Summary of current knowledge2. Specific problem(s) addressed and reason(s) for addressing |  |  |
| Objective | 1. Primary objective(s), hypothes(es), or aim(s)2. Secondary question(s) |  |  |
|  **Is it worth continuing? Introduction ( /5)** |  |
| **3. Design** |
| Research design | 1. Research design chosen and why2. Suitability of research design(s) |  |  |
| Intervention, treatment, exposure | 1. Intervention(s)/ treatment(s)/ exposure(s) chosen and why2. Precise details of intervention(s)/ treatment(s)/ exposure(s) for each group3. Intervention(s)/ treatment(s)/ exposure(s) valid and reliable |  |  |
| Outcome, output, predictor, measure | 1. Outcome(s)/ output(s)/ predictor(s)/ measure(s) chosen and why2. Clearly define outcome(s)/ output(s)/ predictor(s)/ measure(s) 3. Outcome(s)/ output(s)/ predictor(s)/ measure(s) valid and reliable |  |  |
| Bias, etc | 1. Potential bias, confounding variables, effect modifiers, interactions2. Sequence generation, group allocation, group balance, and by whom3. Equivalent treatment of participants/ cases/ groups |  |  |
|  **Is it worth continuing? Design ( /5)** |  |
| **4. Sampling** |
| Sampling method | 1. Sampling method(s) chosen and why2. Suitability of sampling method |  |  |
| Sampling size | 1. Sampling size, how chosen and why2. Suitability of sample size |  |  |
| Sampling protocol | 1. Target/actual/sample population(s): description and suitability2. Participants/cases/groups: inclusion and exclusion criteria3. Recruitment of participants/cases/groups |  |  |
|  **Is it worth continuing? Sampling ( /5)** |  |
| **5. Data collection** |
| Collection method | 1. Collection method(s) chosen and why2. Suitability of collection method(s) |  |  |
| Collection protocol | 1. Include date(s), location(s), setting(s), personnel, material(s), process(es)2. Methods to ensure/ enhance quality of measurement/ instrumentation3. Manage non-participation, withdrawal, incomplete/ lost data |  |  |
|  **Is it worth continuing? Data collection ( /5)** |  |
| **6. Ethical matters** |
| Participant ethics | 1. Informed consent, equity2. Privacy, confidentiality/ anonymity |  |  |
| Researcher ethics | 1. Ethical approval, funding, conflict(s) of interest2. Subjectivities, relationship(s) with participants/ cases |  |  |
|  **Is it worth continuing? Ethical matters ( /5)** |  |
| **7. Results** |
| Analysis, Integration, Interpretation method | 1. A.I.I. method(s) for primary outcome(s)/ output(s)/ predictor(s) chosen and why2. Additional A.I.I. methods (e.g. subgroup analysis) chosen and why3. Suitability of analysis/ integration/ interpretation method |  |  |
| Essential analysis | 1. Flow of participants/ cases/ groups through each stage of research2. Demographic and other characteristics of participants/ cases/ groups3. Analyse raw data, response rate, non-participation/ withdrawal/ incomplete/lost data |  |  |
| Outcome, output, predictor analysis | 1. Summary of results and precision for each outcome/ output/ predictor/ measure2. Consideration of benefits/ harms, unexpected results, problems/ failures3. Description of outlying data (e.g. diverse cases, adverse effects, minor themes) |  |  |
|  **Results (/5)** |  |
| **8. Discussion** |
| Interpretation | 1. Interpretation of results in the context of current evidence and objectives2. Draw inferences consistent with the strength of data3. Consideration of alternative explanations for observed results4. Account for bias, confounding/ effect modifiers/ interactions/ imprecision |  |  |
| Generalisation | 1. Consideration of overall practical usefulness of the study2. Description of generalisability (external validity) of the study |  |  |
| Concluding remarks | 1. Highlight study’s particular strength2. Suggest steps that may improve future results (e.g. limitations)3. Suggest further studies |  |  |
|  **Discussion ( /5)** |  |
| **9. Total** |
| Total score | 1. Add all scores for categories 1-8
 |  |  |
|  **Total ( /40)** |  |

Note: Scoring for each category is based on the guiding principles recommended in the Crowe Critical Appraisal Tool (CCAT) User Guide Version 1.4 (Crowe 2013)