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Quality improvement interventions to prevent hospital services use among nursing home residents: protocol for a systematic review and meta-analysis

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Title: Quality improvement interventions to prevent hospital services use among nursing home residents: protocol for a systematic review and meta-analysis

Authors:

Ines Basso^{1,2*}, ines.basso@uniupo.it

Silvia Gonella³, silvia.gonella@unito.it

Erika Bassi¹, erika.bassi@uniupo.it

Silvia Caristia¹, silvia.caristia@med.uniupo.it

Sara Campagna^{4#}, sara.campagna@unito.it

and

Alberto Dal Molin^{1#}, alberto.dalmolin@med.uniupo.it

Affiliations:

¹ Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale, Novara, Piemonte, IT

² Azienda Ospedaliera Nazionale SS Antonio e Biagio e C Arrigo, Department of Research, Training and Innovation Alessandria, Piemonte, IT

³ Azienda Ospedaliero Universitaria Città della Salute e della Scienza di Torino Torino, Piemonte, IT

⁴ Università degli Studi di Torino, Department of Public Health and Pediatrics Torino, Piemonte, IT

***Corresponding author: Ines Basso, ines.basso@uniupo.it**

<https://orcid.org/0000-0002-9283-236X>

#Sara Campagna and Alberto Dal Molin are co-last authors- They contributed equally to this work.

Abstract

Introduction: Quality improvement interventions are a promising strategy to reduce hospital services use among nursing home residents but evidence for their effectiveness is limited. It is unclear what characteristics of the quality improvement intervention and activities planned to facilitate implementation may promote fidelity to organizational and system changes. The aim of this systematic review and meta-analysis will be to assess the effectiveness of quality improvement interventions and the implementation strategies aimed at reducing hospital services use among nursing home residents.

Methods and analysis: Medline, CINAHL, The Cochrane Library, Embase and Web of Science databases will be comprehensively searched. Eligible studies should focus on the implementation of a quality improvement intervention defined as the systematic, continuous approach that designs, tests, and implements changes using real-time measurement to reduce hospitalizations or emergency department visits among long-stay nursing home residents. Quality improvement details and implementation strategies will be deductively categorized into Effective Practice and Organisation of Care taxonomy's domains on delivery arrangements and implementation strategies. Quality and bias assessment will be completed through the Quality Improvement Minimum Quality Criteria Set and the Joanna Briggs Institute Critical Appraisal Tools.

Results will be pooled in a meta-analysis, using incidence risk ratio or rate to synthesize outcomes. Raw data will be requested from the authors, as needed. Heterogeneity will be assessed using the χ^2 test and the I^2 statistics.

Ethics and dissemination: Ethical approval is not required. Results will be published in a peer-review journal and presented at (inter)national conferences.

Prospero registration number: CRD42022364195

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3 51 **Keywords:** Systematic review, nursing homes, quality improvement, implementation science,
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5 52 hospital admissions, emergency department visits
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10 54 **Strengths and limitations of this study**
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- 12 55 • This is the first systematic review and meta-analysis of the effectiveness of QI improvement
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14 56 intervention and implementation strategies in reducing hospital services use among nursing
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17 57 home residents.
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19 58 • The protocol complies with the Preferred Reporting Items for Systematic Reviews and
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21 59 Meta-analyses Protocol guideline.
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24 60 • A comprehensive search strategy has been developed to include all eligible studies that
25
26 61 match inclusion criteria.
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29 62 • The study screening, selection, data extraction and assessment of the risk of bias will be
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31 63 completely by two independent reviewers.
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33 64 • The diversity of quality improvement interventions and designs of included studies might
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35 65 lead to a substantial heterogeneity among studies.
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41 67 **Introduction**
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44 68 By 2050, the global population aged 80 or over is estimated to triple (1) and the demand for
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46 69 Nursing Home (NH) services is expected to rise. Nursing Home residents have complex health
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48
49 70 needs and challenging medical situations (2,3) that lead to frequent hospitalizations (4–6). These
50
51 71 hospitalizations are costly and entail the risk of iatrogenic harms, including delirium, infections, and
52
53 72 loss of functional dependency (7). Moreover, international research suggests that up to 55% of
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55 73 hospitalizations from NH can be potentially avoided with timely identification and management of
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57 74 acute changes in health status (8). In fact, many conditions that result in admission or an emergency
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60 75 department visit, such as infections, exacerbation of chronic diseases, decreased food or fluid

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3 76 intake, or functional decline could be prevented or effectively managed on-site (9,10). Quality
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5 77 improvement (QI) intervention may be a promising strategy to improve care for NH residents and
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7 78 prevent their hospitalizations (11–13). A QI intervention is defined as a systematic, continuous
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10 79 approach that design, test and implement changes using real-time measurement to improve safety,
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12 80 effectiveness, and experience of care (14).

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15 81 Quality improvement is usually designed as a multicomponent intervention to tackle an
16
17 82 improvement problem, involving all the organization providers, including front-line staff, and using
18
19 83 recognized methods to identify all potential causes of the problem and assess the impact of the
20
21 84 intervention against the expected results through reliable process and outcome measures (15).
22
23
24 85 Quality improvement interventions rely on several implementation strategies to improve adaptation
25
26 86 and stakeholders' engagement, which may widely vary across projects and include, for example,
27
28 87 audit and feedback, staff education, tools, and site champions (11,16). Evidence about the effect of
29
30 88 different implementation strategies on the success of QI intervention is unclear.
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35 89 To better describe the heterogeneity of the healthcare intervention, including QI research, the
36
37 90 Cochrane Effective Practice and Organization of Care (EPOC) group developed a taxonomy for
38
39 91 quality interventions based on the pragmatic descriptions of the components rather than theoretical
40
41 92 constructs (17). The EPOC taxonomy, which can be used as a framework for exploring the
42
43 93 intervention, includes four domains of interventions: delivery arrangements, financial arrangements,
44
45 94 governance arrangements, and implementation strategies, each of which is divided in categories and
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47 95 subcategories (18).
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51 96 A QI approach has been widely used in the acute care setting, however evidence of effectiveness in
52
53 97 NH is still limited (19,20). Seeing the high frequency of hospitalizations of NH residents is pivotal
54
55 98 to understanding whether this strategy may help to prevent avoidable transfers. Compared to the
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57 99 hospital setting, the long-term care context poses several challenges that could impede a smooth
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59 100 implementation of a QI initiative (19,21,22). The long-term care context has multiple, unique,
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3 101 barriers at the organizational level including inner/internal barriers, for example, organizational
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5 102 culture, leadership or learning climate and outer/external barriers, for example, organizational
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8 103 funding, law, and regulation, as well as at staff level (knowledge, skills, and motivation) (23).
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10
11 104 The NH environment can be particularly challenging due to workforce shortages and high turnover
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13 105 (24,25). Introducing a practice change that requires staff engagement in an under-resourced
14
15 106 organization may result in poor adherence to the intervention or in an unsuccessful program because
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17
18 107 of the lack of time (26). In addition, high staff turnover may lead to a continuous need to support
19
20 108 training and education in evidence-based practice and QI methods (22).
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22

23 109 Another important factor that may influence the organization's readiness for change is leadership's
24
25 110 involvement in QI interventions (27). The extent to which management sustains and reinforces the
26
27
28 111 cultural change, establishes a positive relationship with front-line staff, and invests resources in the
29
30 112 adoption of a new model of care, are crucial features for achieving a high standard of care (22,28).
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32 113 However, NH management is often characterized by a vertical hierarchal structure that can hinder
33
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35 114 an open flow of communication and prevent all stakeholders to collaborate fruitfully (29).
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38 115 To date, no secondary studies have investigated the effectiveness of QI interventions, by exploring
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40 116 factors that can contribute to their success, such as delivery arrangements and implementation
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42 117 strategies used. Therefore, the aim of the systematic review will be to evaluate the effects of QI
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45 118 interventions and the implementation strategies aimed at reducing hospitalizations among NH
46
47 119 residents and to provide an estimate of the effectiveness of QI interventions. The secondary aims
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49 120 will be to assess the quality of the QI interventions and describe their delivery arrangements and
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52 121 implementation strategies.
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54 122 **Research questions**

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58 123 What is the effectiveness of QI interventions and implementation strategies aimed at preventing
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60 124 hospital service use for nursing home residents?

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3 125 What is the quality of the QI interventions provided in Nursing Homes?
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6 126 **Methods and analysis**
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9 127 The protocol complies with the Preferred Reporting Items for Systematic Reviews and Meta-
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11 128 analyses Protocol (PRISMA-P) 2015 statement for reporting (30) (Supplementary material). It has
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14 129 been registered in PROSPERO (CRD42022364195).
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17 130 **Review conceptual model**
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20 131 The review will be developed following the implementation research conceptual model proposed by
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22 132 Proctor et al (31). According to the model (Figure 1), QI intervention strategies and implementation
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24
25 133 processes are separated but linked domains. For the purpose of this review, QI strategies are defined
26
27 134 as the organizational and system changes to reduce hospital services use. The implementation
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30 135 processes are the activities projected to transfer QI intervention strategies into clinical practice.
31
32 136 Both domains impact different but interrelated types of outcomes, implementation and residents'
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34 137 outcomes. Implementation outcomes are used to assess fidelity in implementation strategies. The
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36 138 objective of this review is to assess the effectiveness of the QI intervention strategies on hospital
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39 139 service use, assuming that this effect is mediated by implementation strategies and implementation
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41 140 outcomes.
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44 141 *Please insert Figure 1*
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47 142 **Search strategy**
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50 143 Three steps approaches will be used: 1) a preliminary search on PubMed will be conducted to
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53 144 identify keywords; 2) peer-reviewed publications will be sought in Medline, CINAHL, The
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55 145 Cochrane Library, Embase and Web of Science databases; grey literature will be excluded; 3) The
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57 146 reference list of all eligible studies will be hand-searched for additional papers.
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3 147 The search strategy has been developed with the collaboration of a librarian; it combines controlled
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5 148 vocabulary and text words, with title and abstract field limiters, since 2000, as no QI has been
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8 149 undertaken before this date (23). No language limits have been applied. The full search strategy is
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10 150 available as supplementary material.

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13 151 Based on a recent international survey (32), an extensive list of terms referring to “nursing homes”
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15 152 has been included.

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19 153 For the intervention concept, search terms which focus on “Quality improvement” or
20
21 154 “Organizational innovation” or “Quality Assurance, Health Care” or “Management Quality
22
23 155 Circles”, or on a formal model of QI intervention have been used (Plan Do Study Act (PDSA); Six
24
25 156 Sigma (DMAIC and DMADV); Total Quality Management (TQM), Continuous Quality
26
27
28 157 Improvement (CQI), Focus Analyze Develop Execute (FADE)) (33). Moreover, terms concerning
29
30 158 implementation strategies have been used, including “Implementation Science”, “Program
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32 159 Implementation”, or “Diffusion of Innovation”. When complex interventions are introduced in a
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35 160 real-world context with the goal of changing health care professionals’ behaviours, the
36
37 161 implementation phase needs to be developed and planned along with the intervention itself (34).

40 162 **Eligibility criteria**

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43 163 The review’s eligibility criteria will be identified based on the following elements of the PICO
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45 164 framework:

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49 165 *Types of participants/setting:* Long-stay nursing home residents, defined as persons who have been
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51 166 institutionalised for at least 30 days. Residences needing short-term NH or rehabilitation services
52
53 167 will be excluded. Studies that recruited mixed populations (short- and long-residents) that did not
54
55
56 168 present stratified results, as well as those undertaken in multiple settings (i.e., NHs, acute care
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58 169 hospitals, home health agencies) and no opportunity to detect the impact of the QI in NH will be
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60 170 excluded. Nursing homes will be defined as facilities that provide nursing care for people with

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171 functional or cognitive disabilities and assist them with activities of daily living, with the aim to
172 provide a safe and supportive environment (35). Studies conducted in facilities providing
173 accommodation, without nurses on-site will be excluded.

174 Intervention(s): the review will include studies focused on the implementation of QI interventions
175 aimed at reducing hospital services use among NH residents. The Academy of Medical Royal
176 Colleges' definition of QI will be used (14). Collaborative QI interventions will be also included
177 due to the importance of the model in the healthcare setting (36).

178 Empirical studies will be included if they: 1) report measurable continuous local iterative testing of
179 solutions; 2) use real data in guiding the change; 2) obtain a practical contextual knowledge 3)
180 encompass at least one implementation strategy developed by the EPOC taxonomy of interventions
181 targeted healthcare workers (e.g., distribution of educational materials, educational meetings,
182 clinical practice guidelines, overcoming challenges to improving quality, local opinion leaders, etc)
183 (18) . These studies may or may not use a formal model (PDSA, Six Sigma, TQM, etc.) or a
184 framework for improvement.

185 Alternatives to QI strategies, such as research (studies aim to produce generalizable knowledge,
186 testing a hypothesis, though a rigorous method), service evaluation (aims to assess current patient
187 care) or clinical transformation (radical or deep transformation activity without the iterative test of
188 change will be excluded (37).

189 *Types of comparison(s):* studies must have a control group that does not receive any QI
190 interventions or a historical cohort with which to compare changes before and after the intervention.

191 Types of outcomes: the outcomes of the review will be hospital services use. In the specific, the
192 primary outcome will be the all-cause hospitalizations, while the secondary outcomes will be
193 hospitalizations at the end of life, potentially avoidable hospitalizations (8), ED visits (the following

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194 terms will be considered interchangeably “ED transfers” or “ED attendances” or “ED presentations”
195 or “Unplanned transfers”), and readmissions.

196 *Type of study designs:* Randomized Controlled Trials (RCTs), Non-Randomised Controlled Trials
197 (NRCTs), Uncontrolled Before- and- After trials (UBA) or Interrupted Time Series (ITS) designed
198 with at least three data points before and three after the intervention.

199 **Selecting studies**

200 Two reviewers (I.B. and S.G.) will perform the screening process to determine potential eligibility
201 independently. Zotero will be used as reference manager software. As the first step, the title and
202 abstract will be evaluated; then the full text of the potentially eligible studies will be examined for
203 compliance with eliciting criteria. Any disagreement will be resolved by a third author (AD).

205 **Risk-of-bias assessment**

206 Two independent reviewers will assess the Risk of Bias of the studies included in the review
207 following the JBI Critical Appraisal Tools, based on study design (38). These tools provide a set of
208 questions, which reviewers can answer with yes (i.e., criterion met), no (i.e., a criterion not met),
209 unclear or not applicable. No studies will be excluded by the methodological quality assessment.

210 **Appraisal of the quality of QI interventions**

211 The quality of the QI interventions will be appraised for each included study using the QI Minimum
212 Quality Criteria Set (QI-MQCS) to inform the transferability of the best evidence into clinical
213 practice (39). The QI-MQCS addresses the following core QI domains: Organizational Motivation,
214 Intervention Rationale, Intervention Description, Organizational Characteristics, Implementation,
215 Study Design, Comparator, Data Source, Timing, Adherence/Fidelity, Health Outcomes,
216 Organisational Readiness, Penetration/Reach, Sustainability, Spread and Limitations.

217 **Data extraction**

218 The following study characteristics will be independently extracted by two members (IB and SG) of
219 the research team:

- 220 - Study details: study design, date of publication, participants (NH organizational
221 characteristics, ownership, size, etc), study setting.
- 222 - QI intervention details: characteristics and implementation strategies, data on the formal
223 model used (if any), and information to appraise the quality of the QI interventions
224 (description of organizational problem, reason or motivation for the intervention,
225 intervention description, basic characteristics of the organization, etc) were extracted.
- 226 - Hospital services use .

228 **Data synthesis**

229 Data from the included studies will be combined in a meta-analysis, based on the outcome. Results
230 will be pooled by combining the natural logarithms of the rate ratio across studies or calculating the
231 rate ratio using the generic inverse-variance method. Heterogeneity will be assessed using the χ^2 test
232 and the I^2 statistics: $I^2 \leq 50\%$ indicates low heterogeneity and $>50\%$ high heterogeneity. Subgroup
233 analysis will be conducted according to the characteristic of the population and the type of QI
234 intervention and implementation strategies, if the number of included studies allows it.

235 Publication bias will be visually evaluated using funnel plot if the number of included studies will
236 be higher than 10. Whether measure outcomes reported in the included studies will be not
237 homogeneous, raw data will be requested from the authors. All the analysis will be performed using
238 STATA/SE17 version.

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3 239 Moreover, a narrative synthesis will be arranged. The characteristics of the included studies will be
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5 240 synthesized and compared in a table. The characteristic of the QI and the implementation strategies
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8 241 will be deductively categorized into the EPOC taxonomy's domains on delivery arrangements and
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10 242 implementation strategies, using all the subcategories (18). The domains of governance
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12 243 arrangements and financial arrangements will be excluded because beyond the scope of the review.
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15 244 **Discussion**

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18 245 Hospital services use is on the rise and associated with health risk for older NH residents. Growing
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21 246 evidence suggest that QI intervention may reduce potentially avoidable transfers among NH
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23 247 residents. The systematic review and meta-analysis will support clinical and organizational
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25 248 decision-making, by identifying what strategies of QI intervention prevent the use of hospital
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28 249 services and what implementation strategies are more effective in promoting fidelity to
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30 250 organisational and system changes.
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55 367 **Contributors:** IB, ADM, SC, SG, EB, and SC jointly contributed to the study aims, research design
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57 368 and methodology. IB, SG, SC and EB produced the first draft of the article outline with the
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59 369 guidance of SC, and ADM. IB and EB designed the search strategy. All authors (IB, ADM, SC, SG,
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3 370 SC, EB) contributed substantially to the manuscript and critically revised the content. All authors
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5 371 read and approved the final version of the manuscript.
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13 374 Medicine, Università del Piemonte Orientale
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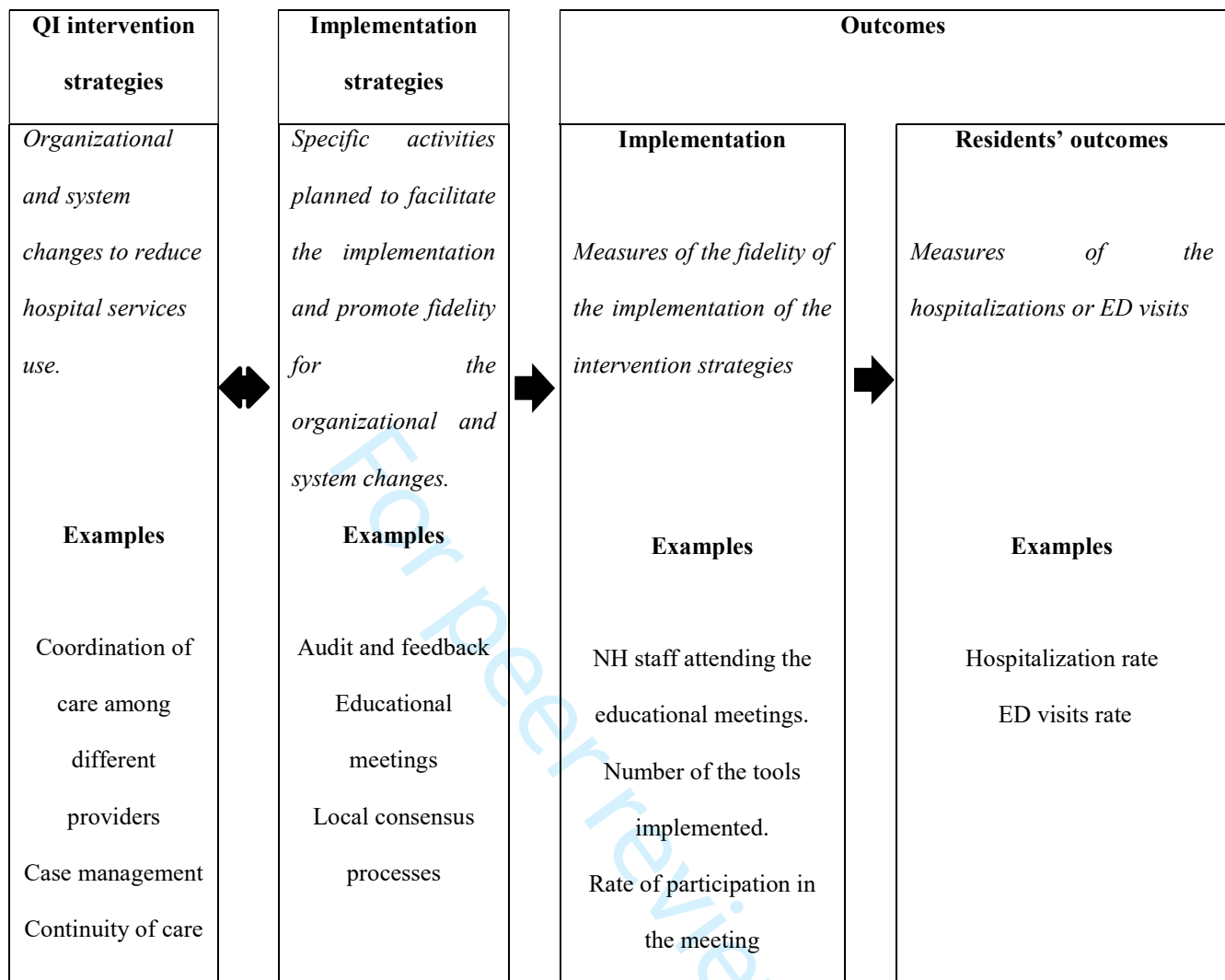


Figure 1: Adaptation of the implementation research conceptual model

PubMed (Searched 31 th December 2022)		
Search	Query	Items
# 1	("Nursing Homes" [Mesh] OR "Nursing home*" [Title/Abstract] OR "Homes for the Aged" [Mesh] OR "Geriatric Home*" [Title/Abstract] OR "Old age home*" [Title/Abstract] OR "Home, old age" [Title/Abstract] OR "Homes, old age" [Title/Abstract] OR "Old people home*" [Title/Abstract] OR "Old people's home*" [Title/Abstract] OR "Long-Term Care" [Mesh] OR "Long-Term Care" [Title/Abstract] OR "Long Term Care" [Title/Abstract] OR "Long term facilit*" [Title/Abstract] OR "long-term facilit*" [Title/Abstract] OR "Skilled Nursing Facilities"[Mesh] OR "Skilled Nursing Facilit*" [Title/Abstract] OR "Care home*" [Title/Abstract] OR "Residential Facilities"[Mesh] OR "Residential facilit*" [Title/Abstract] OR "Residential home*" [Title/Abstract] OR "Residential institution*" [Title/abstract] OR "Institutional care*" [Title/Abstract] OR "Care facilit*" [Title/Abstract] OR "Continuing care*" [Title/Abstract] OR "Subacute Care"[Mesh] OR "Sub-acute care" [Title/Abstract] OR "Medical home*" [Title/Abstract] OR "Medical care" [Title/Abstract] OR "Extended care facilit*" [Title/Abstract] OR "Assisted Living Facilities"[Mesh] OR "Assisted living facility*" [Title/abstract] OR "Assisted living" [Title/Abstract] OR "Skilled care" [Title/Abstract] OR "Restorative care" [Title/Abstract] OR "Retirement center" [Title/Abstract] OR "Retirement centre" [Title/Abstract] OR "Retirement home" [Title/Abstract] OR "Senior residence facilit*" [Title/Abstract])	190,129
#2	("Quality Improvement"[Mesh] OR "Quality improvement" [Title/Abstract] OR "Improvement Quality" [Title/Abstract] OR "Organizational Innovation"[Mesh] OR "Organizational innovation" [Title/Abstract] OR "Organisational innovation" [Title/Abstract] OR "Quality Assurance, Health Care"[Mesh] OR "Health Care Quality Assurance" [Title/Abstract] OR "Quality assurance, health care" [Title/Abstract] OR "Program Evaluation"[Mesh] OR "Program Evaluation*" [Title/Abstract] OR "Program effectiveness" [Title/Abstract] OR "Healthcare Quality Assurance" [Title/Abstract] OR "Management Quality Circles"[Mesh] OR "Management Quality Circles" [Title/abstract] OR "Total Quality Management"[Mesh] OR "Quality Management" [Title/Abstract] OR "Management, Total Quality" [Title/Abstract] OR "Total Quality Management" [Title/Abstract] OR "Clinical Governance"[Mesh] OR "Outcome Assessment, Health Care"[Majr] OR "Healthcare outcome assessment" [Title/Abstract] OR "Health Care outcome assessment" [Title/Abstract] OR "Process Assessment, Health Care"[Majr] OR "Process assessment, health care" [Title/Abstract] OR "Outcome measure" [Title/Abstract] OR "Outcome assessment" [Title/Abstract] OR "Health Care Process Assessment" [Title/Abstract] OR "Healthcare Process Assessment" [Title/Abstract] OR TQM [Title/Abstract] OR "Plan Do Study Act" [Title/Abstract] OR PDSA [Title/Abstract] OR "Plan Do Check Act" [Title/Abstract] OR PDCA [Title/Abstract] OR "Six Sigma" [Title/Abstract] OR Lean [Title/Abstract] OR DMAIC [Title/Abstract] OR DMADV [Title/Abstract] OR "Continuous Quality Improvement" [Title/Abstract] OR CQI [Title/Abstract] OR "Focus Analyse Develop Execute" [Title/Abstract] OR FADE [Title/Abstract] OR "Collaborative Quality Improvement*" [Title/Abstract] OR "Quality Improvement Collaborative*" [Title/Abstract] OR "Performance Improvement*" [Title/Abstract] or "Collaborative Improvement" [Title/Abstract] OR "Implementation Science"[Mesh] OR "Implement*" [Title/Abstract] OR ADOPT* [Title/Abstract] OR feedback [Title/Abstract] or "professional development" [Title/Abstract] or network* [Title/Abstract] or leadership [Title/Abstract] or opinion leader* [Title/Abstract] or "consensus process*" [Title/Abstract] or "change manage*" [Title/Abstract] or train* [Title/Abstract] or audit* [Title/Abstract] OR "root cause analysis" [Title/Abstract] OR "Diffusion of Innovation"[Mesh])	2,915,751
#3	("Emergency Service, Hospital" [Mesh] OR "Hospital Emergency Service*" [Title/Abstract] OR "Emergency Hospital Service*" [Title/Abstract] OR "Emergency unit*" [Title/Abstract] OR "Unit Emergency" [Title/Abstract] OR "Units Emergency" [Title/Abstract] OR "Emergency Ward*" [Title/Abstract] OR "Ward Emergency" [Title/Abstract] OR "Wards Emergency" [Title/Abstract] OR "Emergency Department*" [Title/Abstract] OR "Room Emergency" [Title/Abstract] OR "Emergency Room*" [Title/Abstract] OR "Emergency Outpatient Unit*" [Title/Abstract] OR "Department Emergency" [Title/Abstract] OR "Departments Emergency" [Title/Abstract] OR "Outpatient Unit Emergency" [Title/Abstract] OR "Outpatient Units Emergency" [Title/Abstract] OR "Patient Admission"	1,032,253

	[Mesh] OR Admission* [Title/Abstract] OR "Hospitalization"[Mesh] OR Hospitali* [Title/Abstract] OR "Hospital Transfer*" [Title/Abstract] OR "Hospital Admittance" [Title/Abstract] OR "Hospital Stay" [Title/Abstract] OR "Patient Readmission" [Mesh] OR Readmission* [Title/abstract] OR "Patient Transfer"[Mesh] OR "Emergency Treatment"[Mesh] OR "Acute care" [Title/Abstract] OR "Emergency care" [Title/Abstract] OR "Critical care" [Title/Abstract] OR "Acute service*" [Title/Abstract] OR "Emergency service*" [Title/Abstract] OR "Critical service*" [Title/Abstract] OR "Transitional Care"[Mesh] OR "Transitional care" [Title/Abstract]	
#4	#1 AND #2 AND #3 AND (2000:2022[pdat])	8,058

CINAHL Complete (Searched 31th December 2022)		
Search	Query	Items
#1	((MH "Nursing Home Patients") OR (MH "Home Nursing") OR (MH "Nursing Homes") OR (MH "Residential Care") OR (MH "Housing for the Elderly") OR (MH "Long Term Care") OR (MH "Skilled Nursing Facilities") OR (MH "Residential Facilities") OR TI ("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*") OR AB ("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*"))	128,129
#2	((MH "Quality Improvement+") OR (MH "Evaluation and Quality Improvement Program") OR (MH "Quality Management, Organizational") OR (MH "Quality Assurance") OR (MH "Quality Circles") OR (MH "Clinical Governance") OR (MH "Program Evaluation") OR (MH "Outcome Assessment") OR (MH "Process Assessment (Health Care)") OR TI ("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative") OR AB ("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR (MH "Implementation Science") OR "implementation science" OR (MH "Program Implementation") OR (MH "Systems Implementation") OR (MH "Root Cause Analysis") OR "implementation" OR (MH "Organizational Development") OR (MH "Audit") OR (MH "Change Management") OR (MH "Organizational Change") OR "Local consensus process"))	393,141
#3	((MH "Emergency Service") OR (MH "Hospitalization") OR (MH "Aged, Hospitalized") OR (MH "Hospitals") OR (MH "Patient Admission") OR (MH "Observation Units") OR	432,718

	(MH "Readmission") OR (MH "Transfer, Discharge") OR (MH "Emergency Treatment" OR (MH "Transitional Care") OR TI ("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR "Admission*" OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") OR AB ("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR "Admission*" OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*"))	
#4	#1 AND #2 AND #3 AND (Published Date: 20000101-20221231)	3270

EMBASE (Searched 31th December 2022)		
Search	Query	Items
#1	'nursing home'/exp OR 'extended care facility':ti,ab,kw OR 'intermediate care facilities':ti,ab,kw OR 'long term care facility':ti,ab,kw OR 'nursing home':ti,ab,kw OR 'nursing homes':ti,ab,kw OR 'skilled nursing facilities':ti,ab,kw OR 'skilled nursing facility':ti,ab,kw OR 'nursing home patient'/mj OR 'long term care patient':ti,ab,kw OR 'nursing home patient':ti,ab,kw OR 'nursing home resident':ti,ab,kw OR 'residential home'/mj OR 'institution, residential':ti,ab,kw OR 'residential facilities':ti,ab,kw OR 'residential home':ti,ab,kw OR 'residential institution':ti,ab,kw OR 'home for the aged'/mj OR 'continuing care retirement center':ti,ab,kw OR 'geriatric homes':ti,ab,kw OR 'home for the aged':ti,ab,kw OR 'home for the elderly':ti,ab,kw OR 'homes for the aged':ti,ab,kw OR 'housing for the elderly':ti,ab,kw OR 'old age home':ti,ab,kw OR 'old age homes':ti,ab,kw OR 'old people home':ti,ab,kw OR 'old people`s home':ti,ab,kw OR 'retirement center':ti,ab,kw OR 'retirement centre':ti,ab,kw OR 'retirement home':ti,ab,kw OR 'senior residence facility':ti,ab,kw OR 'long term care'/mj OR 'chronic treatment':ti,ab,kw OR 'long term care':ti,ab,kw OR 'long term medical care':ti,ab,kw OR 'long-term care':ti,ab,kw OR 'treatment, long term':ti,ab,kw OR 'assisted living facility'/mj OR 'assisted living':ti,ab,kw OR 'assisted living facilities':ti,ab,kw OR 'assisted living facility':ti,ab,kw OR 'institutional care'/mj OR 'care, institutional':ti,ab,kw OR 'institutional care':ti,ab,kw OR 'institutional practice':ti,ab,kw OR 'institutional therapy':ti,ab,kw OR 'institutional treatment':ti,ab,kw OR 'continuing care':ti,ab OR 'extended care':ti,ab,kw OR 'restorative care':ti,ab,kw OR 'skilled care':ti,ab,kw OR 'medical home'/mj OR 'institutional care'/mj)	152,919
#2	'(quality improvement':ti,ab,kw OR 'quality improvements':ti,ab,kw OR 'total quality management'/exp OR 'quality management':ti,ab,kw OR 'total quality management':ti,ab,kw OR 'management, total quality':ti,ab,kw OR 'quality improvement study'/exp OR 'organisational innovation':ti,ab,kw OR 'organizational innovation':ti,ab,kw OR 'quality control'/mj OR 'quality assessment':ti,ab,kw OR 'quality assurance':ti,ab,kw OR 'quality control':ti,ab,kw OR 'clinical governance':ti,ab,kw OR 'health care evaluation':ti,ab,kw OR 'health care quality assurance':ti,ab,kw OR 'healthcare evaluation':ti,ab,kw OR 'healthcare process assessment':ti,ab,kw OR 'healthcare quality assurance':ti,ab,kw OR 'quality assurance, health care':ti,ab,kw OR 'management quality circles':ti,ab,kw OR 'tqm:ti,ab OR 'plan do study act cycle'/exp OR 'pdsa:ti,ab OR 'plan do check act':ti,ab OR 'six sigma methodology'/exp OR 'six sigma':ti,ab,kw OR 'six sigma methodology':ti,ab,kw OR 'lean methodology'/exp OR 'lean initiative':ti,ab,kw OR 'lean management':ti,ab,kw OR 'lean methodology':ti,ab,kw OR 'lean philosophy':ti,ab,kw OR 'lean quality improvement':ti,ab,kw OR 'lean quality initiative':ti,ab,kw OR 'lean thinking':ti,ab,kw OR 'dmaic:ti,ab OR 'dmadv:ti,ab OR 'pdca:ti,ab OR 'continuous quality improvement'/exp OR 'cqi:ti,ab OR 'focus analyze develop execute':ti,ab OR 'ciq:ti,ab	1,278,108

	OR 'collaborative quality improvement*':ti,ab OR 'performance improvement'/exp OR 'collaborative improvement':ti,ab OR 'outcome assessment'/mj OR 'health care outcome assessment':ti,ab,kw OR 'healthcare outcome assessment':ti,ab,kw OR 'outcome assessment':ti,ab,kw OR 'outcome assessment (health care)':ti,ab,kw OR 'outcome assessment, health care':ti,ab,kw OR 'outcome measurement':ti,ab,kw OR 'implementation science'/exp OR 'implementation'/mj OR 'adoption'/mj OR 'education'/mj OR 'education':ti,ab,kw OR 'self-evaluation programmes':ti,ab,kw OR 'self-evaluation programs':ti,ab,kw OR 'training support':ti,ab,kw OR 'local consensus process':ti,ab,kw OR 'professional development'/mj OR 'professional development':ti,ab,kw OR 'feedback system'/mj OR 'change management'/mj OR 'root cause analysis'/mj OR 'leadership'/mj OR 'leader':ti,ab,kw OR 'leadership':ti,ab,kw)	
#3	('hospital readmission'/exp OR 'hospital readmission':ti,ab,kw OR 'patient readmission':ti,ab,kw OR 'readmission':ti,ab,kw OR 'readmission rate':ti,ab,kw OR 'readmissions':ti,ab,kw OR 'rehospitalization':ti,ab,kw OR 'hospital admission'/exp OR 'admission, hospital':ti,ab,kw OR 'hospital admission':ti,ab,kw OR 'hospital admittance':ti,ab,kw OR 'hospital admitting department':ti,ab,kw OR 'hospital admitting service':ti,ab,kw OR 'hospital admitting unit':ti,ab,kw OR 'patient admission':ti,ab,kw OR 'hospitalization'/exp OR 'hospital stay':ti,ab,kw OR 'hospitalization':ti,ab,kw OR 'short stay hospitalization':ti,ab,kw OR 'emergency health service'/mj OR 'emergency health service'/exp/mj OR 'emergency medical service':ti,ab,kw OR 'emergency medical services':ti,ab,kw OR 'emergency service':ti,ab,kw OR 'patient transport'/mj OR 'patient transfer':ti,ab,kw OR 'patient transport':ti,ab,kw OR 'transport, patient':ti,ab,kw OR 'transportation of patients':ti,ab,kw OR 'Emergency Department*':ti,ab,kw OR 'Emergency Room*':ti,ab,kw OR 'Emergency ward*':ti,ab,kw OR 'emergency care'/mj OR 'acute care':ti,ab,kw OR 'acute medical care':ti,ab,kw OR 'emergency care':ti,ab,kw OR 'transitional care'/mj OR 'transition care':ti,ab,kw OR 'transitional care':ti,ab,kw)	1,184,917
#4	#1 AND #2 AND #3 AND [2000-2022]/py	2,326

The Cochrane Library (Trials database) (Searched 31th December 2022)		
Search	Query	Items
#1	("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "homes for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home" OR "Medical homes" OR "Medical care" OR "senior residence facilit*") in Title Abstract Keyword	25,298
#2	("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR Implement* OR Adopt* OR "Change management" OR "Workforce development" OR "professional development" OR feedback OR audit OR "Root cause analysis" OR "Local consensus process" OR leadership) in Title Abstract Keyword	251,531
#3	("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit Emergency" OR "Emergency Ward*" OR "Ward Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospital* OR "Hospital Transfer*" OR	235,675

	"Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") in Title Abstract Keyword	
#4	#1 AND #2 AND #3 AND	2,790

Web of science (Searched 31th December 2022)		
Search	Query	Items
#1	TI=("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*") OR AB=("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*")	126,846
#2	TI=("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR "Implementation" OR "Change management") OR AB=("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR "Implementation" OR "Change management")	1,394,815
#3	TI=("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") OR AB=("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*")	729,489
#4	#1 AND #2 AND #3 AND Timespan: 2000-01-01 to 2022-12-31 (Index Date)	2007

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For peer review only

Reporting checklist for protocol of a systematic review and meta analysis.

Based on the PRISMA-P guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA-Preporting guidelines, and cite them as:

Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement. Syst Rev. 2015;4(1):1.

		Reporting Item	Page Number
Title			
Identification	#1a	Identify the report as a protocol of a systematic review	1; 5
Update	#1b	If the protocol is for an update of a previous systematic review, identify as such	na
Registration			
	#2	If registered, provide the name of the registry (such as PROSPERO) and registration number	5
Authors			
Contact	#3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contribution	#3b	Describe contributions of protocol authors and identify the	16

guarantor of the review

Amendments

#4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	na
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Support

Sources	#5a	Indicate sources of financial or other support for the review	16
Sponsor	#5b	Provide name for the review funder and / or sponsor	16
Role of sponsor or funder	#5c	Describe roles of funder(s), sponsor(s), and / or institution(s), if any, in developing the protocol	16

Introduction

Rationale	#6	Describe the rationale for the review in the context of what is already known	3-5
Objectives	#7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	5

Methods

Eligibility criteria	#8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	7-8-9
Information sources	#9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	6-7
Search strategy	#10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	6-7
Study records - data management	#11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	9
Study records -	#11b	State the process that will be used for selecting studies (such	6-7

1			
2			
3	selection process	as two independent reviewers) through each phase of the	
4		review (that is, screening, eligibility and inclusion in meta-	
5		analysis)	
6			
7			
8	Study records -	#11c Describe planned method of extracting data from reports	6-7
9	data collection	(such as piloting forms, done independently, in duplicate),	
10	process	any processes for obtaining and confirming data from	
11		investigators	
12			
13			
14	Data items	#12 List and define all variables for which data will be sought	7-8
15		(such as PICO items, funding sources), any pre-planned data	
16		assumptions and simplifications	
17			
18			
19			
20	Outcomes and	#13 List and define all outcomes for which data will be sought,	8
21	prioritization	including prioritization of main and additional outcomes, with	
22		rationale	
23			
24			
25	Risk of bias in	#14 Describe anticipated methods for assessing risk of bias of	9
26	individual studies	individual studies, including whether this will be done at the	
27		outcome or study level, or both; state how this information will	
28		be used in data synthesis	
29			
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31			
32	Data synthesis	#15a Describe criteria under which study data will be quantitatively	10
33		synthesised	
34			
35	Data synthesis	#15b If data are appropriate for quantitative synthesis, describe	10
36		planned summary measures, methods of handling data and	
37		methods of combining data from studies, including any	
38		planned exploration of consistency (such as I ² , Kendall's τ)	
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42	Data synthesis	#15c Describe any proposed additional analyses (such as	10
43		sensitivity or subgroup analyses, meta-regression)	
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46	Data synthesis	#15d If quantitative synthesis is not appropriate, describe the type	10
47		of summary planned	
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50	Meta-bias(es)	#16 Specify any planned assessment of meta-bias(es) (such as	10
51		publication bias across studies, selective reporting within	
52		studies)	
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55	Confidence in	#17 Describe how the strength of the body of evidence will be	na
56	cumulative	assessed (such as GRADE)	
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For peer review only

BMJ Open

Quality improvement interventions to prevent the use of hospital services among nursing home residents: protocol for a systematic review and meta-analysis

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2023-074684.R1
Article Type:	Protocol
Date Submitted by the Author:	04-Aug-2023
Complete List of Authors:	Basso, Ines; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale Gonella, Silvia; Azienda Ospedaliero Universitaria Citta della Salute e della Scienza di Torino Bassi, Erika; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale Caristia, Silvia; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale Campagna, Sara; Università degli Studi di Torino, Department of Public Health and Pediatrics Dal Molin, Alberto; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale
Primary Subject Heading:	Geriatric medicine
Secondary Subject Heading:	Evidence based practice, Health services research, Palliative care
Keywords:	Aging, Hospitalization, Change management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Nursing Care, Systematic Review

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Manuscripts

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1 **Title:** Quality improvement interventions to prevent the use of hospital services among nursing
2 home residents: protocol for a systematic review and meta-analysis

3
4
5
6
7
8
9
10 **Authors:**

11
12 5 Ines Basso^{1,2*}, ines.basso@uniupo.it

13
14 6 Silvia Gonella³, silvia.gonella@unito.it

15
16 7 Erika Bassi¹, erika.bassi@uniupo.it

17
18 8 Silvia Caristia¹, silvia.caristia@med.uniupo.it

19
20 9 Sara Campagna^{4#}, sara.campagna@unito.it

21
22
23
24
25 10 and

26
27
28 11 Alberto Dal Molin^{1#}, alberto.dalmolin@med.uniupo.it (<https://orcid.org/0000-0003-2263-1340>)

29
30
31
32
33 **Affiliations:**

34
35
36 14 ¹ Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina
37 Traslazionale, Novara, Piemonte, IT

38 15
39 16 ² Azienda Ospedaliera Nazionale SS Antonio e Biagio e C Arrigo, Department of Research,
40 Training and Innovation Alessandria, Piemonte, IT

41 17
42 18 ³ Azienda Ospedaliero Universitaria Città della Salute e della Scienza di Torino
43 Torino, Piemonte, IT

44 19
45 20 ⁴ Università degli Studi di Torino, Department of Public Health and Pediatrics
46 Torino, Piemonte, IT

47
48
49
50
51
52 23 ***Corresponding author: Ines Basso, ines.basso@uniupo.it**

53
54 24 <https://orcid.org/0000-0002-9283-236X>

55
56
57
58
59 26 #Sara Campagna and Alberto Dal Molin are co-last authors- They contributed equally to this work.

Abstract

Introduction: Quality improvement interventions are a promising strategy for reducing hospital services use among nursing home residents. However, evidence for their effectiveness is limited. It is unclear which characteristics of the quality improvement intervention and activities planned to facilitate implementation may promote fidelity to organizational and system changes. This systematic review and meta-analysis will assess the effectiveness of quality improvement interventions and implementation strategies aimed at reducing hospital services use among nursing home residents.

Methods and analysis: The Medline, CINAHL, Cochrane Library, Embase and Web of Science databases will be comprehensively searched in September 2023. The eligible studies should focus on the implementation of a quality improvement intervention defined as the systematic, continuous approach that designs, tests, and implements changes using real-time measurement to reduce hospitalizations or emergency department visits among long-stay nursing home residents. Quality improvement details and implementation strategies will be deductively categorized into effective practice and organisation of care taxonomy domains for delivery arrangements and implementation strategies. Quality and bias assessments will be completed using the Quality Improvement Minimum Quality Criteria Set and the Joanna Briggs Institute Critical Appraisal Tools.

The results will be pooled in a meta-analysis, by combining the natural logarithms of the rate ratios across the studies or by calculating the rate ratio using the generic inverse-variance method. Heterogeneity will be assessed using the I^2 or H^2 statistics if the number of included studies will be less than 10. Raw data will be requested from the authors, as required.

Ethics and dissemination: Ethical approval is not required. The results will be published in a peer-review journal and presented at (inter)national conferences.

Prospero registration number: CRD42022364195

1
2
3 52 **Keywords:** Systematic review, nursing homes, quality improvement, implementation science,
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5 53 hospital admissions, emergency department visits
6
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9
10 55 **Strengths and limitations of this study**
11

- 12 56 • The protocol complies with the Preferred Reporting Items for Systematic Reviews and
13
14 Meta-analyses Protocol guideline.
15 57
16
17 58 • A comprehensive search strategy has been developed to include all eligible studies meeting
18
19 59 the inclusion criteria.
20
21
22 60 • The study screening, selection, data extraction and assessment of the risk of bias will be
23
24 61 completed by two independent reviewers.
25
26 62 • The study will assess both the risk of bias and quality of quality improvement interventions.
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31
32 64 **Introduction**
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35 65 By 2050, the global population aged 80 years or over is estimated to triple (1) and the demand for
36
37 66 Nursing Home (NH) services is expected to increase. NH residents have complex health needs and
38
39 67 challenging medical situations (2,3) that lead to frequent hospital service use (4–6). These are costly
40
41 68 and entail the risk of iatrogenic harms, including delirium, infections, and loss of functional
42
43 69 dependency (7). Although a significant proportion of accesses to hospital services are helpful and
44
45 70 necessary, international research suggests that up to 55% of hospitalizations in NHs can be avoided
46
47 71 with appropriate care (8). In fact, many conditions that result in admission or emergency department
48
49 72 visit could be averted through proper prevention (e.g., exacerbation of chronic diseases or
50
51 73 functional decline) or effective on-site management at an early stage (e.g., infection or dehydration)
52
53 74 (9,10). Improving the NH staff's skills in early recognition and management of acute change of
54
55 75 conditions, and the use of standardized communication tools could prevent avoidable access to
56
57 76 hospital services (11). Similarly, promoting palliative care and advanced care planning enables

1
2
3 77 healthcare professionals to be aligned with residents' preferences and values, ensuring the provision
4
5 78 of respectful and patient-centred care (12).
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8
9 79 Quality improvement (QI) interventions may be a promising strategy for improving care for NH
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11 80 residents and preventing hospital service use (13–15). QI intervention is defined as a systematic and
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13 81 continuous approach that designs, tests and implements changes using real-time measurements to
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15 82 improve the safety, effectiveness, and experience of care (16).
16
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18
19 83 Quality improvements are usually designed as multi-component interventions to tackle an
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21 84 improvement problem, involving all the organization providers, including front-line staff, and using
22
23 85 recognized methods to identify all potential causes of the problem and assess the impact of the
24
25 86 intervention against the expected results through reliable process and outcome measures (17).
26
27

28 87 Quality improvement interventions rely on several implementation strategies to improve adaptation
29
30 88 and stakeholder engagement, which may vary widely across projects and include audits, feedback,
31
32 89 staff education, tools, and site champions (13,18). However, the effects of different implementation
33
34 90 strategies on the success of QI interventions remain unclear.
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37
38 91 To better describe the heterogeneity of the healthcare interventions, including QI research, the
39
40 92 Cochrane Effective Practice and Organization of Care (EPOC) group developed a taxonomy for
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42 93 quality interventions based on pragmatic descriptions of components rather than theoretical
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44 94 constructs (19). The EPOC taxonomy, which can be used as a framework for exploring
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46 95 interventions, includes four domains of intervention delivery arrangements, financial arrangements,
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48 96 governance arrangements, and implementation strategies each of which is divided into categories
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50 97 and subcategories (20).
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54
55 98 Previous experiences in hospital acute care setting found QI interventions beneficial in enhancing
56
57 99 process care outcomes, such as organizational culture or teamwork, and improving patient care, by
58
59 100 reducing the nosocomial infection rate, preventing falls, or improving surgical outcomes (21-24).
60

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3 101 Although previous studies have obtained encouraging results related to QI interventions, evidence
4
5 102 of its effectiveness in NH remain limited (25,26) In particular, the INTERACT II intervention
6
7
8 103 significantly reduced hospital admissions through a multi-component QI intervention aimed at
9
10 104 training NH staff to identify and proactively manage major geriatric syndromes, encouraging
11
12 105 advanced care planning, and promoting palliative care-oriented care. (27)

14
15 106 Given the high rate of hospital service use among NH residents, it is important to understand
16
17
18 107 whether QI interventions can prevent avoidable transfers. Compared to the hospital setting, the
19
20 108 long-term care context poses several challenges that could impede the smooth implementation of a
21
22 109 QI initiative (25,28,29). The long-term care context has multiple unique barriers at the
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24
25 110 organizational level: inner/internal barriers (e.g., organizational culture, leadership or learning
26
27 111 climate), outer/external barriers (e.g., organizational funding, law, and regulation), and barriers at
28
29 112 the staff level (e.g., knowledge, skills, and motivation) (30).

31
32 113 The NH environment can be particularly challenging because of workforce shortages and high
33
34
35 114 turnover rates (31,32). Introducing a practice change that requires staff engagement in an under
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37 115 resourced organization may result in poor adherence to the intervention or an unsuccessful program
38
39 116 because of lack of time (33). Additionally, a high staff turnover may lead to a continuous need to
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41
42 117 support training and education in evidence-based practices and QI methods (29).

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45 118 Another important factor that may influence an organization's readiness to change is the
46
47 119 involvement of leadership in QI interventions (34). The extent to which management sustains and
48
49 120 reinforces cultural change, establishes a positive relationship with front-line staff, and invests
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51
52 121 resources in the adoption of a new model of care, are crucial features for achieving a high standard
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54 122 of care (29, 35). However, NH management is often characterized by a vertical hierarchal structure
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56 123 that can hinder an open flow of communication and prevent all stakeholders from collaborating
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58 124 fruitfully (36).

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3 125 To date, no secondary studies have investigated the effectiveness of QI interventions to prevent
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5 126 hospital services use among NH residents by exploring the factors that contribute to their success,
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8 127 such as delivery arrangements and implementation strategies. Therefore, this systematic review
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10 128 aims to estimate the effectiveness of QI interventions and their implementation strategies in
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12 129 reducing hospital service use among NH residents. In addition, given that the quality of QI
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15 130 interventions is often debated in the literature (37), the secondary aim is to assess the quality and
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17 131 rigor of QI interventions by evaluating whether the solutions tested consider the fundamental
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19 132 domains of a QI interventions, such as organizational readiness, implementation phase,
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21
22 133 sustainability, or adherence (38). Moreover, we will describe delivery arrangements and
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24 134 implementation strategies of QI interventions.

27 135 **Research questions**

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30 136 How effective are the QI interventions and implementation strategies aimed at preventing hospital
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32 137 service use among NH residents?

33
34
35 138 What is the quality and rigor of the QI interventions provided in NHs?

38 39 139 **Methods and analysis**

40
41
42 140 The protocol complies with the Preferred Reporting Items for Systematic Reviews and Meta-
43
44 141 analyses Protocol (PRISMA-P) 2015 statement for reporting (39) (Supplementary material). It has
45
46 142 been registered in PROSPERO (CRD42022364195).

48 49 50 143 **Review conceptual model**

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52
53 144 The review will be developed following the implementation research conceptual model proposed by
54
55 145 Proctor and collaborators (40). According to the model (Figure 1), QI intervention strategies and
56
57 146 implementation processes are separated but linked domains. In this review, QI strategies are defined
58
59 147 as organizational and system changes to reduce hospital services use. The implementation process

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3 148 involves activities that transfer QI intervention strategies into clinical practice. Both domains
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5 149 impact different but interrelated types of outcomes: implementation and resident outcomes.
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8 150 Implementation outcomes are used to assess the fidelity of implementation strategies. This review
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10 151 aims to assess the effectiveness of QI intervention strategies on hospital service use, assuming that
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12 152 this effect is mediated by implementation strategies and outcomes.
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15 153 *Please insert Figure 1*
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17

18 154 **Search strategy**

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22 155 Three steps will be used: a) a preliminary search of PubMed will be conducted to identify
23
24 156 keywords; b) peer-reviewed publications will be sought in the Medline, CINAHL, Cochrane
25
26 157 Library, Embase and Web of Science databases; grey literature will be excluded; and c) the
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28
29 158 reference lists of all eligible studies will be manually searched for additional papers.
30

31
32 159 The search strategy has been developed in collaboration with an expert librarian, by combining
33
34 160 terms according to the PICO framework. All terms were searched as controlled vocabulary and text
35
36 161 words with title and abstract field limiters, and combined with Boolean Operators (AND, OR). The
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38
39 162 research has been set from 2000, as no QI has been undertaken before this date (30), until
40
41 163 December 31, 2022, and will be re-run on September 1, 2023. No language limitations have been
42
43 164 applied. The full search strategy is available in the supplementary material.
44
45

46 165 Based on a recent international survey (41), an extensive list of terms referring to “nursing homes”
47
48
49 166 has been included.
50

51
52 167 For the intervention concept, search terms which focus on “Quality improvement” or
53
54 168 “Organizational innovation” or “Quality Assurance, Health Care” or “Management Quality
55
56 169 Circles,” or on a formal model of QI intervention have been used (Plan Do Study Act (PDSA); Six
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58
59 170 Sigma (DMAIC and DMADV); Total Quality Management (TQM), Continuous Quality
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171 Improvement (CQI), Focus Analyze Develop Execute (FADE)) (42). Moreover, terms concerning

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3 172 implementation strategies have been used, including “Implementation Science,” “Program
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5 173 Implementation,” or “Diffusion of Innovation.” Indeed, when complex interventions are introduced
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8 174 in a real-world context with the goal of changing health care professionals’ behaviours, the
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10 175 implementation phase needs to be developed and planned along with the intervention itself (43).

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13 176 For the outcomes, search terms focusing on “Hospital admissions” or “Emergency Service,
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15 177 Hospital” have been used.

18 178 **Eligibility criteria**

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22 179 The review’s eligibility criteria will be identified based on the following elements of the PICO
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24 180 framework:

25
26
27 181 *Types of participants/setting:* Long-stay nursing home residents, defined as persons who have been
28
29 182 institutionalized for at least 30 days. Residents requiring short-term NH or rehabilitation services
30
31 183 will be excluded. Studies that recruited mixed populations (short and long-term residents) that did
32
33 184 not present stratified results, as well as those undertaken in multiple settings (i.e., NHs, acute care
34
35 185 hospitals, home health agencies) and no opportunity to detect the impact of the QI in NH will be
36
37 186 excluded. NHs are defined as facilities that provide nursing care for people with functional or
38
39 187 cognitive disabilities and assist them with activities of daily living, with the aim of providing a safe
40
41 188 and supportive environment (44). Studies conducted in facilities providing accommodations,
42
43 189 without on-site nurses will be excluded.

44
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49 190 *Intervention(s):* This review will include studies focusing on the implementation of QI interventions
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51 191 aimed at reducing hospital services use among NH residents. The Academy of Medical Royal
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53 192 Colleges definition of QI will be used (16). Collaborative QI interventions will also be included
54
55 193 because of the importance of the model in healthcare setting (45).

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59 194 Empirical studies will be included if they 1) report measurable continuous local iterative testing of
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195 solutions, 2) use real data to guide the change, 2) obtain practical contextual knowledge, and 3)

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3 196 encompass at least one implementation strategy developed by the EPOC taxonomy of interventions
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5 197 targeting healthcare workers (e.g., distribution of educational materials, educational meetings,
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7 198 clinical practice guidelines, overcoming challenges to improving quality, local opinion leaders, etc)
8
9
10 199 (20). These studies may or may not use a formal model (PDSA, Six Sigma, Total Quality
11
12 200 Management, etc.) or a framework for improvement.

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15 201 Alternatives to QI strategies, such as research (studies that aim to produce generalizable knowledge,
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17 202 testing a hypothesis, though a rigorous method), service evaluation (aims to assess current patient
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19 203 care) or clinical transformation (radical or deep transformation activity without the iterative test of
20
21 204 change will be excluded) (46).

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25 205 *Types of comparison(s)*: Studies must have a control group that does not receive any QI
26
27 206 interventions or a historical cohort to compare the changes before and after the intervention.

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31 207 *Types of outcomes*: Primary outcome of the review will focus on hospitalizations, defined as the
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33 208 acute admissions occurring for any conditions, while the secondary outcomes will include
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35 209 hospitalizations at the end of life (last 60 days of life), potentially avoidable hospitalizations (as
36
37 210 defined by the authors, using all the existing metrics (8)), ED visits (the following terms will be
38
39 211 considered interchangeably “ED transfers” or “ED attendances” or “ED presentations” or
40
41 212 “Unplanned transfers”), and readmissions.

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45 213 Both subjective (e.g., self-reported by NH staff) or objective measure (e.g., hospital database) of
46
47 214 hospital service use will be collected.

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51 215 *Type of study designs*: Randomized Controlled Trials (RCTs), Non-Randomised Controlled Trials
52
53 216 (NRCTs), Uncontrolled Before- and- After trials (UBA) or Interrupted Time Series (ITS) designed
54
55 217 with at least three data points before and three after the intervention.

58 218 **Selecting studies**

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3 219 Two reviewers (I.B. and S.G.) independently performed the screening process to determine
4
5 220 eligibility. Zotero will be used as the reference manager software. First, the title and abstract will be
6
7
8 221 evaluated; then, the full text of potentially eligible studies will be examined for compliance with the
9
10 222 inclusion criteria. Any disagreements will be resolved by a third author (AD).
11
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13 223 **Risk-of-bias assessment**

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16 224 Two independent reviewers will assess the risk of bias of the studies included in the review using
17
18 225 the JBI Critical Appraisal Tools, based on the study design (47). These tools provide a set of
19
20
21 226 questions, that reviewers can answer with yes (i.e., criterion met), no (i.e., a criterion not met),
22
23 227 unclear or not applicable. No study will be excluded by the methodological quality assessment.
24
25

26 228 **Appraisal of the quality of QI interventions**

27
28
29 229 The quality of the QI interventions will be appraised for each included study using the QI Minimum
30
31 230 Quality Criteria Set (QI-MQCS) to inform the transferability of the best evidence into clinical
32
33
34 231 practice (38). The QI-MQCS addresses the following core QI domains: organizational motivation,
35
36 232 intervention rationale, intervention description, organizational characteristics, implementation,
37
38
39 233 study design, comparator, data source, timing, adherence/fidelity, health outcomes, organisational
40
41 234 readiness, penetration/reach, sustainability, spread and limitations.
42
43

44 235 **Data extraction**

45
46
47 236 Two members (IB and SG) of the research team will independently extract the following study
48
49 237 characteristics:

- 50
51
52 238 - Study details: Study design, date of publication, participants (NH organizational
53
54
55 239 characteristics, ownership, size, etc), and study setting.
- 56
57 240 - QI intervention details: Characteristics and implementation strategies, data on the formal
58
59 241 model used (if any), and information to appraise the quality of QI interventions (description

1
2
3 242 of organizational problems, reasons or motivations for the intervention, intervention
4
5 243 description, basic characteristics of the organization, etc) were extracted.
6
7
8 244 - Hospital service use: Data on hospitalizations, potentially avoidable hospitalizations, end-of-
9
10 245 life hospitalizations, ED visits and readmissions.
11

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13

14 247 **Data synthesis**

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18 248 Data from the included studies will be combined into a meta-analysis based on the outcomes. The
19
20 249 results will be pooled by combining the natural logarithms of the rate ratio across studies, or by
21
22 250 calculating the rate ratio using the generic inverse-variance method. We will use a permutation
23
24
25 251 random-effect model to estimate meta-analysis effect. Heterogeneity will be assessed using the
26
27 252 I^2 statistics and we will consider high level of heterogeneity an $I^2 > 75\%$. Considering that the
28
29 253 I^2 statistics is biased in small meta-analysis, we will test heterogeneity with the H^2 if it will be
30
31 254 included less than 10 studies. We choose an acceptable level of H^2 under 1.88 with a confidence of
32
33 255 95% (48).
34
35

36
37 256 Publication bias will be visually evaluated using funnel plot if more than 10 studies will be
38
39 257 included. We will request raw data from the authors when the reported outcomes in the included
40
41
42 258 studies are not homogenous. All analyses will be performed using STATA/SE17 version.
43

44
45 259 A narrative synthesis will also be arranged. The characteristics of the included studies will be
46
47 260 synthesized and compared in a table. The characteristics of the QI and implementation strategies
48
49 261 will be deductively categorized into the EPOC taxonomy's domains on delivery arrangements and
50
51 262 implementation strategies, using all subcategories (20). The domains of governance and financial
52
53 263 arrangements will be excluded because they are beyond the scope of this review.
54
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57 264 **Patient and public involvement:** Patients and/or the public were not involved in this research's
58
59 265 design, conduct, reporting, or dissemination plans.
60

266 **Ethics and dissemination**

267 Ethical approval is not required for this study as it is a review based on published studies. The
268 findings of this systematic review and meta-analysis will support clinical and organizational
269 decision-making by determining which QI interventions effectively prevent the use of hospital
270 services and identifying which implementation strategies are most successful in fostering adherence
271 to organizational and system changes within NH settings. The results of this study will be presented
272 at a scientific conference and submitted to a peer-reviewed journal for publication.

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3 426 **Acknowledgements:** The authors would like to thank Ms Maoret Roberta of the Biblioteca Virtuale
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5 427 per la Salute – Piemonte - for her support in the development of the search strategy.
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8 428 **Figure 1 Legend: Adaptation of the implementation research conceptual model (40).** QI intervention and implementation
9 strategies are interconnected domains that influence both implementation and resident outcomes.
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For peer review only

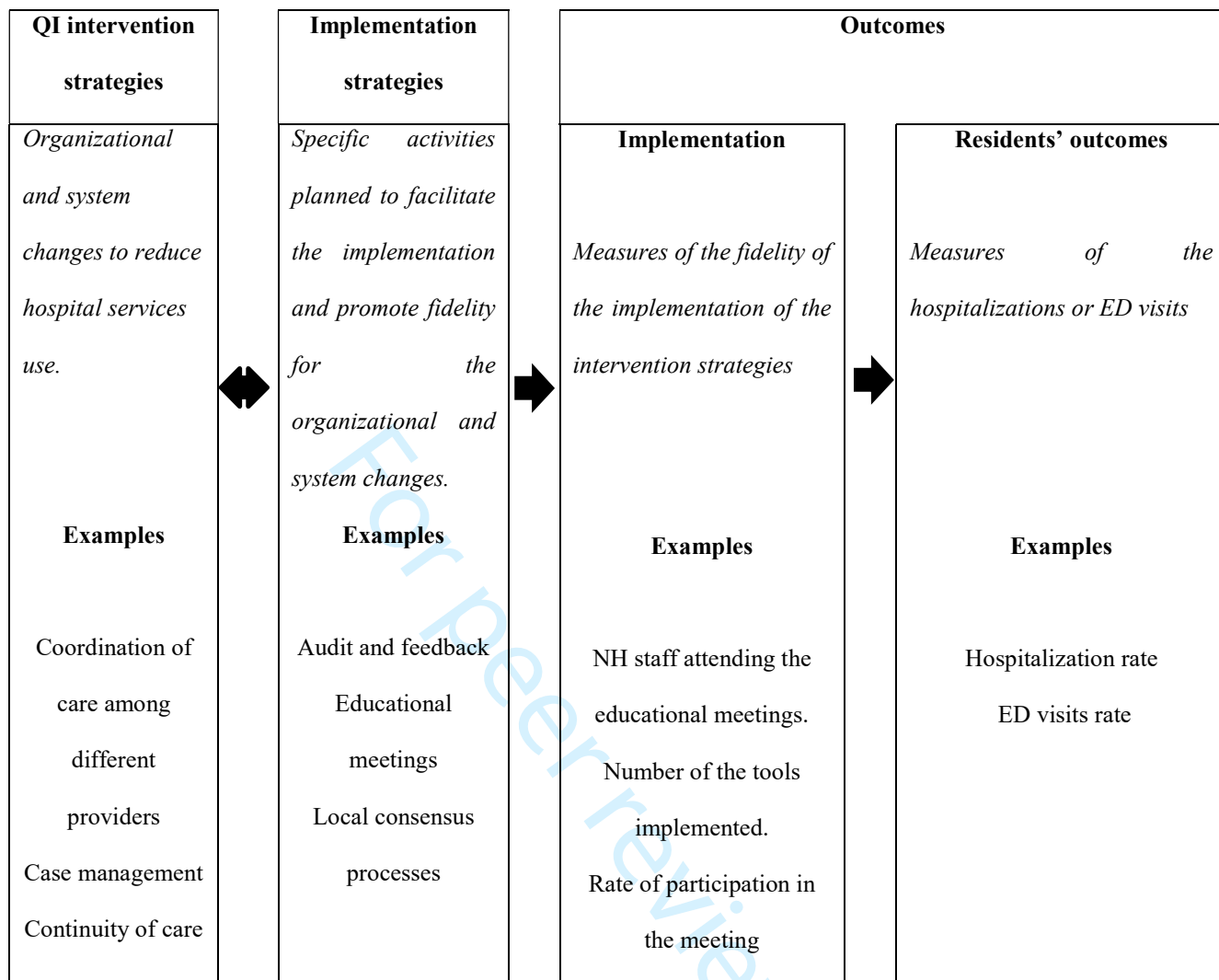


Figure 1

PubMed (Searched 31 th December 2022)		
Search	Query	Items
# 1	("Nursing Homes" [Mesh] OR "Nursing home*" [Title/Abstract] OR "Homes for the Aged" [Mesh] OR "Geriatric Home*" [Title/Abstract] OR "Old age home*" [Title/Abstract] OR "Home, old age" [Title/Abstract] OR "Homes, old age" [Title/Abstract] OR "Old people home*" [Title/Abstract] OR "Old people's home*" [Title/Abstract] OR "Long-Term Care" [Mesh] OR "Long-Term Care" [Title/Abstract] OR "Long Term Care" [Title/Abstract] OR "Long term facilit*" [Title/Abstract] OR "long-term facilit*" [Title/Abstract] OR "Skilled Nursing Facilities"[Mesh] OR "Skilled Nursing Facilit*" [Title/Abstract] OR "Care home*" [Title/Abstract] OR "Residential Facilities"[Mesh] OR "Residential facilit*" [Title/Abstract] OR "Residential home*" [Title/Abstract] OR "Residential institution*" [Title/abstract] OR "Institutional care*" [Title/Abstract] OR "Care facilit*" [Title/Abstract] OR "Continuing care*" [Title/Abstract] OR "Subacute Care"[Mesh] OR "Sub-acute care" [Title/Abstract] OR "Medical home*" [Title/Abstract] OR "Medical care" [Title/Abstract] OR "Extended care facilit*" [Title/Abstract] OR "Assisted Living Facilities"[Mesh] OR "Assisted living facility*" [Title/abstract] OR "Assisted living" [Title/Abstract] OR "Skilled care" [Title/Abstract] OR "Restorative care" [Title/Abstract] OR "Retirement center" [Title/Abstract] OR "Retirement centre" [Title/Abstract] OR "Retirement home" [Title/Abstract] OR "Senior residence facilit*" [Title/Abstract])	190,129
#2	("Quality Improvement"[Mesh] OR "Quality improvement" [Title/Abstract] OR "Improvement Quality" [Title/Abstract] OR "Organizational Innovation"[Mesh] OR "Organizational innovation" [Title/Abstract] OR "Organisational innovation" [Title/Abstract] OR "Quality Assurance, Health Care"[Mesh] OR "Health Care Quality Assurance" [Title/Abstract] OR "Quality assurance, health care" [Title/Abstract] OR "Program Evaluation"[Mesh] OR "Program Evaluation*" [Title/Abstract] OR "Program effectiveness" [Title/Abstract] OR "Healthcare Quality Assurance" [Title/Abstract] OR "Management Quality Circles"[Mesh] OR "Management Quality Circles" [Title/abstract] OR "Total Quality Management"[Mesh] OR "Quality Management" [Title/Abstract] OR "Management, Total Quality" [Title/Abstract] OR "Total Quality Management" [Title/Abstract] OR "Clinical Governance"[Mesh] OR "Outcome Assessment, Health Care"[Majr] OR "Healthcare outcome assessment" [Title/Abstract] OR "Health Care outcome assessment" [Title/Abstract] OR "Process Assessment, Health Care"[Majr] OR "Process assessment, health care" [Title/Abstract] OR "Outcome measure" [Title/Abstract] OR "Outcome assessment" [Title/Abstract] OR "Health Care Process Assessment" [Title/Abstract] OR "Healthcare Process Assessment" [Title/Abstract] OR TQM [Title/Abstract] OR "Plan Do Study Act" [Title/Abstract] OR PDSA [Title/Abstract] OR "Plan Do Check Act" [Title/Abstract] OR PDCA [Title/Abstract] OR "Six Sigma" [Title/Abstract] OR Lean [Title/Abstract] OR DMAIC [Title/Abstract] OR DMADV [Title/Abstract] OR "Continuous Quality Improvement" [Title/Abstract] OR CQI [Title/Abstract] OR "Focus Analyse Develop Execute" [Title/Abstract] OR FADE [Title/Abstract] OR "Collaborative Quality Improvement*" [Title/Abstract] OR "Quality Improvement Collaborative*" [Title/Abstract] OR "Performance Improvement*" [Title/Abstract] or "Collaborative Improvement" [Title/Abstract] OR "Implementation Science"[Mesh] OR "Implement*" [Title/Abstract] OR ADOPT* [Title/Abstract] OR feedback [Title/Abstract] or "professional development" [Title/Abstract] or network* [Title/Abstract] or leadership [Title/Abstract] or opinion leader* [Title/Abstract] or "consensus process*" [Title/Abstract] or "change manage*" [Title/Abstract] or train* [Title/Abstract] or audit* [Title/Abstract] OR "root cause analysis" [Title/Abstract] OR "Diffusion of Innovation"[Mesh])	2,915,751
#3	("Emergency Service, Hospital" [Mesh] OR "Hospital Emergency Service*" [Title/Abstract] OR "Emergency Hospital Service*" [Title/Abstract] OR "Emergency unit*" [Title/Abstract] OR "Unit Emergency" [Title/Abstract] OR "Units Emergency" [Title/Abstract] OR "Emergency Ward*" [Title/Abstract] OR "Ward Emergency" [Title/Abstract] OR "Wards Emergency" [Title/Abstract] OR "Emergency Department*" [Title/Abstract] OR "Room Emergency" [Title/Abstract] OR "Emergency Room*" [Title/Abstract] OR "Emergency Outpatient Unit*" [Title/Abstract] OR "Department Emergency" [Title/Abstract] OR "Departments Emergency" [Title/Abstract] OR "Outpatient Unit Emergency" [Title/Abstract] OR "Outpatient Units Emergency" [Title/Abstract] OR "Patient Admission"	1,032,253

	[Mesh] OR Admission* [Title/Abstract] OR "Hospitalization"[Mesh] OR Hospitali* [Title/Abstract] OR "Hospital Transfer*" [Title/Abstract] OR "Hospital Admittance" [Title/Abstract] OR "Hospital Stay" [Title/Abstract] OR "Patient Readmission" [Mesh] OR Readmission* [Title/abstract] OR "Patient Transfer"[Mesh] OR "Emergency Treatment"[Mesh] OR "Acute care" [Title/Abstract] OR "Emergency care" [Title/Abstract] OR "Critical care" [Title/Abstract] OR "Acute service*" [Title/Abstract] OR "Emergency service*" [Title/Abstract] OR "Critical service*" [Title/Abstract] OR "Transitional Care"[Mesh] OR "Transitional care" [Title/Abstract]	
#4	#1 AND #2 AND #3 AND (2000:2022[pdat])	8,058

CINAHL Complete (Searched 31th December 2022)		
Search	Query	Items
#1	((MH "Nursing Home Patients") OR (MH "Home Nursing") OR (MH "Nursing Homes") OR (MH "Residential Care") OR (MH "Housing for the Elderly") OR (MH "Long Term Care") OR (MH "Skilled Nursing Facilities") OR (MH "Residential Facilities") OR TI ("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*") OR AB ("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*"))	128,129
#2	((MH "Quality Improvement+") OR (MH "Evaluation and Quality Improvement Program") OR (MH "Quality Management, Organizational") OR (MH "Quality Assurance") OR (MH "Quality Circles") OR (MH "Clinical Governance") OR (MH "Program Evaluation") OR (MH "Outcome Assessment") OR (MH "Process Assessment (Health Care)") OR TI ("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative") OR AB ("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR (MH "Implementation Science") OR "implementation science" OR (MH "Program Implementation") OR (MH "Systems Implementation") OR (MH "Root Cause Analysis") OR "implementation" OR (MH "Organizational Development") OR (MH "Audit") OR (MH "Change Management") OR (MH "Organizational Change") OR "Local consensus process"))	393,141
#3	((MH "Emergency Service") OR (MH "Hospitalization") OR (MH "Aged, Hospitalized") OR (MH "Hospitals") OR (MH "Patient Admission") OR (MH "Observation Units") OR	432,718

	<p>(MH "Readmission") OR (MH "Transfer, Discharge") OR (MH "Emergency Treatment" OR (MH "Transitional Care") OR TI ("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR "Admission*" OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") OR AB ("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR "Admission*" OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*"))</p>	
#4	#1 AND #2 AND #3 AND (Published Date: 20000101-20221231)	3270

EMBASE (Searched 31th December 2022)		
Search	Query	Items
#1	<p>('nursing home'/exp OR 'extended care facility':ti,ab,kw OR 'intermediate care facilities':ti,ab,kw OR 'long term care facility':ti,ab,kw OR 'nursing home':ti,ab,kw OR 'nursing homes':ti,ab,kw OR 'skilled nursing facilities':ti,ab,kw OR 'skilled nursing facility':ti,ab,kw OR 'nursing home patient'/mj OR 'long term care patient':ti,ab,kw OR 'nursing home patient':ti,ab,kw OR 'nursing home resident':ti,ab,kw OR 'residential home'/mj OR 'institution, residential':ti,ab,kw OR 'residential facilities':ti,ab,kw OR 'residential home':ti,ab,kw OR 'residential institution':ti,ab,kw OR 'home for the aged'/mj OR 'continuing care retirement center':ti,ab,kw OR 'geriatric homes':ti,ab,kw OR 'home for the aged':ti,ab,kw OR 'home for the elderly':ti,ab,kw OR 'homes for the aged':ti,ab,kw OR 'housing for the elderly':ti,ab,kw OR 'old age home':ti,ab,kw OR 'old age homes':ti,ab,kw OR 'old people home':ti,ab,kw OR 'old people`s home':ti,ab,kw OR 'retirement center':ti,ab,kw OR 'retirement centre':ti,ab,kw OR 'retirement home':ti,ab,kw OR 'senior residence facility':ti,ab,kw OR 'long term care'/mj OR 'chronic treatment':ti,ab,kw OR 'long term care':ti,ab,kw OR 'long term medical care':ti,ab,kw OR 'long-term care':ti,ab,kw OR 'treatment, long term':ti,ab,kw OR 'assisted living facility'/mj OR 'assisted living':ti,ab,kw OR 'assisted living facilities':ti,ab,kw OR 'assisted living facility':ti,ab,kw OR 'institutional care'/mj OR 'care, institutional':ti,ab,kw OR 'institutional care':ti,ab,kw OR 'institutional practice':ti,ab,kw OR 'institutional therapy':ti,ab,kw OR 'institutional treatment':ti,ab,kw OR 'continuing care':ti,ab OR 'extended care':ti,ab,kw OR 'restorative care':ti,ab,kw OR 'skilled care':ti,ab,kw OR 'medical home'/mj OR 'institutional care'/mj)</p>	152,919
#2	<p>('quality improvement':ti,ab,kw OR 'quality improvements':ti,ab,kw OR 'total quality management'/exp OR 'quality management':ti,ab,kw OR 'total quality management':ti,ab,kw OR 'management, total quality':ti,ab,kw OR 'quality improvement study'/exp OR 'organisational innovation':ti,ab,kw OR 'organizational innovation':ti,ab,kw OR 'quality control'/mj OR 'quality assessment':ti,ab,kw OR 'quality assurance':ti,ab,kw OR 'quality control':ti,ab,kw OR 'clinical governance':ti,ab,kw OR 'health care evaluation':ti,ab,kw OR 'health care quality assurance':ti,ab,kw OR 'healthcare evaluation':ti,ab,kw OR 'healthcare process assessment':ti,ab,kw OR 'healthcare quality assurance':ti,ab,kw OR 'quality assurance, health care':ti,ab,kw OR 'management quality circles':ti,ab,kw OR 'tqm':ti,ab OR 'plan do study act cycle'/exp OR 'pdca':ti,ab OR 'plan do check act':ti,ab OR 'six sigma methodology'/exp OR 'six sigma':ti,ab,kw OR 'six sigma methodology':ti,ab,kw OR 'lean methodology'/exp OR 'lean initiative':ti,ab,kw OR 'lean management':ti,ab,kw OR 'lean methodology':ti,ab,kw OR 'lean philosophy':ti,ab,kw OR 'lean quality improvement':ti,ab,kw OR 'lean quality initiative':ti,ab,kw OR 'lean thinking':ti,ab,kw OR 'dmaic':ti,ab OR 'dmadv':ti,ab OR 'pdca':ti,ab OR 'continuous quality improvement'/exp OR 'cqi':ti,ab OR 'focus analyze develop execute':ti,ab OR 'ciq':ti,ab</p>	1,278,108

	OR 'collaborative quality improvement*':ti,ab OR 'performance improvement'/exp OR 'collaborative improvement':ti,ab OR 'outcome assessment'/mj OR 'health care outcome assessment':ti,ab,kw OR 'healthcare outcome assessment':ti,ab,kw OR 'outcome assessment':ti,ab,kw OR 'outcome assessment (health care)':ti,ab,kw OR 'outcome assessment, health care':ti,ab,kw OR 'outcome measurement':ti,ab,kw OR 'implementation science'/exp OR 'implementation'/mj OR 'adoption'/mj OR 'education'/mj OR 'education':ti,ab,kw OR 'self-evaluation programmes':ti,ab,kw OR 'self-evaluation programs':ti,ab,kw OR 'training support':ti,ab,kw OR 'local consensus process':ti,ab,kw OR 'professional development'/mj OR 'professional development':ti,ab,kw OR 'feedback system'/mj OR 'change management'/mj OR 'root cause analysis'/mj OR 'leadership'/mj OR 'leader':ti,ab,kw OR 'leadership':ti,ab,kw)	
#3	('hospital readmission'/exp OR 'hospital readmission':ti,ab,kw OR 'patient readmission':ti,ab,kw OR 'readmission':ti,ab,kw OR 'readmission rate':ti,ab,kw OR 'readmissions':ti,ab,kw OR 'rehospitalization':ti,ab,kw OR 'hospital admission'/exp OR 'admission, hospital':ti,ab,kw OR 'hospital admission':ti,ab,kw OR 'hospital admittance':ti,ab,kw OR 'hospital admitting department':ti,ab,kw OR 'hospital admitting service':ti,ab,kw OR 'hospital admitting unit':ti,ab,kw OR 'patient admission':ti,ab,kw OR 'hospitalization'/exp OR 'hospital stay':ti,ab,kw OR 'hospitalization':ti,ab,kw OR 'short stay hospitalization':ti,ab,kw OR 'emergency health service'/mj OR 'emergency health service'/exp/mj OR 'emergency medical service':ti,ab,kw OR 'emergency medical services':ti,ab,kw OR 'emergency service':ti,ab,kw OR 'patient transport'/mj OR 'patient transfer':ti,ab,kw OR 'patient transport':ti,ab,kw OR 'transport, patient':ti,ab,kw OR 'transportation of patients':ti,ab,kw OR 'Emergency Department*':ti,ab,kw OR 'Emergency Room*':ti,ab,kw OR 'Emergency ward*':ti,ab,kw OR 'emergency care'/mj OR 'acute care':ti,ab,kw OR 'acute medical care':ti,ab,kw OR 'emergency care':ti,ab,kw OR 'transitional care'/mj OR 'transition care':ti,ab,kw OR 'transitional care':ti,ab,kw)	1,184,917
#4	#1 AND #2 AND #3 AND [2000-2022]/py	2,326

The Cochrane Library (Trials database) (Searched 31th December 2022)		
Search	Query	Items
#1	("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "homes for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home" OR "Medical homes" OR "Medical care" OR "senior residence facilit*") in Title Abstract Keyword	25,298
#2	("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR Implement* OR Adopt* OR "Change management" OR "Workforce development" OR "professional development" OR feedback OR audit OR "Root cause analysis" OR "Local consensus process" OR leadership) in Title Abstract Keyword	251,531
#3	("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit Emergency" OR "Emergency Ward*" OR "Ward Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospital* OR "Hospital Transfer*" OR	235,675

	"Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") in Title Abstract Keyword	
#4	#1 AND #2 AND #3 AND	2,790

Web of science (Searched 31th December 2022)		
Search	Query	Items
#1	TI=("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*") OR AB=("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*")	126,846
#2	TI=("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR "Implementation" OR "Change management") OR AB=("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR "Implementation" OR "Change management")	1,394,815
#3	TI=("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") OR AB=("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*")	729,489
#4	#1 AND #2 AND #3 AND Timespan: 2000-01-01 to 2022-12-31 (Index Date)	2007

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For peer review only

Reporting checklist for protocol of a systematic review and meta analysis.

Based on the PRISMA-P guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA-Preporting guidelines, and cite them as:

Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement. Syst Rev. 2015;4(1):1.

		Reporting Item	Page Number
Title			
Identification	#1a	Identify the report as a protocol of a systematic review	1; 6
Update	#1b	If the protocol is for an update of a previous systematic review, identify as such	na
Registration			
	#2	If registered, provide the name of the registry (such as PROSPERO) and registration number	6
Authors			
Contact	#3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contribution	#3b	Describe contributions of protocol authors and identify the	17

guarantor of the review

Amendments

#4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	na
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Support

Sources	#5a	Indicate sources of financial or other support for the review	17
Sponsor	#5b	Provide name for the review funder and / or sponsor	17
Role of sponsor or funder	#5c	Describe roles of funder(s), sponsor(s), and / or institution(s), if any, in developing the protocol	17

Introduction

Rationale	#6	Describe the rationale for the review in the context of what is already known	3-6
Objectives	#7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	6

Methods

Eligibility criteria	#8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	8-9
Information sources	#9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	6-7
Search strategy	#10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	7-8
Study records - data management	#11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	10
Study records -	#11b	State the process that will be used for selecting studies (such	10

1			
2			
3	selection process	as two independent reviewers) through each phase of the	
4		review (that is, screening, eligibility and inclusion in meta-	
5		analysis)	
6			
7			
8	Study records -	#11c Describe planned method of extracting data from reports	10-11
9	data collection	(such as piloting forms, done independently, in duplicate),	
10	process	any processes for obtaining and confirming data from	
11		investigators	
12			
13			
14	Data items	#12 List and define all variables for which data will be sought	10-11
15		(such as PICO items, funding sources), any pre-planned data	
16		assumptions and simplifications	
17			
18			
19			
20	Outcomes and	#13 List and define all outcomes for which data will be sought,	10-11
21	prioritization	including prioritization of main and additional outcomes, with	
22		rationale	
23			
24			
25	Risk of bias in	#14 Describe anticipated methods for assessing risk of bias of	10
26	individual studies	individual studies, including whether this will be done at the	
27		outcome or study level, or both; state how this information will	
28		be used in data synthesis	
29			
30			
31			
32	Data synthesis	#15a Describe criteria under which study data will be quantitatively	11
33		synthesised	
34			
35	Data synthesis	#15b If data are appropriate for quantitative synthesis, describe	11
36		planned summary measures, methods of handling data and	
37		methods of combining data from studies, including any	
38		planned exploration of consistency (such as I ² , Kendall's τ)	
39			
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41			
42	Data synthesis	#15c Describe any proposed additional analyses (such as	11
43		sensitivity or subgroup analyses, meta-regression)	
44			
45			
46	Data synthesis	#15d If quantitative synthesis is not appropriate, describe the type	na
47		of summary planned	
48			
49			
50	Meta-bias(es)	#16 Specify any planned assessment of meta-bias(es) (such as	11
51		publication bias across studies, selective reporting within	
52		studies)	
53			
54			
55	Confidence in	#17 Describe how the strength of the body of evidence will be	na
56	cumulative	assessed (such as GRADE)	
57	evidence		
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For peer review only

BMJ Open

Quality improvement interventions to prevent the use of hospital services among nursing home residents: protocol for a systematic review and meta-analysis

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2023-074684.R2
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Complete List of Authors:	Basso, Ines; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale Gonella, Silvia; Azienda Ospedaliero Universitaria Citta della Salute e della Scienza di Torino Bassi, Erika; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale Caristia, Silvia; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale Campagna, Sara; Università degli Studi di Torino, Department of Public Health and Pediatrics Dal Molin, Alberto; Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina Traslazionale
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1 **Title:** Quality improvement interventions to prevent the use of hospital services among nursing
2 home residents: protocol for a systematic review and meta-analysis

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10 **Authors:**

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12
13 5 Ines Basso^{1,2*}, ines.basso@uniupo.it

14
15 6 Silvia Gonella³, silvia.gonella@unito.it

16
17 7 Erika Bassi¹, erika.bassi@uniupo.it

18
19 8 Silvia Caristia¹, silvia.caristia@med.uniupo.it

20
21
22 9 Sara Campagna^{4#}, sara.campagna@unito.it

23
24
25 10 and

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27
28 11 Alberto Dal Molin^{1#}, alberto.dalmolin@med.uniupo.it (<https://orcid.org/0000-0003-2263-1340>)

29
30
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32
33 **Affiliations:**

34
35
36 14 ¹ Università degli Studi del Piemonte Orientale Amedeo Avogadro, Department of Medicina
37 Traslazionale, Novara, Piemonte, IT

38 15
39 16 ² Azienda Ospedaliera Nazionale SS Antonio e Biagio e C Arrigo, Department of Research,
40 Training and Innovation Alessandria, Piemonte, IT

41 17
42 18 ³ Azienda Ospedaliero Universitaria Città della Salute e della Scienza di Torino
43 Torino, Piemonte, IT

44 19
45 20 ⁴ Università degli Studi di Torino, Department of Public Health and Pediatrics
46 Torino, Piemonte, IT

47
48
49
50
51
52 23 ***Corresponding author: Ines Basso, ines.basso@uniupo.it**

53
54 24 <https://orcid.org/0000-0002-9283-236X>

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57
58
59 26 #Sara Campagna and Alberto Dal Molin are co-last authors- They contributed equally to this work.

Abstract

Introduction: Quality improvement interventions are a promising strategy for reducing hospital services use among nursing home residents. However, evidence for their effectiveness is limited. It is unclear which characteristics of the quality improvement intervention and activities planned to facilitate implementation may promote fidelity to organizational and system changes. This systematic review and meta-analysis will assess the effectiveness of quality improvement interventions and implementation strategies aimed at reducing hospital services use among nursing home residents.

Methods and analysis: The Medline, CINAHL, Cochrane Library, Embase and Web of Science databases will be comprehensively searched in September 2023. The eligible studies should focus on the implementation of a quality improvement intervention defined as the systematic, continuous approach that designs, tests, and implements changes using real-time measurement to reduce hospitalizations or emergency department visits among long-stay nursing home residents. Quality improvement details and implementation strategies will be deductively categorized into effective practice and organisation of care taxonomy domains for delivery arrangements and implementation strategies. Quality and bias assessments will be completed using the Quality Improvement Minimum Quality Criteria Set and the Joanna Briggs Institute Critical Appraisal Tools.

The results will be pooled in a meta-analysis, by combining the natural logarithms of the rate ratios across the studies or by calculating the rate ratio using the generic inverse-variance method. Heterogeneity will be assessed using the I^2 or H^2 statistics if the number of included studies will be less than 10. Raw data will be requested from the authors, as required.

Ethics and dissemination: Ethical approval is not required. The results will be published in a peer-review journal and presented at (inter)national conferences.

Prospero registration number: CRD42022364195

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2
3 51 **Keywords:** Systematic review, nursing homes, quality improvement, implementation science,
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5 52 hospital admissions, emergency department visits
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10 54 **Strengths and limitations of this study**
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- 12 55 • The protocol complies with the Preferred Reporting Items for Systematic Reviews and
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14 56 Meta-analyses Protocol guideline.
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17 57 • A comprehensive search strategy has been developed to include all eligible studies meeting
18
19 58 the inclusion criteria.
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22 59 • The study screening, selection, data extraction and assessment of the risk of bias will be
23
24 60 completed by two independent reviewers.
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27 61 • The study will assess both the risk of bias and quality of quality improvement interventions.
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29 62 • The search strategy will not include grey literature.
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34 64 **Introduction**
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36
37 65 By 2050, the global population aged 80 years or over is estimated to triple (1) and the demand for
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39 66 Nursing Home (NH) services is expected to increase. NH residents have complex health needs and
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41
42 67 challenging medical situations (2,3) that lead to frequent hospital service use (4–6). These are costly
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44 68 and entail the risk of iatrogenic harms, including delirium, infections, and loss of functional
45
46 69 dependency (7). Although a significant proportion of accesses to hospital services are helpful and
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49 70 necessary, international research suggests that up to 55% of hospitalizations in NHs can be avoided
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51 71 with appropriate care (8). In fact, many conditions that result in admission or emergency department
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53 72 visit could be averted through proper prevention (e.g., exacerbation of chronic diseases or functional
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55 73 decline) or effective on-site management at an early stage (e.g., infection or dehydration) (9,10).
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58 74 Improving the NH staff' skills in early recognition and management of acute change of conditions,
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60 75 and the use of standardized communication tools could prevent avoidable access to hospital services

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3 76 (11). Similarly, promoting palliative care and advanced care planning enables healthcare
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5 77 professionals to be aligned with residents' preferences and values, ensuring the provision of respectful
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8 78 and patient-centred care (12).
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10
11 79 Quality improvement (QI) interventions may be a promising strategy for improving care for NH
12
13 80 residents and preventing hospital service use (13–14). QI intervention is defined as a systematic and
14
15 81 continuous approach that designs, tests and implements changes using real-time measurements to
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18 82 improve the safety, effectiveness, and experience of care (15). QI interventions are planned as a
19
20 83 cyclical process, starting with problem analysis to design a tailored intervention before
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22 84 implementation (16). Changes are constantly measured during and after implementation to
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25 85 understand the impact and adopt the required adjustments (16). The iterative cycle, also known as the
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27 86 plan-do-study-act (PDSA) method is the model used by several QI interventions, such as Total
28
29 87 Quality Management, Lean and Six Sigma (17). Quality improvements are usually designed as multi-
30
31 88 component interventions to tackle an improvement problem, involving all the organization providers,
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33
34 89 including front-line staff, and using recognized methods to identify all potential causes of the problem
35
36 90 and assess the impact of the intervention against the expected results through reliable process and
37
38
39 91 outcome measures (16). Quality improvement interventions rely on several implementation strategies
40
41 92 to improve adaptation and stakeholder engagement, which may vary widely across projects and
42
43 93 include audits, feedback, staff education, tools, and site champions (13,18). However, the effects of
44
45 94 different implementation strategies on the success of QI interventions remain unclear.
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49 95 To better describe the heterogeneity of the healthcare interventions, including QI research, the
50
51 96 Cochrane Effective Practice and Organization of Care (EPOC) group developed a taxonomy for
52
53 97 quality interventions based on pragmatic descriptions of components rather than theoretical
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55 98 constructs (19). The EPOC taxonomy, which can be used as a framework for exploring interventions,
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58 99 includes four domains of intervention delivery arrangements, financial arrangements, governance
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100 arrangements, and implementation strategies each of which is divided into categories and
101 subcategories (20).

102 Previous experiences in hospital acute care setting found QI interventions beneficial in enhancing
103 process care outcomes, such as organizational culture or teamwork, and improving patient care, by
104 reducing the nosocomial infection rate, preventing falls, or improving surgical outcomes (21-24).
105 Although previous studies have obtained encouraging results related to QI interventions, evidence of
106 its effectiveness in NH remain limited (25,26) In particular, the INTERACT II intervention
107 significantly reduced hospital admissions through a multi-component QI intervention aimed at
108 training NH staff to identify and proactively manage major geriatric syndromes, encouraging
109 advanced care planning, and promoting palliative care-oriented care. (27)

110 Given the high rate of hospital service use among NH residents, it is important to understand whether
111 QI interventions can prevent avoidable transfers. Compared to the hospital setting, the long-term care
112 context poses several challenges that could impede the smooth implementation of a QI initiative
113 (25,28,29). The long-term care context has multiple unique barriers at the organizational level:
114 inner/internal barriers (e.g., organizational culture, leadership or learning climate), outer/external
115 barriers (e.g., organizational funding, law, and regulation), and barriers at the staff level (e.g.,
116 knowledge, skills, and motivation) (30).

117 The NH environment can be particularly challenging because of workforce shortages and high
118 turnover rates (31,32). Introducing a practice change that requires staff engagement in an under
119 resourced organization may result in poor adherence to the intervention or an unsuccessful program
120 because of lack of time (33). Additionally, a high staff turnover may lead to a continuous need to
121 support training and education in evidence-based practices and QI methods (29).

122 Another important factor that may influence an organization's readiness to change is the involvement
123 of leadership in QI interventions (34). The extent to which management sustains and reinforces

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124 cultural change, establishes a positive relationship with front-line staff, and invests resources in the
125 adoption of a new model of care, are crucial features for achieving a high standard of care (29, 35).
126 However, NH management is often characterized by a vertical hierarchal structure that can hinder an
127 open flow of communication and prevent all stakeholders from collaborating fruitfully (36).

128 To date, no secondary studies have investigated the effectiveness of QI interventions to prevent
129 hospital services use among NH residents by exploring the factors that contribute to their success,
130 such as delivery arrangements and implementation strategies. Therefore, this systematic review aims
131 to estimate the effectiveness of QI interventions and their implementation strategies in reducing
132 hospital service use among NH residents. In addition, given that the quality of QI interventions is
133 often debated in the literature (37), the secondary aim is to assess the quality and rigor of QI
134 interventions by evaluating whether the solutions tested consider the fundamental domains of a QI
135 interventions, such as organizational readiness, implementation phase, sustainability, or adherence
136 (38). Moreover, we will describe delivery arrangements and implementation strategies of QI
137 interventions.

138 **Research questions**

139 How effective are the QI interventions and implementation strategies aimed at preventing hospital
140 service use among NH residents?

141 What is the quality and rigor of the QI interventions provided in NHs?

142 **Methods and analysis**

143 The protocol complies with the Preferred Reporting Items for Systematic Reviews and Meta-analyses
144 Protocol (PRISMA-P) 2015 statement for reporting (39) (Supplementary material 1). It has been
145 registered in PROSPERO (CRD42022364195).

146 **Review conceptual model**

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3 147 The review will be developed following the implementation research conceptual model proposed by
4
5 148 Proctor and collaborators (40). According to the model (Figure 1), QI intervention strategies and
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8 149 implementation processes are separated but linked domains. In this review, QI strategies are defined
9
10 150 as organizational and system changes to reduce hospital services use. The implementation process
11
12 151 involves activities that transfer QI intervention strategies into clinical practice. Both domains impact
13
14 152 different but interrelated types of outcomes: implementation and resident outcomes. Implementation
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17 153 outcomes are used to assess the fidelity of implementation strategies. This review aims to assess the
18
19 154 effectiveness of QI intervention strategies on hospital service use, assuming that this effect is
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22 155 mediated by implementation strategies and outcomes.

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25 156 *Please insert Figure 1*

28 157 **Search strategy**

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31 158 Three steps will be used: a) a preliminary search of PubMed will be conducted to identify keywords;
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33 159 b) peer-reviewed publications will be sought in the Medline, CINAHL, Cochrane Library, Embase
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36 160 and Web of Science databases; grey literature will be excluded; and c) the reference lists of all eligible
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38 161 studies will be manually searched for additional papers.

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41 162 The search strategy has been developed in collaboration with an expert librarian, by combining terms
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43 163 according to the PICO framework. All terms were searched as controlled vocabulary and text words
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46 164 with title and abstract field limiters, and combined with Boolean Operators (AND, OR). The research
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48 165 has been set from 2000, as no QI has been undertaken before this date (30), until December 31, 2022,
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50 166 and will be re-run on September 1, 2023. No language limitations have been applied. The full search
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53 167 strategy is available in the Supplementary material 2.

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56 168 Based on a recent international survey (41), an extensive list of terms referring to “nursing homes”
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58 169 has been included.

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3 170 For the intervention concept, search terms which focus on “Quality improvement” or “Organizational
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5 171 innovation” or “Quality Assurance, Health Care” or “Management Quality Circles,” or on a formal
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8 172 model of QI intervention have been used (Plan Do Study Act (PDSA); Six Sigma (DMAIC and
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10 173 DMADV); Total Quality Management (TQM), Continuous Quality Improvement (CQI), Focus
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12 174 Analyze Develop Execute (FADE)) (42). Moreover, terms concerning implementation strategies have
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15 175 been used, including “Implementation Science,” “Program Implementation,” or “Diffusion of
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17 176 Innovation.” Indeed, when complex interventions are introduced in a real-world context with the goal
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19 177 of changing health care professionals’ behaviours, the implementation phase needs to be developed
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22 178 and planned along with the intervention itself (43).

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25 179 For the outcomes, search terms focusing on “Hospital admissions” or “Emergency Service,
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27 180 Hospital” have been used.

30 181 **Eligibility criteria**

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33 182 The review’s eligibility criteria will be identified based on the following elements of the PICO
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35 183 framework:

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39 184 *Types of participants/setting:* Long-stay nursing home residents, defined as persons who have been
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41 185 institutionalized for at least 30 days. Residents requiring short-term NH or rehabilitation services will
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43 186 be excluded. Studies that recruited mixed populations (short and long-term residents) that did not
44
45 187 present stratified results, as well as those undertaken in multiple settings (i.e., NHs, acute care
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48 188 hospitals, home health agencies) and no opportunity to detect the impact of the QI in NH will be
49
50 189 excluded. NHs are defined as facilities that provide nursing care for people with functional or
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52 190 cognitive disabilities and assist them with activities of daily living, with the aim of providing a safe
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55 191 and supportive environment (44). Studies conducted in facilities providing accommodations, without
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57 192 on-site nurses will be excluded.

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3 193 *Intervention(s)*: This review will include studies focusing on the implementation of QI interventions
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5 194 aimed at reducing hospital services use among NH residents. The Academy of Medical Royal
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8 195 Colleges definition of QI will be used (15). Collaborative QI interventions will also be included
9
10 196 because of the importance of the model in healthcare setting (45).
11
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13 197 Empirical studies will be included if they 1) report measurable continuous local iterative testing of
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15 198 solutions, 2) use real data to guide the change, 2) obtain practical contextual knowledge, and 3)
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18 199 encompass at least one implementation strategy developed by the EPOC taxonomy of interventions
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20 200 targeting healthcare workers (e.g., distribution of educational materials, educational meetings,
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22 201 clinical practice guidelines, overcoming challenges to improving quality, local opinion leaders, etc)
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25 202 (20). These studies may or may not use a formal model (PDSA, Six Sigma, Total Quality
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27 203 Management, etc.) or a framework for improvement.
28
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30 204 Alternatives to QI strategies, such as research (studies that aim to produce generalizable knowledge,
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32 205 testing a hypothesis, though a rigorous method), service evaluation (aims to assess current patient
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35 206 care) or clinical transformation (radical or deep transformation activity without the iterative test of
36
37 207 change will be excluded) (46).
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40 208 *Types of comparison(s)*: Studies must have a control group that does not receive any QI interventions
41
42 209 or a historical cohort to compare the changes before and after the intervention.
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46 210 *Types of outcomes*: Primary outcome of the review will focus on hospitalizations, defined as the acute
47
48 211 admissions occurring for any conditions, while the secondary outcomes will include hospitalizations
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50 212 at the end of life (last 60 days of life), potentially avoidable hospitalizations (as defined by the authors,
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52 213 using all the existing metrics (8)), ED visits (the following terms will be considered interchangeably
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55 214 “ED transfers” or “ED attendances” or “ED presentations” or “Unplanned transfers”), and
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57 215 readmissions.
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3 216 Both subjective (e.g., self-reported by NH staff) or objective measure (e.g., hospital database) of
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5 217 hospital service use will be collected.
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8 218 *Type of study designs:* Randomized Controlled Trials (RCTs), Non-Randomised Controlled Trials
9
10 (NRCTs), Uncontrolled Before- and- After trials (UBA) or Interrupted Time Series (ITS) designed
11 219
12 with at least three data points before and three after the intervention.
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16 221 **Selecting studies**

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19 222 Two reviewers (I.B. and S.G.) independently performed the screening process to determine eligibility.
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22 223 Zotero will be used as the reference manager software. First, the title and abstract will be evaluated;
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24 224 then, the full text of potentially eligible studies will be examined for compliance with the inclusion
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26 225 criteria. Any disagreements will be resolved by a third author (AD).
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29 226 **Risk-of-bias assessment**

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32 227 Two independent reviewers will assess the risk of bias of the studies included in the review using the
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35 228 JBI Critical Appraisal Tools, based on the study design (47). These tools provide a set of questions,
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37 229 that reviewers can answer with yes (i.e., criterion met), no (i.e., a criterion not met), unclear or not
38
39 230 applicable. No study will be excluded by the methodological quality assessment.
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42 231 **Appraisal of the quality of QI interventions**

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45 232 The quality of the QI interventions will be appraised for each included study using the QI Minimum
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47
48 233 Quality Criteria Set (QI-MQCS) to inform the transferability of the best evidence into clinical practice
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50 234 (38). The QI-MQCS addresses the following core QI domains: organizational motivation,
51
52 235 intervention rationale, intervention description, organizational characteristics, implementation, study
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55 236 design, comparator, data source, timing, adherence/fidelity, health outcomes, organisational
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57 237 readiness, penetration/reach, sustainability, spread and limitations.
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60 238 **Data extraction**

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239 Two members (IB and SG) of the research team will independently extract the following study
240 characteristics:

- 241 - Study details: Study design, date of publication, participants (NH organizational
242 characteristics, ownership, size, etc), and study setting.
- 243 - QI intervention details: Characteristics and implementation strategies, data on the formal
244 model used (if any), and information to appraise the quality of QI interventions (description
245 of organizational problems, reasons or motivations for the intervention, intervention
246 description, basic characteristics of the organization, etc) were extracted.
- 247 - Hospital service use: Data on hospitalizations, potentially avoidable hospitalizations, end-of-
248 life hospitalizations, ED visits and readmissions.

250 **Data synthesis**

251 Data from the included studies will be combined into a meta-analysis based on the outcomes. The
252 results will be pooled by combining the natural logarithms of the rate ratio across studies, or by
253 calculating the rate ratio using the generic inverse-variance method. We will use a permutation
254 random-effect model to estimate meta-analysis effect. Heterogeneity will be assessed using the
255 I^2 statistics and we will consider high level of heterogeneity an $I^2 > 75\%$. Considering that the
256 I^2 statistics is biased in small meta-analysis, we will test heterogeneity with the H^2 if it will be included
257 less than 10 studies. We choose an acceptable level of H^2 under 1.88 with a confidence of 95% (48).
258 Publication bias will be visually evaluated using funnel plot if more than 10 studies will be included.
259 We will request raw data from the authors when the reported outcomes in the included studies are not
260 homogenous. All analyses will be performed using STATA/SE17 version.

261 A narrative synthesis will also be arranged. The characteristics of the included studies will be
262 synthesised and compared in a table. The characteristics of the QI and implementation strategies will

1
2
3 263 be deductively categorized into the EPOC taxonomy's domains on delivery arrangements and
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5 264 implementation strategies, using all subcategories (20). The domains of governance and financial
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8 265 arrangements will be excluded because they are beyond the scope of this review.
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11 266 **Patient and public involvement:** Patients and/or the public were not involved in this research's
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14 267 design, conduct, reporting, or dissemination plans.
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16 268 **Ethics and dissemination**

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19 269 Ethical approval is not required for this study as it is a review based on published studies. The findings
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22 270 of this systematic review and meta-analysis will support clinical and organizational decision-making
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24 271 by determining which QI interventions effectively prevent the use of hospital services and identifying
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26 272 which implementation strategies are most successful in fostering adherence to organizational and
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29 273 system changes within NH settings. The results of this study will be presented at a scientific
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31 274 conference and submitted to a peer-reviewed journal for publication.
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39 412 10.19080/BBOAJ.2017.01.555555 020)
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44 414 **Contributors:** IB, ADM, SC, SG, EB, and SC jointly contributed to the study aims, research design
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46 415 and methodology. IB, SG, SC and EB produced the first draft of the article outline with the guidance
47
48 416 of SC, and ADM. IB and EB designed the search strategy. All authors (IB, ADM, SC, SG, SC, EB)
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50 417 contributed substantially to the manuscript and critically revised the content. All authors read and
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52 418 approved the final version of the manuscript.
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15

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19 425 per la Salute – Piemonte - for her support in the development of the search strategy.
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26 427 **Figure Legend**
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29 428 **Figure 1: Adaptation of the implementation research conceptual model.** According to the model proposed by Proctor et al. (2), QI
30 429 intervention strategies and implementation processes are separated but linked domains. Both domains impact different but interrelated
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32 430 types of outcomes, implementation and residents' outcomes.
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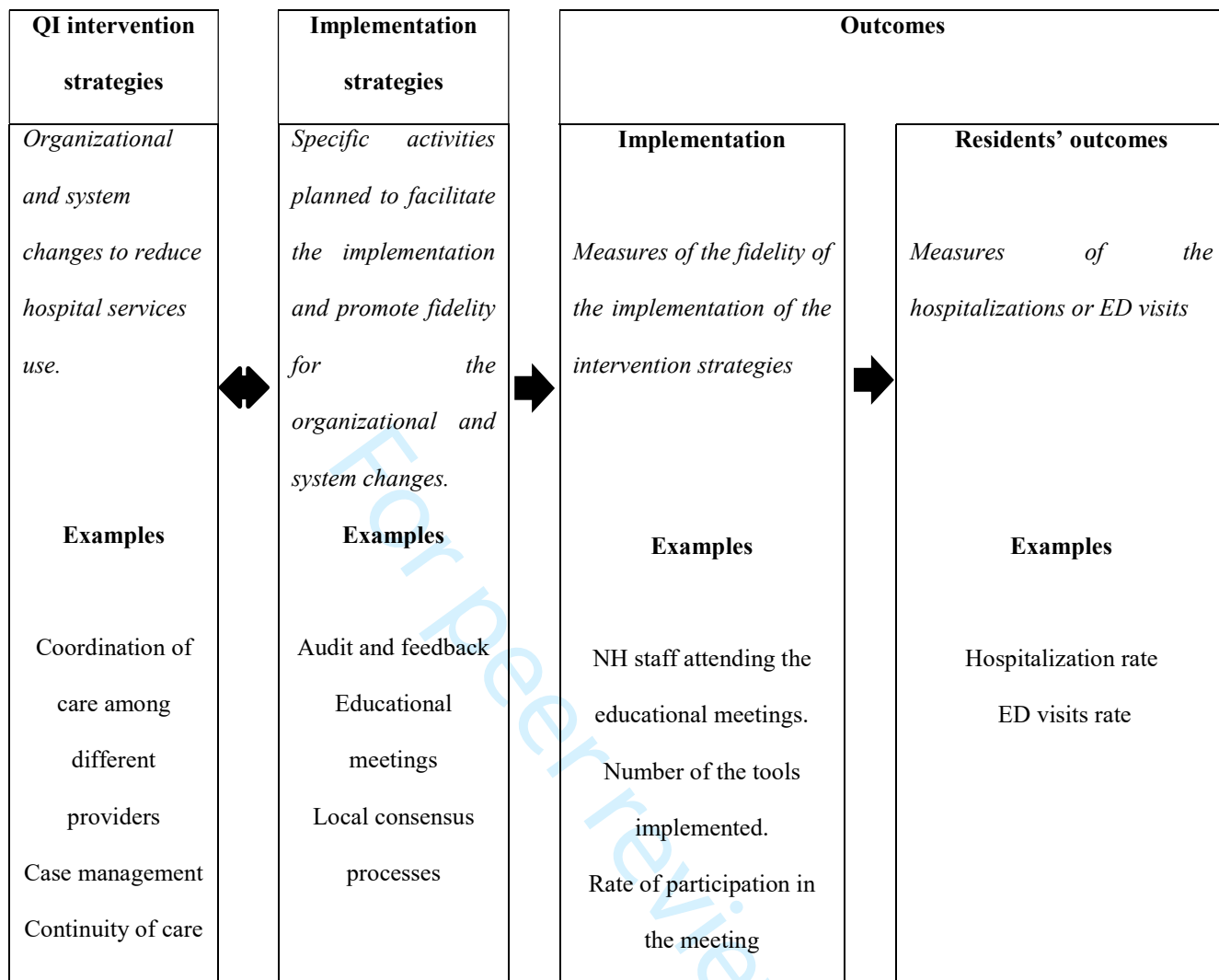


Figure 1

Reporting checklist for protocol of a systematic review and meta analysis.

Based on the PRISMA-P guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA-Preporting guidelines, and cite them as:

Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement. Syst Rev. 2015;4(1):1.

		Reporting Item	Page Number
Title			
Identification	#1a	Identify the report as a protocol of a systematic review	1; 6
Update	#1b	If the protocol is for an update of a previous systematic review, identify as such	na
Registration			
	#2	If registered, provide the name of the registry (such as PROSPERO) and registration number	6
Authors			
Contact	#3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contribution	#3b	Describe contributions of protocol authors and identify the	17

guarantor of the review

Amendments

#4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	na
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Support

Sources	#5a	Indicate sources of financial or other support for the review	17
Sponsor	#5b	Provide name for the review funder and / or sponsor	17
Role of sponsor or funder	#5c	Describe roles of funder(s), sponsor(s), and / or institution(s), if any, in developing the protocol	17

Introduction

Rationale	#6	Describe the rationale for the review in the context of what is already known	3-6
Objectives	#7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	6

Methods

Eligibility criteria	#8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	8-9
Information sources	#9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	6-7
Search strategy	#10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	7-8
Study records - data management	#11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	10
Study records -	#11b	State the process that will be used for selecting studies (such	10

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3	selection process	as two independent reviewers) through each phase of the	
4		review (that is, screening, eligibility and inclusion in meta-	
5		analysis)	
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8	Study records -	#11c Describe planned method of extracting data from reports	10-11
9	data collection	(such as piloting forms, done independently, in duplicate),	
10	process	any processes for obtaining and confirming data from	
11		investigators	
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14	Data items	#12 List and define all variables for which data will be sought	10-11
15		(such as PICO items, funding sources), any pre-planned data	
16		assumptions and simplifications	
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20	Outcomes and	#13 List and define all outcomes for which data will be sought,	10-11
21	prioritization	including prioritization of main and additional outcomes, with	
22		rationale	
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25	Risk of bias in	#14 Describe anticipated methods for assessing risk of bias of	10
26	individual studies	individual studies, including whether this will be done at the	
27		outcome or study level, or both; state how this information will	
28		be used in data synthesis	
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32	Data synthesis	#15a Describe criteria under which study data will be quantitatively	11
33		synthesised	
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35	Data synthesis	#15b If data are appropriate for quantitative synthesis, describe	11
36		planned summary measures, methods of handling data and	
37		methods of combining data from studies, including any	
38		planned exploration of consistency (such as I ² , Kendall's τ)	
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42	Data synthesis	#15c Describe any proposed additional analyses (such as	11
43		sensitivity or subgroup analyses, meta-regression)	
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46	Data synthesis	#15d If quantitative synthesis is not appropriate, describe the type	na
47		of summary planned	
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50	Meta-bias(es)	#16 Specify any planned assessment of meta-bias(es) (such as	11
51		publication bias across studies, selective reporting within	
52		studies)	
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55	Confidence in	#17 Describe how the strength of the body of evidence will be	na
56	cumulative	assessed (such as GRADE)	
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For peer review only

PubMed (Searched 31 th December 2022)		
Search	Query	Items
# 1	("Nursing Homes" [Mesh] OR "Nursing home*" [Title/Abstract] OR "Homes for the Aged" [Mesh] OR "Geriatric Home*" [Title/Abstract] OR "Old age home*" [Title/Abstract] OR "Home, old age" [Title/Abstract] OR "Homes, old age" [Title/Abstract] OR "Old people home*" [Title/Abstract] OR "Old people's home*" [Title/Abstract] OR "Long-Term Care" [Mesh] OR "Long-Term Care" [Title/Abstract] OR "Long Term Care" [Title/Abstract] OR "Long term facilit*" [Title/Abstract] OR "long-term facilit*" [Title/Abstract] OR "Skilled Nursing Facilities"[Mesh] OR "Skilled Nursing Facilit*" [Title/Abstract] OR "Care home*" [Title/Abstract] OR "Residential Facilities"[Mesh] OR "Residential facilit*" [Title/Abstract] OR "Residential home*" [Title/Abstract] OR "Residential institution*" [Title/abstract] OR "Institutional care*" [Title/Abstract] OR "Care facilit*" [Title/Abstract] OR "Continuing care*" [Title/Abstract] OR "Subacute Care"[Mesh] OR "Sub-acute care" [Title/Abstract] OR "Medical home*" [Title/Abstract] OR "Medical care" [Title/Abstract] OR "Extended care facilit*" [Title/Abstract] OR "Assisted Living Facilities"[Mesh] OR "Assisted living facility*" [Title/abstract] OR "Assisted living" [Title/Abstract] OR "Skilled care" [Title/Abstract] OR "Restorative care" [Title/Abstract] OR "Retirement center" [Title/Abstract] OR "Retirement centre" [Title/Abstract] OR "Retirement home" [Title/Abstract] OR "Senior residence facilit*" [Title/Abstract])	190,129
#2	("Quality Improvement"[Mesh] OR "Quality improvement" [Title/Abstract] OR "Improvement Quality" [Title/Abstract] OR "Organizational Innovation"[Mesh] OR "Organizational innovation" [Title/Abstract] OR "Organisational innovation" [Title/Abstract] OR "Quality Assurance, Health Care"[Mesh] OR "Health Care Quality Assurance" [Title/Abstract] OR "Quality assurance, health care" [Title/Abstract] OR "Program Evaluation"[Mesh] OR "Program Evaluation*" [Title/Abstract] OR "Program effectiveness" [Title/Abstract] OR "Healthcare Quality Assurance" [Title/Abstract] OR "Management Quality Circles"[Mesh] OR "Management Quality Circles" [Title/abstract] OR "Total Quality Management"[Mesh] OR "Quality Management" [Title/Abstract] OR "Management, Total Quality" [Title/Abstract] OR "Total Quality Management" [Title/Abstract] OR "Clinical Governance"[Mesh] OR "Outcome Assessment, Health Care"[Majr] OR "Healthcare outcome assessment" [Title/Abstract] OR "Health Care outcome assessment" [Title/Abstract] OR "Process Assessment, Health Care"[Majr] OR "Process assessment, health care" [Title/Abstract] OR "Outcome measure" [Title/Abstract] OR "Outcome assessment" [Title/Abstract] OR "Health Care Process Assessment" [Title/Abstract] OR "Healthcare Process Assessment" [Title/Abstract] OR TQM [Title/Abstract] OR "Plan Do Study Act" [Title/Abstract] OR PDSA [Title/Abstract] OR "Plan Do Check Act" [Title/Abstract] OR PDCA [Title/Abstract] OR "Six Sigma" [Title/Abstract] OR Lean [Title/Abstract] OR DMAIC [Title/Abstract] OR DMADV [Title/Abstract] OR "Continuous Quality Improvement" [Title/Abstract] OR CQI [Title/Abstract] OR "Focus Analyse Develop Execute" [Title/Abstract] OR FADE [Title/Abstract] OR "Collaborative Quality Improvement*" [Title/Abstract] OR "Quality Improvement Collaborative*" [Title/Abstract] OR "Performance Improvement*" [Title/Abstract] or "Collaborative Improvement" [Title/Abstract] OR "Implementation Science"[Mesh] OR "Implement*" [Title/Abstract] OR ADOPT* [Title/Abstract] OR feedback [Title/Abstract] or "professional development" [Title/Abstract] or network* [Title/Abstract] or leadership [Title/Abstract] or opinion leader* [Title/Abstract] or "consensus process*" [Title/Abstract] or "change manage*" [Title/Abstract] or train* [Title/Abstract] or audit* [Title/Abstract] OR "root cause analysis" [Title/Abstract] OR "Diffusion of Innovation"[Mesh])	2,915,751
#3	("Emergency Service, Hospital" [Mesh] OR "Hospital Emergency Service*" [Title/Abstract] OR "Emergency Hospital Service*" [Title/Abstract] OR "Emergency unit*" [Title/Abstract] OR "Unit Emergency" [Title/Abstract] OR "Units Emergency" [Title/Abstract] OR "Emergency Ward*" [Title/Abstract] OR "Ward Emergency" [Title/Abstract] OR "Wards Emergency" [Title/Abstract] OR "Emergency Department*" [Title/Abstract] OR "Room Emergency" [Title/Abstract] OR "Emergency Room*" [Title/Abstract] OR "Emergency Outpatient Unit*" [Title/Abstract] OR "Department Emergency" [Title/Abstract] OR "Departments Emergency" [Title/Abstract] OR "Outpatient Unit Emergency" [Title/Abstract] OR "Outpatient Units Emergency" [Title/Abstract] OR "Patient Admission"	1,032,253

	[Mesh] OR Admission* [Title/Abstract] OR "Hospitalization"[Mesh] OR Hospitali* [Title/Abstract] OR "Hospital Transfer*" [Title/Abstract] OR "Hospital Admittance" [Title/Abstract] OR "Hospital Stay" [Title/Abstract] OR "Patient Readmission" [Mesh] OR Readmission* [Title/abstract] OR "Patient Transfer"[Mesh] OR "Emergency Treatment"[Mesh] OR "Acute care" [Title/Abstract] OR "Emergency care" [Title/Abstract] OR "Critical care" [Title/Abstract] OR "Acute service*" [Title/Abstract] OR "Emergency service*" [Title/Abstract] OR "Critical service*" [Title/Abstract] OR "Transitional Care"[Mesh] OR "Transitional care" [Title/Abstract]	
#4	#1 AND #2 AND #3 AND (2000:2022[pdat])	8,058

CINAHL Complete (Searched 31th December 2022)		
Search	Query	Items
#1	((MH "Nursing Home Patients") OR (MH "Home Nursing") OR (MH "Nursing Homes") OR (MH "Residential Care") OR (MH "Housing for the Elderly") OR (MH "Long Term Care") OR (MH "Skilled Nursing Facilities") OR (MH "Residential Facilities") OR TI ("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*") OR AB ("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*"))	128,129
#2	((MH "Quality Improvement+") OR (MH "Evaluation and Quality Improvement Program") OR (MH "Quality Management, Organizational") OR (MH "Quality Assurance") OR (MH "Quality Circles") OR (MH "Clinical Governance") OR (MH "Program Evaluation") OR (MH "Outcome Assessment") OR (MH "Process Assessment (Health Care)") OR TI ("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative") OR AB ("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR (MH "Implementation Science") OR "implementation science" OR (MH "Program Implementation") OR (MH "Systems Implementation") OR (MH "Root Cause Analysis") OR "implementation" OR (MH "Organizational Development") OR (MH "Audit") OR (MH "Change Management") OR (MH "Organizational Change") OR "Local consensus process"))	393,141
#3	((MH "Emergency Service") OR (MH "Hospitalization") OR (MH "Aged, Hospitalized") OR (MH "Hospitals") OR (MH "Patient Admission") OR (MH "Observation Units") OR	432,718

	(MH "Readmission") OR (MH "Transfer, Discharge") OR (MH "Emergency Treatment" OR (MH "Transitional Care") OR TI ("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR "Admission*" OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") OR AB ("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR "Admission*" OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*"))	
#4	#1 AND #2 AND #3 AND (Published Date: 20000101-20221231)	3270

EMBASE (Searched 31th December 2022)		
Search	Query	Items
#1	'nursing home'/exp OR 'extended care facility':ti,ab,kw OR 'intermediate care facilities':ti,ab,kw OR 'long term care facility':ti,ab,kw OR 'nursing home':ti,ab,kw OR 'nursing homes':ti,ab,kw OR 'skilled nursing facilities':ti,ab,kw OR 'skilled nursing facility':ti,ab,kw OR 'nursing home patient'/mj OR 'long term care patient':ti,ab,kw OR 'nursing home patient':ti,ab,kw OR 'nursing home resident':ti,ab,kw OR 'residential home'/mj OR 'institution, residential':ti,ab,kw OR 'residential facilities':ti,ab,kw OR 'residential home':ti,ab,kw OR 'residential institution':ti,ab,kw OR 'home for the aged'/mj OR 'continuing care retirement center':ti,ab,kw OR 'geriatric homes':ti,ab,kw OR 'home for the aged':ti,ab,kw OR 'home for the elderly':ti,ab,kw OR 'homes for the aged':ti,ab,kw OR 'housing for the elderly':ti,ab,kw OR 'old age home':ti,ab,kw OR 'old age homes':ti,ab,kw OR 'old people home':ti,ab,kw OR 'old people`s home':ti,ab,kw OR 'retirement center':ti,ab,kw OR 'retirement centre':ti,ab,kw OR 'retirement home':ti,ab,kw OR 'senior residence facility':ti,ab,kw OR 'long term care'/mj OR 'chronic treatment':ti,ab,kw OR 'long term care':ti,ab,kw OR 'long term medical care':ti,ab,kw OR 'long-term care':ti,ab,kw OR 'treatment, long term':ti,ab,kw OR 'assisted living facility'/mj OR 'assisted living':ti,ab,kw OR 'assisted living facilities':ti,ab,kw OR 'assisted living facility':ti,ab,kw OR 'institutional care'/mj OR 'care, institutional':ti,ab,kw OR 'institutional care':ti,ab,kw OR 'institutional practice':ti,ab,kw OR 'institutional therapy':ti,ab,kw OR 'institutional treatment':ti,ab,kw OR 'continuing care':ti,ab OR 'extended care':ti,ab,kw OR 'restorative care':ti,ab,kw OR 'skilled care':ti,ab,kw OR 'medical home'/mj OR 'institutional care'/mj)	152,919
#2	'(quality improvement':ti,ab,kw OR 'quality improvements':ti,ab,kw OR 'total quality management'/exp OR 'quality management':ti,ab,kw OR 'total quality management':ti,ab,kw OR 'management, total quality':ti,ab,kw OR 'quality improvement study'/exp OR 'organisational innovation':ti,ab,kw OR 'organizational innovation':ti,ab,kw OR 'quality control'/mj OR 'quality assessment':ti,ab,kw OR 'quality assurance':ti,ab,kw OR 'quality control':ti,ab,kw OR 'clinical governance':ti,ab,kw OR 'health care evaluation':ti,ab,kw OR 'health care quality assurance':ti,ab,kw OR 'healthcare evaluation':ti,ab,kw OR 'healthcare process assessment':ti,ab,kw OR 'healthcare quality assurance':ti,ab,kw OR 'quality assurance, health care':ti,ab,kw OR 'management quality circles':ti,ab,kw OR 'tqm:ti,ab OR 'plan do study act cycle'/exp OR 'pdsa:ti,ab OR 'plan do check act':ti,ab OR 'six sigma methodology'/exp OR 'six sigma':ti,ab,kw OR 'six sigma methodology':ti,ab,kw OR 'lean methodology'/exp OR 'lean initiative':ti,ab,kw OR 'lean management':ti,ab,kw OR 'lean methodology':ti,ab,kw OR 'lean philosophy':ti,ab,kw OR 'lean quality improvement':ti,ab,kw OR 'lean quality initiative':ti,ab,kw OR 'lean thinking':ti,ab,kw OR 'dmaic:ti,ab OR 'dmadv:ti,ab OR 'pdca:ti,ab OR 'continuous quality improvement'/exp OR 'cqi:ti,ab OR 'focus analyze develop execute':ti,ab OR 'ciq:ti,ab	1,278,108

	OR 'collaborative quality improvement*':ti,ab OR 'performance improvement'/exp OR 'collaborative improvement':ti,ab OR 'outcome assessment'/mj OR 'health care outcome assessment':ti,ab,kw OR 'healthcare outcome assessment':ti,ab,kw OR 'outcome assessment':ti,ab,kw OR 'outcome assessment (health care)':ti,ab,kw OR 'outcome assessment, health care':ti,ab,kw OR 'outcome measurement':ti,ab,kw OR 'implementation science'/exp OR 'implementation'/mj OR 'adoption'/mj OR 'education'/mj OR 'education':ti,ab,kw OR 'self-evaluation programmes':ti,ab,kw OR 'self-evaluation programs':ti,ab,kw OR 'training support':ti,ab,kw OR 'local consensus process':ti,ab,kw OR 'professional development'/mj OR 'professional development':ti,ab,kw OR 'feedback system'/mj OR 'change management'/mj OR 'root cause analysis'/mj OR 'leadership'/mj OR 'leader':ti,ab,kw OR 'leadership':ti,ab,kw)	
#3	('hospital readmission'/exp OR 'hospital readmission':ti,ab,kw OR 'patient readmission':ti,ab,kw OR 'readmission':ti,ab,kw OR 'readmission rate':ti,ab,kw OR 'readmissions':ti,ab,kw OR 'rehospitalization':ti,ab,kw OR 'hospital admission'/exp OR 'admission, hospital':ti,ab,kw OR 'hospital admission':ti,ab,kw OR 'hospital admittance':ti,ab,kw OR 'hospital admitting department':ti,ab,kw OR 'hospital admitting service':ti,ab,kw OR 'hospital admitting unit':ti,ab,kw OR 'patient admission':ti,ab,kw OR 'hospitalization'/exp OR 'hospital stay':ti,ab,kw OR 'hospitalization':ti,ab,kw OR 'short stay hospitalization':ti,ab,kw OR 'emergency health service'/mj OR 'emergency health service'/exp/mj OR 'emergency medical service':ti,ab,kw OR 'emergency medical services':ti,ab,kw OR 'emergency service':ti,ab,kw OR 'patient transport'/mj OR 'patient transfer':ti,ab,kw OR 'patient transport':ti,ab,kw OR 'transport, patient':ti,ab,kw OR 'transportation of patients':ti,ab,kw OR 'Emergency Department*':ti,ab,kw OR 'Emergency Room*':ti,ab,kw OR 'Emergency ward*':ti,ab,kw OR 'emergency care'/mj OR 'acute care':ti,ab,kw OR 'acute medical care':ti,ab,kw OR 'emergency care':ti,ab,kw OR 'transitional care'/mj OR 'transition care':ti,ab,kw OR 'transitional care':ti,ab,kw)	1,184,917
#4	#1 AND #2 AND #3 AND [2000-2022]/py	2,326

The Cochrane Library (Trials database) (Searched 31th December 2022)		
Search	Query	Items
#1	("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "homes for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home" OR "Medical homes" OR "Medical care" OR "senior residence facilit*") in Title Abstract Keyword	25,298
#2	("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR Implement* OR Adopt* OR "Change management" OR "Workforce development" OR "professional development" OR feedback OR audit OR "Root cause analysis" OR "Local consensus process" OR leadership) in Title Abstract Keyword	251,531
#3	("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit Emergency" OR "Emergency Ward*" OR "Ward Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospital* OR "Hospital Transfer*" OR	235,675

	"Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") in Title Abstract Keyword	
#4	#1 AND #2 AND #3 AND	2,790

Web of science (Searched 31th December 2022)		
Search	Query	Items
#1	TI=("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*") OR AB=("Nursing home*" OR "Geriatric home*" OR "Care home*" OR "care facilit*" OR "skilled nursing facilit*" OR "residential facilit*" OR "home* for aged" OR "long-term care*" OR "long term care*" OR "residential home*" OR "assisted living facilit*" OR "institutional care" OR "retirement home*" OR "retirement centre" OR "retirement center" OR "old people home" OR "old people homes" OR "continuing care" OR "Medical home*" OR "Medical care" OR "senior residence facility*")	126,846
#2	TI=("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR "Implementation" OR "Change management") OR AB=("Quality improvement*" OR "Improvement quality" OR "Health care quality assurance" OR "Health-care quality assurance" OR "Quality assurance" OR "Organizational innovation" OR "Outcome assessment" OR "Process assessment" OR "program evaluation" OR "Program effectiveness" OR "Quality management" OR "Management, total quality" OR "Clinical Governance" OR "Outcome measure" OR "Health Care Process Assessment" OR "Healthcare Process Assessment" OR TQM OR "Plan Do Study Act" OR PDSA OR "Plan Do Check Act" OR PDCA OR "Six Sigma" OR Lean OR DMAIC OR DMADV OR "Continuous Quality Improvement" OR CQI OR "Focus Analyse Develop Execute" OR FADE OR "Collaborative Quality Improvement" OR "Quality Improvement Collaborative" OR "Implementation" OR "Change management")	1,394,815
#3	TI=("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*") OR AB=("Hospital Emergency Service*" OR "Emergency Hospital Service*" OR "Emergency unit*" OR "Unit* Emergency" OR "Emergency Ward*" OR "Ward* Emergency" OR "Emergency Department*" OR "Room Emergency" OR "Emergency Room*" OR "Department* Emergency" OR "Patient Admission" OR Admission* OR "Hospitalization" OR Hospitali* OR "Hospital Transfer*" OR "Hospital Admittance" OR "Hospital Stay" OR "Patient Readmission" OR Readmission* OR "Patient Transfer" OR "Emergency Treatment" OR "Acute care" OR "Emergency care" OR "Critical care" OR "Acute service*" OR "Emergency service*" OR "Critical service*")	729,489
#4	#1 AND #2 AND #3 AND Timespan: 2000-01-01 to 2022-12-31 (Index Date)	2007

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