

# REVIEW ARTICLE

## Pain mitigation during vaccine injections of the frail older adult population: A systematic review

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### Abstract

**Background:** Adults require disease-appropriate immunizations against a variety of vaccine preventable illnesses. The frail older adult population is at particular risk if not appropriately immunized due to increased vulnerability of morbidity and mortality. Despite this, adult immunization rates continue to be suboptimal, and studies have shown that pain mitigation is an important, modifiable factor in low immunization rates.

**Objectives:** To determine the effective pain mitigating interventions available for use by the frail older adult population during routine vaccine injections.

**Methods:** A systematic review of randomized controlled trials and quasi-randomized controlled trials was conducted, evaluating the effectiveness of available pain-relieving interventions during vaccine injections of the frail older adult population. Original articles were searched through MEDLINE via Ovid, EMBASE, the Cochrane Central Database, CINAHL via EBSCOhost, and grey literature until February 2017.

**Results:** There were no documented trials to investigate the effectiveness of pain-mitigating strategies during vaccine injections of the frail older adult population.

**Conclusion:** This systematic review demonstrates the need for investigation and further research of pain-mitigating strategies in the immunization of frail older adults. Research in this field may help to improve vaccination rates in this population.

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### Introduction

Immunizations are widely considered to be one of the most effective and safe public health interventions available, but despite best efforts, vaccination rates remain suboptimal in adults<sup>1</sup>. Immunization schedules are important in adult health for many reasons. As we age, we require several disease-appropriate immunizations to restore waning immunity against vaccine preventable illnesses<sup>2</sup>. Immunizations also protect those who are at increased risk of acquiring various vaccine-preventable diseases due to a range of factors that includes occupation, chronic conditions, and age<sup>3</sup>. Older adults suffer the highest rates of morbidity and mortality of any age group from vaccine-preventable illnesses like influenza<sup>4</sup>. To decrease infection rates in the adult population, current immunization recommendations include tetanus and diphtheria boosters every 10 years and single-dose immunizations against pneumococcal disease and herpes zoster<sup>5</sup>. Depending on individual risk factors, they may also be encouraged to receive additional immunizations against hepatitis A and B, pertussis, and others<sup>6</sup>. Despite the proven ben-

efits from vaccines, fewer than half of Canadian adults are up to date on their vaccinations, and only 38% of Canadians reported they were vaccinated against influenza during the 2017/18 season<sup>7</sup>.

Frailty is a syndrome characterized by cumulative declines in functional reserves across multiple physiologic systems during the lifespan<sup>8</sup>. There are several frailty measures in the literature and a lack of consensus on how the syndrome is best measured; however, all definitions indicate that frail individuals are increasingly vulnerable to adverse outcomes compared to their age-matched peers<sup>9</sup>. These adults are a particularly important target population for immunization because of the increased vulnerability to adverse outcomes from vaccine-preventable illnesses. It is estimated that the majority of influenza-related deaths and hospitalizations occur among older adults<sup>10</sup>. Influenza vaccination of the older adult population has been demonstrated to reduce morbidity and mortality<sup>11</sup>. Despite evidence of the effectiveness of immunization, frail older adults, as with other adult age groups, continue to remain under-vaccinated<sup>12</sup>.

Although the lack of widespread immunization in adults is multifactorial, it is clear that fear and anxiety of pain from immunizations is an important factor<sup>13</sup>. It has been demonstrated that upwards of 20% of adults express anxiety about procedural pain involving needles, and 8% of adults are intensely fearful<sup>14</sup>. These numbers are likely an underestimation of the percentage of adults affected by a fear of needle pain, as those with a fear of a painful stimulus tend to avoid exposure to it<sup>15</sup>. Studies have indicated that at least 8% of adults avoid the yearly influenza immunization because of fear of pain<sup>16</sup>. The specific prevalence of fear and anxiety of pain from immunizations in frail adults is unknown.

Despite routine immunizations being one of the most common painful medical procedures performed, and although there are effective pain management strategies available, current practice to alleviate immunization pain is not well-documented<sup>17</sup>. Developing and communicating methods to manage the pain associated with receiving immunizations has the potential to improve vaccination rates.

There has recently been work completed on mitigation of pain in immunizations as it relates to healthy adults; however, there is still a significant gap in the literature with regards to frail older adult immunization pain mitigation. The purpose of this systematic review was to evaluate the effectiveness of different pain-relieving interventions for reducing pain during vaccine injections in the frail older adult population.

## Case Presentation

### Study design

A systematic review of randomized controlled trials (RCTs) and quasi-randomized controlled trials was conducted to evaluate the effectiveness of pain-relieving interventions during vaccine injections in the frail older adult population. This systematic review is registered with PROSPERO (CRD42015023777, available from: [https://www.crd.york.ac.uk/prospero/display\\_record.php?ID=CRD42015023777](https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42015023777)).

### Search strategy

Detailed search strategies were developed for each electronic database searched. They were based on a search strategy developed for MEDLINE that was revised appropriately for each database. A sensitive search filter to identify geriatric medicine in MEDLINE<sup>18</sup> was modified and used to identify the frail adult population. A MEDLINE search created by Hogan et al<sup>17</sup> was modified to identify pharmacological, physical or psychological techniques to reduce pain during vaccine injections. Studies were identified through keyword

searches in the following databases from inception to February 2017 (with a truncated update completed in the fall of 2019) with no language restrictions: MEDLINE via Ovid, EMBASE, the Cochrane Central Registry of Controlled Trials, and CINAHL via EBSCOhost. A search of grey literature was conducted using Google and Google Scholar, with the first 100 search items reviewed (sorted by relevance). Systematic reviews, and evidence-based clinical guidelines related to pain reduction or pain management strategies for vaccine injections were hand-searched for additional articles. Two reviewers independently screened the titles and abstracts of search results using pre-established eligibility criteria (Figure 1)<sup>19</sup>.

### Selection criteria

Two reviewers independently screened titles and abstracts for the following inclusion criteria determined *a priori*: (1) study population included frail older adults with frailty defined as all accepted definitions of frailty (e.g. frailty index, phenotype) and age greater than 65; (2) randomized control trial or quasi-randomized control trial; (3) vaccine(s) administered via intramuscular or subcutaneous routes in any setting (e.g. hospital or community); (4) pain-mitigating treatment interventions included any pharmacological, physical or psychological technique; (5) determination of acute pain experienced during the vaccine injection was done via self-report using any age-appropriate pain assessment tool with established validity and reliability.

### Risk of bias in individual studies and across studies

Bias assessment of individual studies was planned using the Cochrane risk of bias tool and across studies using GRADE methodology<sup>20,21</sup>.

## Results

Figure 1 summarizes the screening and selection process. All studies were excluded by examination of title or abstract. No studies were identified that included frail older adults in the population being studied.

## Discussion

To our knowledge, this is the first systematic review to address the effectiveness of pharmacological, physical, or psychological pain-relieving interventions for reducing pain during vaccine injections in the frail adult population. We found no studies that examined pain mitigation in this population with any of the three treatment modalities.

Although immunization rates of frail older adults have been widely demonstrated to be below target, and

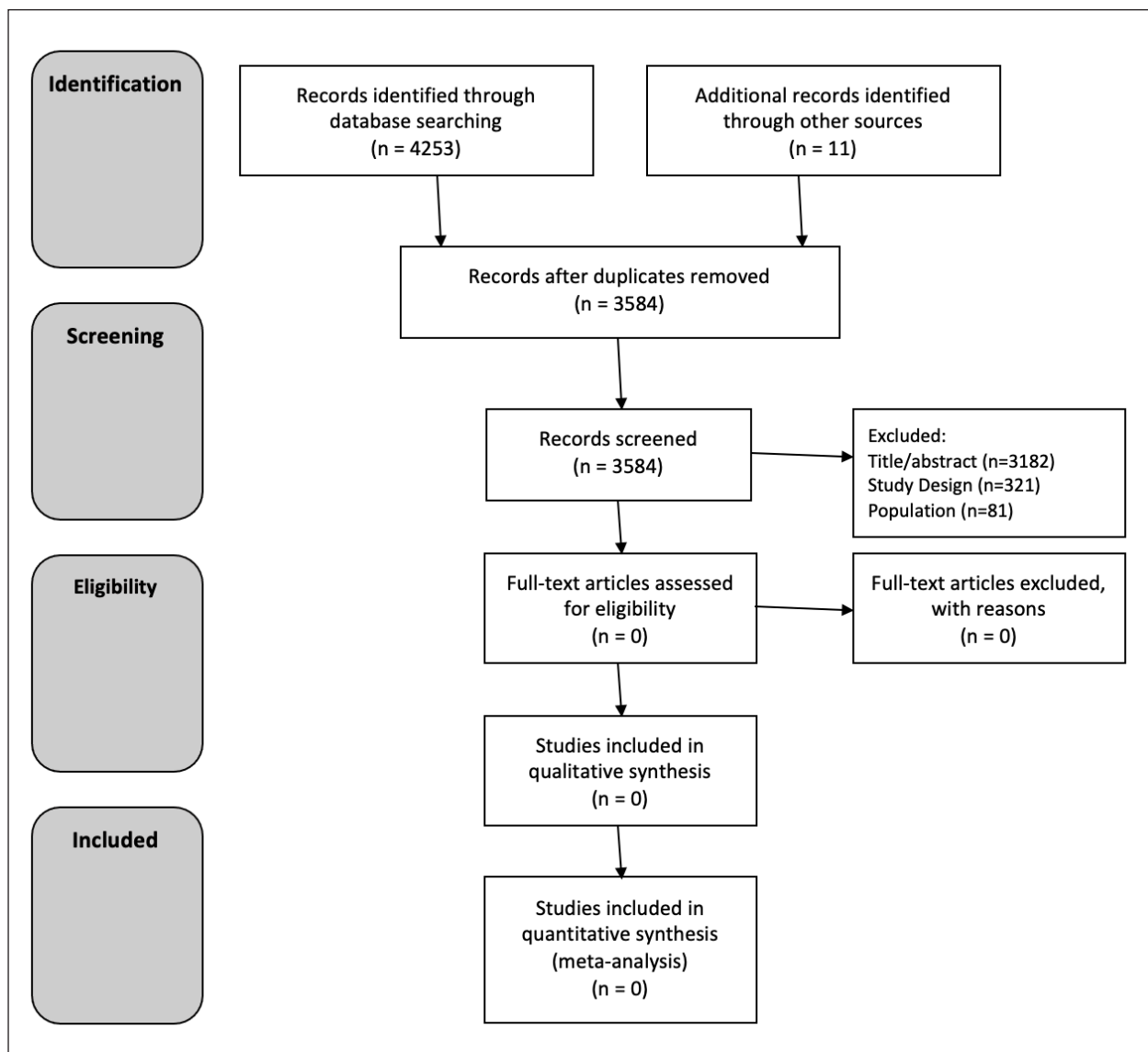


Figure 1. Flow diagram for selection of studies.

there is evidence that pain is a recognized factor in an adult's decision to opt out of recommended immunizations, no studies conducted to date have examined the prevalence of fear and anxiety of pain from immunization in frail adults<sup>13</sup>. This may be one reason why no studies were found to examine effective methods to mitigate pain and improve vaccine uptake in the older adult population.

Furthermore, frailty has been extensively studied and established to increase adverse outcomes in vaccine-preventable illnesses<sup>22</sup>. The 2015 updated evidence-based Canadian clinical practice guideline aimed at reducing pain during vaccine injections contains recommendations for healthy adults, including finding a comfortable seated position, distraction techniques or coughing during injection, and topical anesthetics;

however, studies for translation of these into the frail older adult population have not been developed or tested<sup>23</sup>. Efforts should be made to examine and establish efficacy of these strategies in the frail older adult population. Furthermore, once effective pain-mitigating strategies are established, research should include development of programs that allow dissemination of strategies available to those being immunized and an examination of whether this improves overall satisfaction and improved immunization uptake.

## Conclusion

Our systematic review found that there were no studies that examined the effectiveness of pain mitigating strategies during vaccine injections of frail adults. Based

on our review, recommendations for pain mitigation during vaccine injections of this population must currently be extrapolated from the clinical guidelines established for the non-frail adult population. Additional research is warranted in this area, particularly the investigation of whether there is an issue with avoidance of vaccination in frail adults due to fear and anxiety of pain from immunization and if so translation of efficacy of pain-mitigating strategies established for the non-frail adult population.

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