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 information  2. Balanced and informative |  |  |
| Last | 1. Sufficient detail others could reproduce  2. Clear/concise writing, table(s), diagram(s) and figure(s) |  |  |
| **Preliminaries ( /5)** | | |  |
| **2. Introduction** | | | |
| Background | 1. Summary of current knowledge  2. 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 why  2. Suitability of research design(s) |  |  |
| Intervention, treatment, exposure | 1. Intervention(s)/ treatment(s)/ exposure(s) chosen and why  2. Precise details of intervention(s)/ treatment(s)/ exposure(s) for each group  3. Intervention(s)/ treatment(s)/ exposure(s) valid and reliable |  |  |
| Outcome, output, predictor, measure | 1. Outcome(s)/ output(s)/ predictor(s)/ measure(s) chosen and why  2. 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, interactions  2. Sequence generation, group allocation, group balance, and by whom  3. Equivalent treatment of participants/ cases/ groups |  |  |
| **Is it worth continuing? Design ( /5)** | | |  |
| **4. Sampling** | | | |
| Sampling method | 1. Sampling method(s) chosen and why  2. Suitability of sampling method |  |  |
| Sampling size | 1. Sampling size, how chosen and why  2. Suitability of sample size |  |  |
| Sampling protocol | 1. Target/actual/sample population(s): description and suitability  2. Participants/cases/groups: inclusion and exclusion criteria  3. Recruitment of participants/cases/groups |  |  |
| **Is it worth continuing? Sampling ( /5)** | | |  |
| **5. Data collection** | | | |
| Collection method | 1. Collection method(s) chosen and why  2. 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/ instrumentation  3. Manage non-participation, withdrawal, incomplete/ lost data |  |  |
| **Is it worth continuing? Data collection ( /5)** | | |  |
| **6. Ethical matters** | | | |
| Participant ethics | 1. Informed consent, equity  2. Privacy, confidentiality/ anonymity |  |  |
| Researcher ethics | 1. Ethical approval, funding, conflict(s) of interest  2. 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 why  2. Additional A.I.I. methods (e.g. subgroup analysis) chosen and why  3. Suitability of analysis/ integration/ interpretation method |  |  |
| Essential analysis | 1. Flow of participants/ cases/ groups through each stage of research  2. Demographic and other characteristics of participants/ cases/ groups  3. 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/ measure  2. Consideration of benefits/ harms, unexpected results, problems/ failures  3. 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 objectives  2. Draw inferences consistent with the strength of data  3. Consideration of alternative explanations for observed results  4. Account for bias, confounding/ effect modifiers/ interactions/ imprecision |  |  |
| Generalisation | 1. Consideration of overall practical usefulness of the study  2. Description of generalisability (external validity) of the study |  |  |
| Concluding remarks | 1. Highlight study’s particular strength  2. 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)