Review Article

The Prevalence, Incidence, and Correlates of Fecal Incontinence Among Older People Residing in Care Homes: A Systematic Review

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ABSTRACT

Objective: Older people resident in care homes often rely on staff for support relating to their activities of daily living, including intimate care such as continence care. Managing fecal incontinence can be challenging for both residents and care staff. We conducted this review to describe the prevalence, incidence, and correlates of fecal incontinence among care home residents.
Design: Systematic literature review.
Setting and participants: Older care home residents (both nursing and residential care) aged 60 years and older.
Measures: We defined double incontinence as the presence of fecal plus urinary incontinence, isolated fecal incontinence as fecal incontinence with no urinary incontinence, and all fecal incontinence as anyone with fecal incontinence (whether isolated or double). The CINAHL and MEDLINE databases were searched up to December 31, 2017, to retrieve all studies reporting the prevalence and/or incidence and correlates of fecal incontinence.
Results: We identified 278 citations after removing duplicates, and 23 articles met the inclusion criteria. There were 12 high-quality studies, 5 medium-quality studies, and 6 low-quality studies. The medians for prevalence (as reported by the studies) of isolated fecal incontinence, double incontinence, and all fecal incontinence were 3.5% [interquartile range (IQR) = 2.8%], 47.1% (IQR = 32.1%), and 42.8% (IQR = 21.1%), respectively. The most frequently reported correlates of fecal incontinence were cognitive impairment, limited functional capacity, urinary incontinence, reduced mobility, advanced age, and diarrhea.
Conclusions/Implications: Fecal incontinence is prevalent among older people living in care homes. Correlates included impaired ability to undertake activities of daily living, reduced mobility, laxative use, and altered stool consistency (eg, constipation or diarrhea) which are potentially amenable to interventions to improve fecal incontinence.
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Previous reviews on the prevalence of fecal incontinence (FI) have concentrated on community dwellers.[1,2] To facilitate planning and provision of quality continence care in care homes[3] (a collective term for nursing or residential care settings, or aged care, or skilled nursing facilities), there is a need to understand the prevalence, incidence, and correlates of FI within care homes.

FI is the incapacity to appropriately control bowel movements, resulting in uncontrolled or involuntary leakage of feces that is a social or hygiene problem.[4–6] The commonly described types of fecal incontinence include urge incontinence (FI due to inability to reach to the toilet in time despite active attempts to avoid defecation), passive incontinence (involuntary loss of feces without awareness), and fecal seepage (leakage of stool after normal bowel movement, usually presenting as staining of underclothes).[7] FI can also be described as

"functional" where the underlying problem is an inability to access an appropriate place to defecate or to clean effectively after defecation, rather than physiological inability to retain feces.[2] Research in FI among older people living in care homes has not been reported in terms of physiology, but is instead based on stool consistency and/or frequency.[8–10]

FI is an under-reported but debilitating health problem that affects people of all ages,[11] and particularly older people living with dementia.[12,13] However, FI is not an inevitable consequence of old age or dementia alone,[2] but has multiple underlying factors,[14] some of which can be identified and treated.[15] In the older person, FI may be the consequence of age-related anorectal deficits such as reduced anal sphincter pressure;[16] it also may be underpinned by cognitive impairment,[17,18] length of nursing home stay,[10,19] diarrhea,[20] constipation,[10,17] or effects of polypharmacy.[21] When a cure is not achievable, incontinence management can produce "social continence" (incontinence well managed so that it is not socially evident), thus alleviating embarrassment and preserving the dignity of a person.[15]

An estimated 50% of older people living in care homes experience FI, compared with 18% of the general population.[19,22] FI may result in low self-esteem, stigmatization,[3] and feeling of social isolation,[23] and in some cases it predicts mortality.[24,25] Generally, people are embarrassed to discuss their experience of FI with health care professionals or even with friends and family, as it can be seen as a "taboo within stigma"[26]; this is also the case in care homes.[27,28] Health care workers do not routinely broach the topic with care home residents,[5,6] perhaps because of attitudes of "therapeutic nihilism" (the belief that nothing can be done to help).[26] In a care home, where the majority of residents live with dementia, this nihilism can mean that residents are not assessed to find out why they are incontinent, and incontinence pads are used routinely.[2]

Without any concerted effort to address FI, the dignity and quality of life of older people living in care homes will be compromised given that they are mostly older, frail, and have multiple health conditions compared to the general population.[29]

This review aimed to describe the prevalence, incidence, and correlates of FI among older people living in care homes. To the authors' knowledge, no similar review on this topic has been conducted. The following research questions are addressed: (1) What is the prevalence and incidence of FI among older people living in care homes? and (2) What are the correlates of FI in older people living in care homes?

Methods

Design

A systematic review of studies was conducted. The review followed the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) statement as a guide[30] and was designed to capture studies reporting prevalence, incidence, and correlates of FI (Supplementary Table S1). The protocol of this review was registered with PROSPERO (number CRD42018082596), on February 14, 2018.

Search Strategy

Searches were made via MEDLINE and CINAHL (Cumulative Index to Nursing and Allied Health Literature) from inception to December 31, 2017. PROSPERO and the Cochrane Collaboration databases were also searched for relevant systematic reviews. Electronic searches were supplemented with hand-searching of reference sections from studies retrieved via databases.

Key search terms included *prevalence*, *epidemiology*, *incidence*, *fecal/faecal*, *incontinence*, *care homes*, *nursing homes*, *residential homes*, *aged care facilities*, and *skilled nursing facilities*. Considering the inconsistent use of the terms *fecal incontinence* and *anal incontinence*, we included *anal incontinence* to capture all relevant studies. We used medical subject heading (MeSH) themes and Boolean operators (and/or) to refine searches to retrieve references specific to older people living in care homes (Supplementary Table S2 shows an example of the search strategy).

Study Selection and Eligibility Criteria

None of the retrieved articles reported outcomes based on the etiology or mechanism of FI. No study differentiated soiling/passive FI from urge FI or functional FI, nor was volume (and often even frequency) addressed. Therefore, we considered data reported as isolated FI [FI without concomitant urinary incontinence (UI)][31,32] and double or dual FI (the occurrence of FI along with UI).[10,18] Where the authors did not differentiate isolated FI from double FI, we conceptualized the data to represent all FI (ie, whether isolated FI or double FI). Inclusion of studies in this review followed a priori criteria (Supplementary Table S3).

Data Extraction and Analysis

A standardized data extraction sheet was used to obtain study population characteristics, and diagnostic criteria used to define the outcome of interest (prevalence or incidence rate of FI) and factors associated with outcome measures (with crude or adjusted outcome variables as reported). Three investigators (M.K.M., S.S., and L.E.B.) independently extracted the data, and the results were discussed with C.N. as arbitrator. Any disagreements were resolved through re-examination and discussion of the study until consensus was reached.

Due to high variability across studies in methodological, clinical and statistical differences, a decision to carry out a narrative synthesis of evidence instead of pooling data for a meta-analysis was made. We summarized the prevalence data as medians and interquartile ranges (IQR) because of the variability among reported FI frequency.

Methodological Quality of Identified Studies

The Joanna Briggs Institute (JBI) Checklist for prevalence studies was used, with 2 further questions from the JBI Checklist for Analytical Cross-Sectional Studies (questions 3 and 6) added to assess the correlational aspects of the studies. Two authors (M.K.M., S.S., or L.E.B.) independently assessed each study and then met with a fourth author (C.N.) to determine ranking as low, medium, or high quality (Supplementary Table S4). All studies were qualitatively assessed, and where we were very certain taking into consideration risk of bias, a high quality was scored; where our confidence was very limited, a low quality was scored. We based our decisions on elements of the GRADE (Grading of Recommendations Assessment, Development and Evaluation) criteria.[33] There were 12 high-quality, 5 medium-quality, and 6 low-quality studies (Supplementary Figure S1 shows methodological quality assessment of included studies).

Results

After the removal of duplicates, the searches yielded 241 citations, of which 202 were not considered relevant to the review question following screening of the title and abstract. The remaining 39 articles were read in full and assessed for eligibility. Sixteen articles were excluded: 5 were unavailable in English, 6 were not specific to care home residents, 3 were not related to the outcome of interest, and 2 care home data could not be extracted. Twenty-three studies met inclusion criteria for this review (Supplementary Figure S2 shows the PRISMA Flow Chart).

Table 1
Summary of Prevalence Data

Year, Study	% Isolated FI (iFI)	% Double Incontinence (DI)	% All FI (iFI + DI)	Definition of Frequency of FI	Data Collection Tool
Capewell et al, 1986	—	—	26	Once per week	Questionnaires completed by nurse in charge and interview with the same nursing staff
Tobin and Brocklehurst, 1986	—	—	10.3	At least once weekly	Interviews (residents and staff), and medical records
Burgio et al, 1988	3	75	78	Not stated	Interviews (nursing assistants) and medical records
Kinnunen, 1991	—	—	15	Not stated	Questionnaires and interviews (residents) by staff nurses
Peet et al, 1995	—	—	10.50	1 episode per week	Questionnaires
Johanson et al, 1997	—	—	46	Leakage of stool or soiling	Questionnaires completed by residents
Nelson et al, 1998	—	—	47	Usually, frequently	MDS data by trained professionals
Chiang et al, 2000	6	54	60	Not stated	MDS and medical records
Rodriguez et al, 2007	4	31	35	Not stated	Questionnaires completed by care home managers/senior staff
Harrington et al, 2008	—	—	43.10	More often than once a week	OSCAR data
Aslan et al, 2009	—	—	10.50	Once in 4 wk	Interviews of residents by RNs
Bliss et al, 2013	—	—	-	Not stated	MDS 2 and questionnaires
Saga et al, 2013, 2015	2.60	40.20	42.80	A few times a month	Questionnaires completed by RNs
Mandl et al, 2015	1	69.20	70.20	Any involuntary loss	Questionnaires completed by trained nurses
Blekken et al, 2016	—	—	42.10	Loss of liquid or solid stool	interRAI LTCF and St Mark incontinence score completed by RNs
Ihnat et al, 2016	—	—	57.10	Several times a week	Medical records and interviews of residents by nursing students
Jerez-Roig et al, 2016	—	—	42.70	Loss of liquid or solid stool	MDS 3 and medical records
Carryer et al, 2017	26	23.20	49.60	3-4 times a month	Questionnaires completed by RNs and care providers
Median of studies reporting prevalence	3.50	47.10	42.80		
Interquartile range	2.80	32.10	21.10		

LTC, long-term care; MDS, Minimum Data Set; OSCAR, Online Survey, Certification, and Reporting; RNs, registered nurses.
The dash (—) indicates no data provided.

Description of Studies

There were 14 cross-sectional studies,[4,10,11,19,27,32,34–42] 4 cohort studies,[18,24,43,44] 2 surveys,[29,45] a quasi-randomized controlled trial[46] (from which we extracted baseline cross-sectional data only), a case-control study,[41] and a retrospective chart review.[47] One cross-sectional study was reported twice, in 2013 and 2015[10,48]; only the 2015 report is included in this review. The 23 studies come from diverse geographical locations and included sample sizes ranging from 82[46] to 1,526,066[36] care home residents (Supplementary Table S1).

No standard definition of FI was applied across the studies. Some of the studies clearly defined FI, but did so with differences of frequency by which fecal leakage constitutes FI: once a week,[29,35] several times a week,[19] few times a month,[10] or simply 1 involuntary leakage of feces[24] (Table 1). Other studies did not provide an operational definition for FI.[4,34,42,44] No study reported outcomes based on etiology or mechanism of FI, such as urge FI, passive FI, or postdefecation seepage.

There was a marked variation in data collection tools and the outcome measures differed: interRAI,[27] Cleveland Clinic Incontinence Score,[19] study-specific questionnaires,[10,42] interviews,[34] medical records,[24] and Minimum Data Set (MDS) records.[18,37,43,44,47] Findings from the included studies are presented under 3 subheadings in this review: prevalence of FI, incidence of FI, and correlates of FI.

Prevalence of FI

A summary of FI prevalence found in older people living in care homes is given in Table 1. Isolated FI interquartile ranged from 2.7% to 5.5% (median = 3.5%), double FI interquartile ranged from 33.3% to 65.4% (median = 47.1%), and all FI interquartile ranged from 28.5% to 49.6% (median = 42.8%). Older people living in care homes experience more double FI compared to isolated FI. The apparent anomaly of the median for double FI being less than all FI is because some studies did not report isolated and double FI separately, and mostly these studies reported lower rates of FI than those that did report separately (Table 1). No study categorized FI in terms of etiology.

From Table 1, it can be observed that older studies generally reported a lower prevalence of FI[39,45,46] compared with more recent studies.[11,19,32] It can be observed also from the table that more than 40% of residents were reported to have FI in studies reported after 2015.

Incidence of FI

Of the 23 studies reviewed, 5 studies analyzed incidence of new FI over time among care home residents.[18,24,41,43,44] In 1 of the studies conducted in 13 geriatric institutions in France to evaluate the incidence, identify the risk factors, and to assess the prognosis of older institutionalized patients aged 60 years and older who developed FI, it was reported that 20% (n = 234) of the participants (n = 1186) recruited without any history of FI and followed over 10 months developed new FI.[24] The authors reported 5 factors that were associated with increased risk of developing FI: UI [risk ratio (RR) 2.0, 95% confidence interval (CI) 1.5-2.6; P < .001], neurologic disease (RR 1.9, 95% CI 1.0-3.4; P = .04), poor mobility (RR 1.7, 95% CI 1.2-2.4; P < .001), age >70 years (RR 1.7, 95% CI 1.0-2.8; P = .04), and a Mini-Mental Status Examination score <15 (RR 1.4, 95% CI 1.1-1.9; P < .01).[24] They also reported that long-lasting (8 or more days') or permanent FI was associated with increased mortality.[24] Of the 234 patients who developed FI, 16% died during the study compared with 6.7% of those who were continent of feces throughout.[24]

However, the study did not find correlation between FI and age greater than 80 years, gender, medication use, or history of psychiatric disorder.[24] The study found a protective factor for developing FI in patients who had lived in the same institution for at least 5 years (RR

Table 2
Potentially Modifiable and Nonmodifiable Correlates

Author and Year of Publication	Bliss 2013	Bliss 2017	Blekken 2016	Ihnat 2016	Jerez 2015	Saga 2015	Aslan 2009	Nelson 2005	Chiang 2000	Chassagne 1999	Nelson 1998	Johanson 1997
ADL	Yes		Yes		Yes		Yes				Yes	
Diarrhea			Yes			Yes		No			Yes	Yes
UI	Yes		Yes		Yes		Yes	Yes		Yes	Yes	
Constipation						Yes		No			Yes	No
Mobility					Yes	Yes		No	Yes	Yes		
Laxatives			Yes		Yes					Yes		Yes
Depression			No			No		No	No		No	
Diabetes						No		No	No		No	
Older age	Yes		No	No	No	No		Yes		No	Yes	≤65*
Dementia	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gender			No	No	No	No	F$	No		No	M$	M$
Stroke						No	No	Yes	No		No	
Race/ethnicity	Yes	No										

Yes: statistically significant correlate; No: not statistically significant; blank spaces: not measured; F$ = females only; M$ = males only.
  *Mean protective factor.

0.6, 95% CI 0.4-0.8; *P* < .001).[24] This study seemed consistent with an earlier study that found that 23% of residents with FI compared with 11.9% of those without FI died at the 6-month follow-up.[41]

In Wisconsin, residents from 181 skilled nursing facilities found to be continent to both stool and urine in 1992 (n = 3850) were reassessed 1 year later to determine development of FI or UI.[43] The authors reported that 14.7% of the residents (n = 567) developed new FI, and an additional 12.4% (n = 479) developed double FI, so 27.1% presented with new FI in total over the year. Positive associations with the development of FI were dementia, advanced age, and nonwhite race, but the strongest correlates were impairment in activities of daily living (ADL) [odds ratio (OR) 3.1, 95% CI 2.6-3.8] and use of patient restraints.[43]

Adults aged 65 years and older who were free of double FI as per their Minimum Data Set (MDS) record when admitted to a care home were reported to have developed double FI, and did so sooner if they had UI, more severe limitations in ADL, greater severity of cognitive impairment, or more comorbidities, or if they were older.[18] The study also found a correlation between developing double FI and lower quality of care among care home residents.[18]

Correlates of FI

The most frequently reported correlates are dementia or cognitive impairment, functional incapacity or reduced ADL, UI, reduced mobility, advanced age, use of laxatives, and diarrhea (Table 2). Four studies showed that stroke is not correlated with FI. No study indicated what kind of dementia was present, and how dementia specifically affected continence. Other reported correlates include constipation, race (ethnicity), diabetes, depression, and length of stay in a care home.

Impaired ability to conduct ADL

Impaired ability to conduct ADL was reported as a significant correlate to risk of FI in 5 studies (Table 2). Impairment in components of ADL has been reported to be associated with poorer quality of life (QoL),[49] increased health care costs,[50] increased morbidity,[10] and mortality,[49] and as predictive of future dementia.[50,51] However, 1 study found that impairment in a component of ADL (inability to transfer between bed and chair) was a protective factor for not having FI (OR 0.49, 95% CI 0.26-0.91; *P* < .001).[48] This counterintuitive finding is possibly explained by staff giving more assistance in bowel care to immobile residents compared to residents who were mobile.

Reduced mobility/Locomotion

Reduced mobility/locomotion as a component of ADL was independently analyzed and found to be associated with risk of FI. However, a cross-sectional study of nursing home residents (n = 359) in the United States found that locomotion was not associated with either isolated FI or double FI.[43] Another study conducted across 10 nursing home units (n = 261) in Norway found locomotion for more than 5 m as a protective factor for reporting FI (OR 0.20, 95% CI 0.12-0.35; *P* < .001).[27]

UI

UI is a comorbid condition rather than a risk factor.[40] In this review, UI was 1 of the most frequently reported potentially modifiable correlates of FI. In 1 study, a multivariate logistic regression showed that compared with those without UI, the risk of FI increased 2-fold among those with UI (OR 2.24; *P* < .001).

Laxatives

Laxatives used to treat or manage constipation varied, and included lactulose, Senna, suppository, or enemas. In this review, all such medications were considered as laxatives. Four studies found the use of laxatives to be associated with FI (Table 2).

Stool consistency

Constipation and diarrhea were both found to be independently associated with risk of FI. The term *constipation* in this review also includes data on fecal impaction (an immobile bulk of feces in the rectum) and fecal loading (a large volume of stool of any consistency found in the rectum) because both of the latter can cause the former (ie, infrequent or difficulty of passing stool). The term *diarrhea* was considered synonymous to loose stool.

Depression and diabetes

Depression and diabetes were both found to be not statistically significantly associated with risk of FI. Six studies found depression to be a nonsignificant correlate of FI.[10,27,35,40,43,47] Diabetes was also found to be nonsignificantly associated with risk of FI in 4 studies.[10,40,43,47]

Dementia

Dementia was the most consistent correlate of FI (Table 2). Cognitive impairment among residents with FI is reported as ranging from 54%[35] to 87%.[17] However, a cohort study conducted in France found that psychiatric disorder (which probably included dementia) was not correlated with FI.[24]

Advanced age

Advanced age was reported as a risk factor that is associated with FI among older people in 4 studies. One of the studies reported that the age 65 years or lower was a protective factor for FI.[38] Five other studies reported that age was not statistically significantly correlated with FI.[10,19,24,27,37]

Gender differences

Gender differences in FI were not statistically significantly associated in 6 studies (Table 2). However, 1 study found a correlation between female gender and risk of FI.[34] Two studies found male gender as significantly correlated with FI.[38,40]

Race or ethnicity

Race or ethnicity was found to be associated with development of FI in 2 studies.[4,43] In 1 study, isolated FI was 14% in blacks, 13% in Hispanics, 10% in American Indians, 9% in Asians, and 9% in whites; double FI was 46% in Asians, 44% in blacks, 36% Hispanics, 27% American Indians, and 27% in whites.[4] This study supports an earlier study that also found nonwhite race to be positively correlated with FI.[43] However, in a recent cohort study (n = 39,181 residents) that analyzed development of double FI after admission, the authors found no statistically significant correlation between black race and double FI (HR = 1.05, 95% CI 0.97-1.13).[18] These results are inconsistent with a previous study that found FI was approximately twice as prevalent among white women (20%) as compared to black women (11%).[52]

Stroke

The effect of stroke was analyzed by 5 studies, of which 4 studies showed that stroke does not increase rate of FI.[10,37,40,43] Only 1 study found stroke to be significantly correlated with FI.[34]

Potentially modifiable correlates, in the context of this review, are those factors associated with FI that individual residents, nursing staff, or policy makers have the potential to improve. The most commonly reported potentially modifiable correlates of FI from the studies are ADL, diarrhea, urinary incontinence, constipation, reduced mobility, and the use of laxatives (Table 2).

Discussion

This is the first review that systematically investigates the prevalence, incidence, and correlates of FI specifically related to older people living in care homes. Although 4 systematic reviews have been published previously on prevalence of FI,[1,2,13,53] those reviews concentrated on the general population. The characteristics of the care home population—advanced age, frailty, and high comorbidities (ie, dementia)[10]—suggest that they require different care pathways from the general population. Younger populations have fewer cognitive impairments and fewer episodes of incontinence.[44] In 1 study, age <65 years was found to be a protective factor for not developing FI.[38]

This review showed that double FI is more prevalent among older people living in care homes compared to isolated FI. This raises awareness for appropriate assessment to unravel the underlying causes of double FI when an older person is admitted to a care home. The review did not find literature in this population in which staff considered soiling as FI or not. In the studies included, FI was usually reported by staff rather than residents, probably because most residents are likely to have some degree of cognitive impairment. The figures represented in this review reflect what staff considered as having FI. Hence, the issue of whether the residents considered themselves as having FI is unknown.

Dementia or cognitive impairment is the most consistently reported correlate of FI. Previous studies have found dementia or cognitive impairment as an influencing factor for care home admission.[12,54] There are suggestions that care home residents with dementia experience increased FI, and that over time they experience the highest increase in care dependency compared with residents without dementia.[18] In this review, dementia was a documented risk factor for FI, but its effect on the uptake of different interventions and the dementia-specific continence and toileting skills that staff require remain unknown. A recent review argues that addressing the specific challenges (eg, recognizing the urge to defecate, remembering where the toilet is) that arise when providing continence care to people with dementia is likely to be key to helping to reduce FI in this population.[55]

Many people with FI also experience urinary incontinence, hence the term *double fecal incontinence*. This review found high prevalence of double FI among older people living in care homes. There is evidence to suggest that double FI becomes worse over time following a care home admission among older people.[18] This could be explained by several factors, including deterioration in functional ability with advanced age, poor institutional practices such as poor bowel care, introduction of new types of food, inappropriate use of laxatives, side effects of polypharmacy, or perhaps fecal impaction due to a sedentary lifestyle. Some of these factors need consideration when developing interventions to prevent or reduce double FI among older people resident in care homes.

Consistent with previous reports,[4,27,34,37,40] this review found that impairment in components of ADL is a major influence on FI. This is amplified for residents who also live with dementia.[12] These combined factors present an individual with significant difficulty in maintaining independent FI because socially acceptable defecation involves a sequence of events such as the ability to walk to the toilet, and the dexterity to undress and then dress, and the comprehension to evacuate the bowel appropriately.

The correlation between ethnicity and FI was surprising, as there seems no physiological reason that explains this. It is perhaps due to cultural influences. Conversely, this could also be the result of how health care staff relate to people of different race and ethnicity. The way researchers sometimes report their findings may also explain the correlation. A study conducted in the United States to assess black-white disparities in nursing homes reported that black people in nursing homes were treated? far worse compared to whites: more physical restraints, more antipsychotic medication, and more frequent use of feeding tubes. However, on inspection of the data the authors used, 90.9% (n = 1,458,823) were whites and only 9.1% (n = 146,891) were black.[56] A further robust research study in different regions such as Europe or Australia, taking into consideration the representativeness of participants, is recommended.

The clinical implications of this review's findings are that, apart from aging process, there are several underlying factors associated with FI, such as loose stool and ADL that require further assessment when older people are admitted to a care home.

Limitations of the Evidence Base

All but 1 study was an observational study, so causality cannot be inferred from this review. Heterogeneity in study designs, characteristics of populations, FI diagnostic criteria, data collection methods, and outcome measurements precluded pooling of data for a meta-analysis. This means that the true prevalence rate remains unknown. Not all were high-quality studies. Two-thirds of the residents were female, and all the studies were conducted in middle- and high-income countries. The studies were carried out in predominantly white residents. Therefore, transferability of results from those studies to low-income countries, male gender, or nonwhite care home population requires further research.

Several studies had different study aims other than the outcomes of interest in this review. In some instances, care home data were extracted from studies that also included populations in other health care settings. Therefore, we acknowledge bias in assessing our

outcome measures because compared with studies solely dedicated to investigating FI, those investigating FI as a secondary outcome or as part of a generalized bowel function or care home assessment might be less accurate.

The literature in frail older people in care homes has not, with rare exceptions, attempted to characterize FI according to possible physiological subtypes of the condition. No study in this review reported outcomes based on etiology or mechanism of FI. This is reflected in the FI typology reported in this review, which is how the authors of included studies reported their findings. This, arguably, provides only limited guidance for clinicians and therefore points out the need for further research.

Conclusions and Implications

FI is prevalent among older people living in care homes. Correlates of FI including limits to ADL, reduced mobility, UI, laxative use, and problems with stool consistency (constipation and diarrhea) are potentially amendable to intervention. Our findings suggest the need for interventions to account for the multifactorial underlying causes of FI to reduce the risk and impact of the condition. This is important for care home residents, their relatives, and staff in care homes. An intervention that recognizes and incorporates knowledge and staff training about what supports dementia-specific bowel care and how the care home culture and environment affects uptake and potentially modifiable correlates of FI require further research. The need for a consensus on how FI in care home residents is recognized, reported, and researched to ensure future work captures specific characteristics of the care home population is recommended.
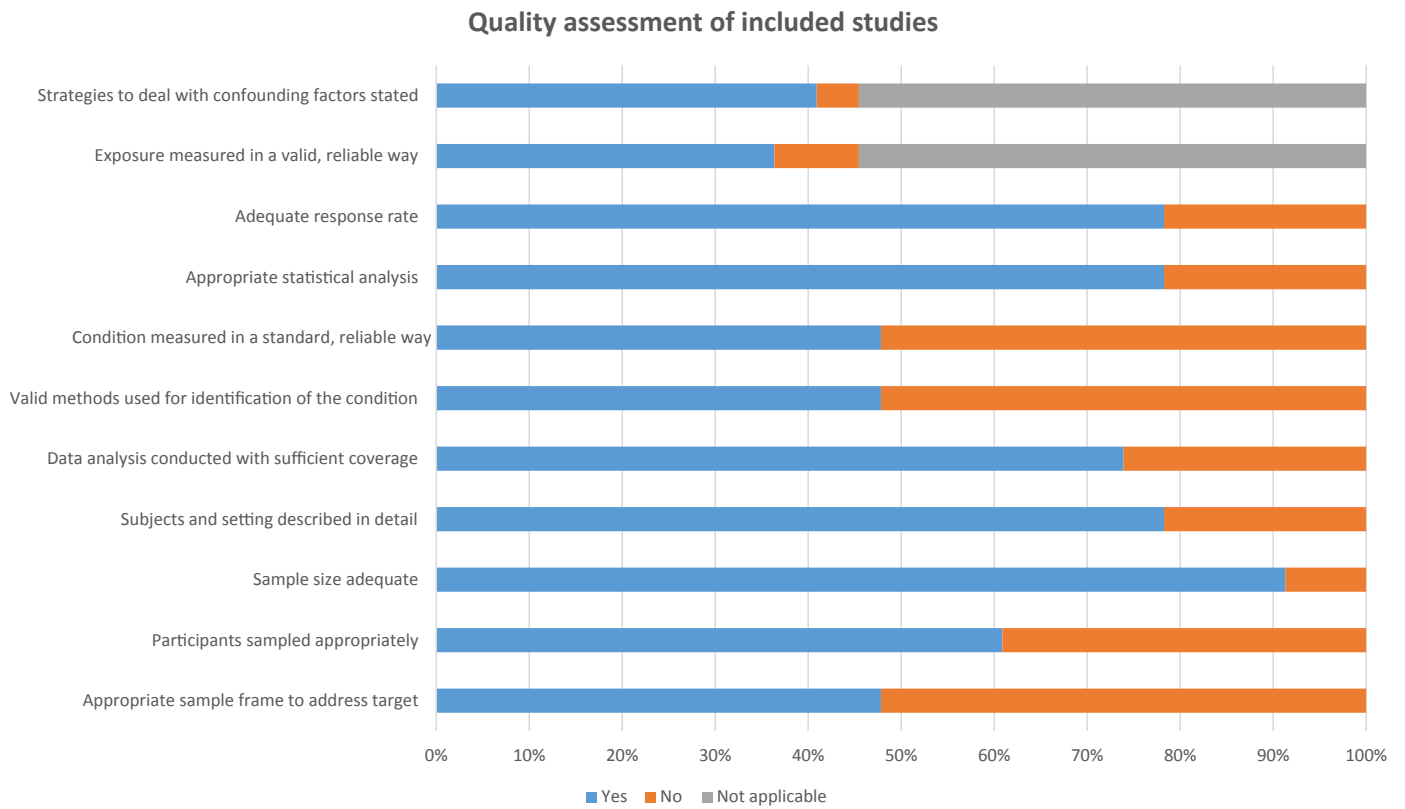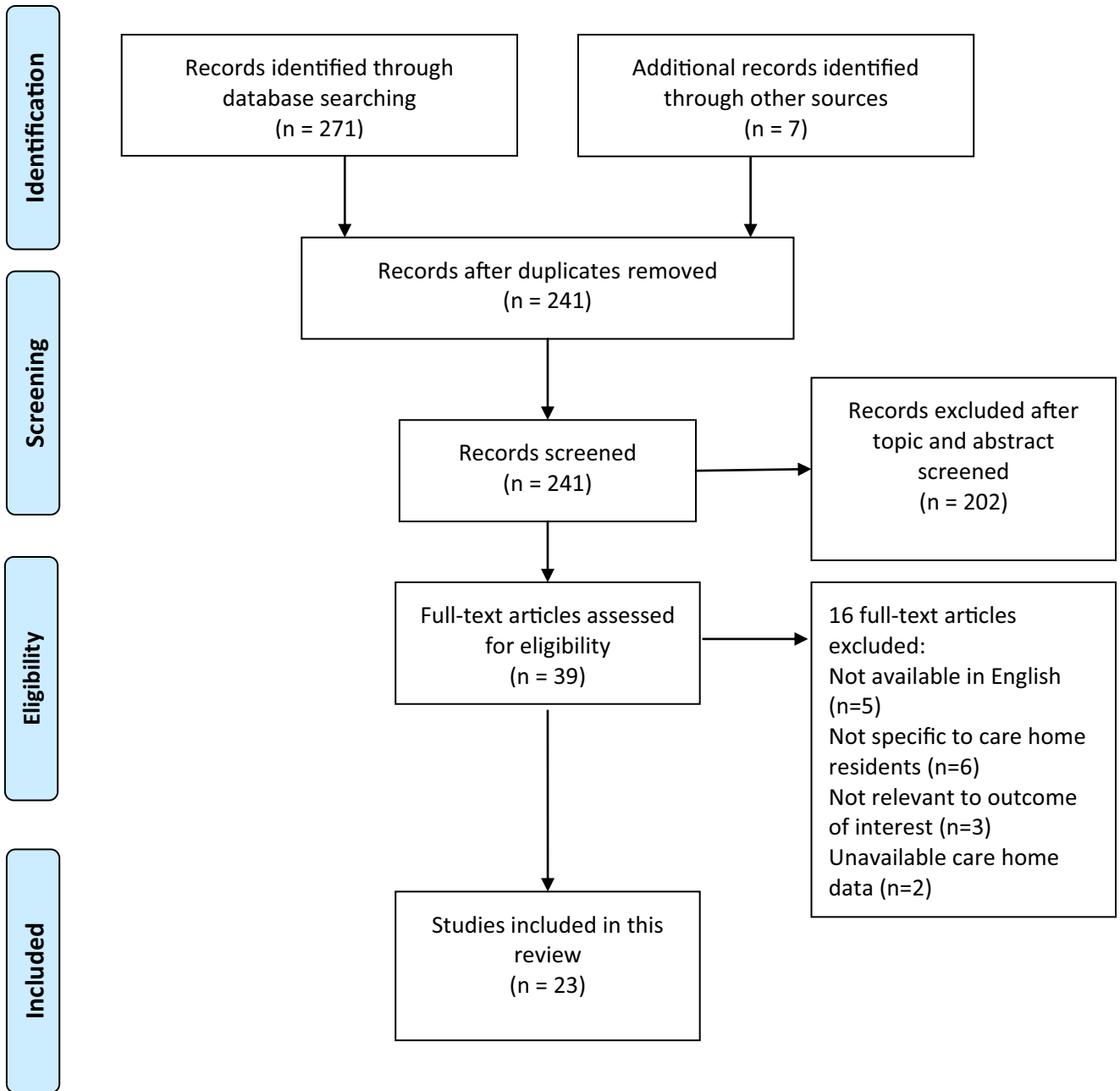
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Quality assessment of included studies

Supplementary Figure S1. Quality assessment of included studies (n = 23).

Identification

Records identified through database searching
(n = 271)

Additional records identified through other sources
(n = 7)

Screening

Records after duplicates removed
(n = 241)

Records screened
(n = 241)

Records excluded after topic and abstract screened
(n = 202)

Eligibility

Full-text articles assessed for eligibility
(n = 39)

16 full-text articles excluded:
Not available in English (n=5)
Not specific to care home residents (n=6)
Not relevant to outcome of interest (n=3)
Unavailable care home data (n=2)

Included

Studies included in this review
(n = 23)

Supplementary Figure S2. PRISMA flowchart of literature review process.

Supplementary Table S1
Summary of Included Studies

Study	Population	Definition and Data Sources	Prevalence/Incidence of FI/DI	Correlates of FI/DI	Methodologic Qualityof Study
Aslan et al. 2009; Turkey; cross-sectional	N = 694 residents, aged > 60 y from 5 selected NHs; 56.5% women	FI not defined. DI defined UI and FI which occur together. The authors interviewed residents and also used the MMT to assess mental and functional states.	FI was 10.5% among the residents. Data extracted shows that FI was more common among females (55%) compared to males (18%). However, the authors reported 14% and 6% FI incidence for female and males, respectively, between January and March 2000.	The factors associated with FI among males according to multivariable logistic regression included diabetes mellitus (RR 57.69, 95% CI 1.58-2108.23), frequency of FI (RR 32.51, 95% CI 1.81-583.54), functional incapacity (RR 147.25, 95% CI 6.23-3478.06), and UI (RR 26.85, 95% CI 1.73-416.57), whereas, for females, associated factors according to multivariable logistic regression included history of stroke (RR 7.01, 95% CI 1.51-32.63) and functional status (RR 17.35, 95% CI 5.23-57.48).	Medium
Blekken et al. 2016; Norway; cross-sectional	N = 261 residents, from 20 NH units across 10 different NHs; aged >60 y; 66.3% women	FI defined as involuntary loss of liquid or solid stool. Data sources: Norwegian version of interRAI LTCF, (Section H3) and a Norwegian version of St Mark's FI score	Prevalence of FI from interRAI LTCF was 42.1%; from St Mark's FI score, it was 54%	Significant predictors of FI (multivariable logistic regression): UI (OR 2.24, 95% CI 1.56-3.20), ADL impairment (OR 1.12, 95% CI 1.05-1.19), cognitive impairment (OR 1.96, 95% CI 1.16-2.44), diarrhea (OR 8.90, 95% CI 1.87-42.5), paraplegia (OR 4.41, 95% CI 1.17-16.69), and use of micro-enemas (OR 3.17, 95% CI 1.83-5.50). Nonstatistically significant factors: advanced age, length of NH stay, social engagement, inability to defer defecation for 15 min, inability to communicate, depression, and diabetes. Protective factors were average time involved in activities (OR 0.33, 95% CI 0.10-0.92) and instability in health (OR 0.62, 95% CI 0.39-0.98).	High
Bliss et al. 2013; USA; cross-sectional	N = 111,140 residents, aged ≥ 65 y (mean age = 82 y), admitted to 457 NHs over 3 y: 2000 to 2002; 65.3% women	No clear definition of FI/DI, except that the authors categorized incontinence data into 6 variables: Only FI, only UI, DI, any incontinence, any FI, and any UI. The authors used MDS version 2 and 2000 US Census records.	DI was highest (46% in Asians, 44% in blacks, 36% Hispanics, 27% in American Indians, and 27% in whites) and FI only (no UI) was lowest (14% in blacks, 13% in Hispanics, 10% in American Indians, 9% in Asians, and 9% in whites).	No correlations reported	High
Bliss et al. 2017; USA; longitudinal cohort	N = 39,181 older NH residents, aged ≥65 y (mean age = 81.3 y; SD = 7.6) admitted to 445 NHs in 27 states without DI; 69.2% women	DI was defined as the report of both urinary and fecal incontinence. Data sources: 3 national data files were analyzed—MDS record, OSCAR, and the 2000 US Census.	Of the 39,181 admissions, 24.6% developed DI. Of these, 4% were admitted with isolated FI, and 35.5% with isolated UI; after admission, 19% developed DI at 3 mo (90 d); 28% developed DI at 6 mo (180 d); 42% developed DI at 1 y; and 61% developed DI at 2 y.	Significant predictors for developing DI over time derived from Cox proportional hazard regression were UI (HR = 1.3, 95% CI 1.2-1.4), greater severity of cognitive impairment (HR = 1.2, 95% CI 1.16-1.19), more comorbidities (HR = 1.1, 95% CI 1.06-1.09), older age (HR = 1.0, 95% CI 1.0-1.01), greater limitations in ADL, and lesser quality of nursing home care. Not statistically significantly associated with race.	High

Study	Population	Definition and Data Sources	Prevalence/Incidence of FI/DI	Correlates of FI/DI	Methodologic Quality of Study
Burgio et al. 1988; USA; cross-sectional	N = 154 patients from one urban nursing home; mean age = 74 (SD = 13.4); 69% women	FI/DI not defined; no specific tool for measuring FI/DI	126 (82%) of residents were incontinent of bowel or bladder at least once per day. Of these, 4 (3%) displayed FI only and 94 (75%) displayed DI "at least once per week." Characteristics of sample: Cognitive impairment (58%), mobility impairment (95%) and depression (39%).	No correlations reported	Low
Capewell et al. 1986; UK; survey	N = 400 residents, aged ≥64 y (age range: 64-101 y, mean age = 80 y). Most of the NH residents (92%) were women.	FI/DI not defined	All FI among the residents was 26%. This included FI once per week or less and frequent FI. The characteristics of the residents were feeding dependency (18%), dressing dependency (71%), and cognitive impairment (72%).	No correlations reported	Medium
Carryer et al. 2017; New Zealand; cross-sectional	N = 276 residents, aged ≥65 y (mean age = 87.2 y, with SD = 7.4 y) from 13 NH facilities; more than 70% women (no exact figure given)	FI was defined as involuntary loss of the bowels 3-4 times a month; DI was defined as involuntary loss of urine and feces. Data source: National Prevalence Measurement of Care Problems questionnaire.	Prevalence of isolated FI was 26.4% and DI was 23.2%. Thus, all FI was 49.6%.	No correlations reported	High
Chassagne et al. 1999; France; cohort	N = 1186 continent residents, aged >60 y from 13 French institutions (5 nonmedical NHs and 8 long-term care geriatric facilities)	FI was defined as at least 1 involuntary loss of feces. FI categorized as "transient" or "long-lasting." The authors extracted data from medical records.	New FI occurred in 20% of residents (n = 234). Of those who developed FI, 16% (34/234) died during the study, compared with 6.7% (64/952) of those who were continent. Long-lasting or permanent FI was associated with increased mortality.	Factors that were statistically significantly associated with FI from the multivariable analysis were UI (RR 2.0, 95% CI 1.50-2.60), presence of neurologic disease (RR 1.9, 95% CI 1.0-3.4), decreased mobility (RR 1.8, 95% CI 1.1-3.0), severe cognitive impairment (RR 1.4, 95% CI 1.1-1.9), age older than 70 y (RR 1.7, 95% CI 1.0-2.8), and acute diarrhea or fecal impaction. Nonsignificant factors: age >80 y, gender, medication use, or history of psychiatric disorder. A protective factor was long stay in an NH for at least 5 y (RR 0.6, 95% CI 0.4-0.8).	Medium
Chiang et al. 2000; USA; retrospective chart review	N = 413 NH residents from 3 states. Mean age = 84 y; 75% women	FI not clearly defined, except that FI meant incontinent of feces only, DI meant incontinent of both feces and urine, and UI meant incontinent of urine only; data collected from the MDS, chart documentations	Isolated FI = 6%; DI = 54%	Residents with DI were significantly more likely to have cognitive impairment and reduced mobility (ie, in-bed and transfer from bed-to-chair) compared to continent residents or residents with UI. Number of diagnoses, congestive heart failure, hypertension, diabetes, Parkinson's disease, anxiety, and cancer did not vary with continence status of residents.	High
Harrington et al. 2008; USA; cross-sectional	There were 1,526,066 nursing facility beds surveyed in 2001 and 1,613,942 in 2007.	Bowel incontinence defined as more often than once a week	Prevalence of FI was reported as 43.3% in 2001 and 43.1% in 2007.	No correlations reported	High
Ihnat et al. 2016; Czech Republic; cross-sectional	N = 588/740 residents from 4 NHs (mean age = 82 y, with SD = 9.9); with 84.4% response rate; 74.5% women	FI classified according to the Cleveland Clinic Incontinence Score; data sources: medical records and interviews with RNs	FI was noted in 336 (57.1%) of the residents. The majority of FI residents (57.8%) reported FI episodes "several times a week." FI was frequently noted in residents aged 85 y and older.	Significant predictors: length of stay up to 6 y, comorbidities, UI, and cognitive impairment Non-statistically significant correlates: advanced age and gender	High

Jerez-Roig et al. 2015; Brazil; cross-sectional	N = 321 residents, aged >60 y (mean age = 81.5 y, with SD = 9), from 10 NHs; 100% response rate; 75.4% women	FI defined as "the involuntary loss of liquid or solid stool"; Data source: H4 of MDS version 3	FI was 42.68% (CI 95%, 37.39-48.15). DI was observed in 42.1% individuals, and only 0.2% isolated FI.	Statistically significant predictors from the multivariable analysis were impairment in cognitive capacity (PR = 3.16, 95% CI 1.19-5.20) and decline in functional capacity (PR = 5.82, 95% CI 3.78-8.95). Non−statistically significant correlates were age ≥81 y (PR = 1.13, 95% CI 0.74-1.71), race (PR = 1.37, 95% CI 0.95-1.97), lack of caregiver as the reason for admission (PR = 1.27, 95% CI 0.84-1.92), and stroke (PR = 1.12, 95% CI 0.65-1.93).	High
Johanson et al. 1997; USA; cross-sectional	N = 388 residents, mean age = 83 y; age range 31-103 y; 76% women	FI was defined as any involuntary leakage of stool or soiling of undergarments.	46% of the residents were incontinent of feces.	Diarrhea, restricted mobility, and male gender were independently associated with FI. Incontinence was 1.5 times more in men and those younger than 65 y old.	Medium
Kinnunen, O. 1991; Finland; cross-sectional	N = 183 people living in Old People's Homes, mean age = 79.2 y (SD = 8.1); 72% women	The authors did not define FI, or explain how FI was measured.	Of the 183 residents, 15% had FI.	No correlations reported	Low
Mandl et al. 2015; Austria; cross-sectional	N = 1397 NH residents in 16 NHs mean age = 83.7 y (SD = 9.6); 80.1% response rate; 78.8% women	FI defined as "involuntary loss of fecal material, without any involuntary loss of urine." DI defined as the loss of both urine and fecal material. Data source: Australian version of International Prevalence Measure of Care Problems was used to measure outcomes.	FI was 1% and DI was 69.2% (95% CI 38.6-42.6). Residents aged ≥81 y reported more DI (58.6%), but less FI (2.9%) compared to those aged ≤80 y.	No correlations reported	Medium
Nelson and Furner 2005; USA; longitudinal cohort study	181 skilled nursing facilities provided resident-based MDS data in 1992 (18,170 NH residents, with attrition of 7842 from 1992 to 1993). In 1992, 3850 residents were categorized as continent of both urine and feces. The mean age of the continent residents was 84.4 y; 72% women	FI not defined; the authors used the MDS to collect data.	Among the continent residents in 1992, 14.7% (n = 567) were reported to have FI and 12.4% (n = 479) were reported to have DI in 1993.	A multiple regression analysis showed positive associations with development of new FI: dementia, advanced age, and nonwhite. The strongest correlates were impairment in ADL (OR 3.1, 95% CI 2.6-3.8) and the use of patient restraints. Arthritis, BMI, and male gender were found to be not statistically significant.	High
Nelson et al. 1998; USA; two cross-sectional studies	N = 8471 (1992), mean age = 85.6 y, and N = 7860 (1993), mean age = 84.9 y; 71% women	FI not defined. Data were obtained from Wisconsin Center for Health Statistics, using the MDS.	In 1992, 47% of the residents were reported to have FI (n = 8471); in 1993, 46% were reported to have FI (7, 860 residents).	Significant factors from a univariable analysis were UI, tube feeding, any loss of ADL, diarrhea, pressure ulcers, dementia, impaired vision, fecal impaction, constipation, stroke, male gender, rising age, and increasing body mass. Age, heart failure, arthritis, depression, diabetes, feeding oneself, inability to transfer from bed to chair, and loss of locomotion were inversely related to FI. Higher BMI was a protective factor.	High

Study	Population	Definition and Data Sources	Prevalence/Incidence of FI/DI	Correlates of FI/DI	Methodologic Qualityof Study
Peet et al. 1995; UK; survey	N = 3894 residents, aged ≥65 y (mean = 82.7 y, SD = 7.8) from 3 of 8 settings surveyed	Residents experiencing at least 1 incontinent episode weekly were defined as being incontinent of feces.	All FI from 3 settings (local authority, private residential, and private nursing) was 10.5%.	No correlations reported	Low
Rodriguez et al. 2007; UK; cross-sectional survey	186 CHs were eligible, of which 20 CHs were used for piloting; final surveys were returned by 66/186 CHs (35% response rate) from March to May 2005. The homes described a total of 1869 residents aged ≥65 y.	FI not defined. A piloted survey questionnaire was used as data collection tool.	Respondents indicated that 66 (4%) of the residents experienced FI, and 569 (31%) experienced DI. The prevalence of FI was higher in the NH population compared to the residential home population (80% vs 49%).	No correlations reported	Low
Saga et al. 2013; 2015; Norway; population-based cross-sectional (*Note*: One study reported in 2 articles: 2013 and 2015)	N = 930 residents, with the mean age = 85.5; SD = 7.3 and a range = 65-107 y; 75.9% women	FI in this study was defined as "involuntary leakage of stool at least a few times a month." A piloted questionnaire was used.	2.6% of residents had FI alone, and 40.2% had DI (2.6% + 40.2% = 42.8% all FI). Mean residency of residents in short-term care was 51.1 (SD = 56.6) d, whereas, for long-term care it was 881.9 (SD = 871.0) d.	Statistically significant correlates from multivariable analysis were diarrhea (OR 7.33, 95% CI 4.39-12.24), UI (OR 2.77, 95% CI 1.73-4.42), dementia (OR 2.17, 95% CI 1.28-3.68), length of stay between 4 and 5 y (OR 2.65, 95% CI 1.20-5.85), feeding dependent (OR 2.17, 95% CI 1.26-3.71), dressing dependent (OR 4.03, 95% CI 1.39-11.65), inability to use toilet (OR 7.37, 95% CI 2.65-20.44), and immobility (OR 2.54, 95% CI 1.07-6.00). Non−statistically significant correlates: age, gender, stroke, grooming, walk with support to toilet, unable to climb stairs, and bathing dependent. A protective factor was needing help to transfer between bed and chair (OR 0.49, 95% CI 0.26-0.91; *P* = .03).	High
Thomas et al. 1987; UK; case-control study	N = 370 residents (70 men and 300 women), from 8 CHs; median age = 83	FI was defined as involuntary passage or leakage of feces twice or more a month.	Prevalence of FI was 16% at baseline. At 6 mo follow-up, 76.9% of cases had continuing FI. 72.7% of men and 92% of women with FI also had DI.14% of the cases had died at follow-up compared to 7% of control.	No correlations reported	Low
Tobin and Brocklehurst 1986; UK; quasi-RCT: only cross-sectional baseline data are reported here.	30 residential homes, with 82 residents enrolled in the study	FI was not defined.	FI occurring at least once weekly was found in 10.3% of residents. Characteristics of residents with FI: advanced age, poor mobility, neurologic disease, and cognitive impairment	No correlations reported	Low
Wang et al. 2009; USA; Longitudinal cohort	N = 4942 extended-stay NH residents admitted into 377 NHs in 2004; aged ≥ 65 y (mean = 84.3, SD = 7.6). Length of follow-up was between 4 and 8 mo.	FI was not defined. Data source: MDS record, nursing home characteristics from 2004 Minnesota state administrative data system and staffing levels from 2004 Minnesota Department of Human Services Annual Facility Survey.	FI at admission was 33.4% among the residents (no figure provided for FI at follow-up). This study reported that bowel incontinence was a nonsignificant predictor of subsequent ADL dependence.	No correlations reported	High

BMI, body mass index; NH, nursing home; CH, care home; LTCF, long-term care facility; OSCAR, Online Survey, Certification, and Reporting; RCT, randomized controlled trial; RN, registered nurse; SD, standard deviation.

Supplementary Table S2
Results of Search in MEDLINE

Search Terms	Results
1. (prevalence or epidemiology or incidence).mp	1,382,426
2. (faecal incontinence or fecal incontinence or anal incontinence or bowel incontinence).mp	53,290
3. (older people or elderly people or frail people or resident$ or veteran$).mp	227,652
4. (care home$ or nursing home$ or residential home$ or veteran home$ or aged care facilit$ or skilled nursing facilit$ or long term care facilit$).mp	49,323
5. 1 and 2	6764
6. 3 and 5	521
7. 4 and 6	271

Supplementary Table S3
Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Studies on incontinence, where prevalence and/or incidence data on FI or double incontinence were available • Studies relating to older people in care homes (eg, nursing or residential care homes), or where care home setting data could be extracted• Participants' age ≥ 60 y, or participants' mean age ≥ 65 y • Peer reviewed, scientific journals. • Studies published in English language	• Studies solely on prevalence of urinary incontinence, where FI and/or double incontinence data cannot be obtained • Population-based studies, where focus is not care home residents • Participants' age <60 y, and/or mean age of participants <65 y • Abstracts only with no full-text publication

Where a study was reported more than once from the same data, a decision was taken to include only one of the reports to avoid duplication and overstatement of results.

Supplementary Table S4
Risk of Bias and Quality Reporting for Included Studies: JBI Checklist for Prevalence Studies, With Slight Modification (Incorporating 2 Questions From JBI Critical Appraisal Checklist for Analytical Cross Sectional Studies: CAC3 and CAC6)

	1	2	3	4	5	6	7	8	9	CAC3	CAC6	Comments	Level
Aslan et al, 2009	Y	N	Y	Y	N	U	U	Y	N	Y	Y	Poor methodology and coverage bias/ poor response rate	Medium
Blekken et al, 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		High
Bliss et al, 2013	Y	U	Y	Y	N	Y	Y	Y	Y	N/A	N/A	Use of for-profit NH as possible bias	High
Bliss et al, 2017	N	U	Y	Y	Y	Y	Y	Y	Y	Y	Y	Poorly described setting and how participants were sampled	High
Burgio et al, 1988	N	N	N	N	N	N	N	N	N	N/A	N/A	Poorly reported	Low
Capewell et al, 1986	Y	Y	Y	N	Y	U	U	Y	Y	N/A	N/A	Different research aim	Medium
Carryer et al, 2017	Y	Y	Y	Y	Y	Y	U	Y	Y	N/A	N/A		High
Chassagne et al, 1999	N	Y	Y	Y	Y	U	U	N	Y	U	Y	Unclear description of measurement and setting	Medium
Chiang et al, 2000	Y	U	Y	Y	Y	U	Y	Y	Y	Y	Y	Different aim	High
Harrington et al, 2008	Y	Y	Y	Y	Y	Y	Y	U	Y	N/A	N/A		High
Ihnat et al, 2016	U	Y	Y	Y	Y	Y	Y	Y	Y	Y	N		High
Jerez-Roig et al, 2015	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		High
Johanson et al, 1997	Y	U	Y	Y	Y	N	N	Y	Y	N	Y	Selection of care homes not clear; outcome measures not validated	Medium
Kinnunen, O. 1991	N	Y	Y	N	Y	U	U	Y	Y	N/A	N/A	Different study aim	Low
Mandl et al, 2015	N	Y	Y	Y	Y	N	N	Y	Y	N/A	N/A	Different aim; *only* 3.4% of NHs responded	Medium
Nelson and Furner 2005	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		High
Nelson et al, 1998	Y	U	Y	Y	N	Y	Y	Y	Y	Y	N	Population unknown	High
Peet et al, 1995	N	Y	Y	N	Y	N	U	Y	Y	N/A	N/A	Poor description of setting and participants	Low
Rodriguez et al, 2007	Y	Y	U	Y	U	U	U	U	N	N/A	N/A	Poor description of methods	Low
Saga et al, 2013	Y	Y	Y	Y	Y	N	Y	Y	Y	U	Y		High
Thomas et al, 1987	N	N	Y	U	U	N	N	Y	U	N/A	N/A		Low
Tobin and Brocklehurst 1986	N	Y	Y	N	Y	U	U	N	U	N/A	N/A	RCT; unclear outcome measure; poor description of setting and sample	Low
Wang et al, 2009	N	Y	Y	Y	Y	Y	Y	Y	Y	N/A	N/A		High

N, no; N/A, not applicable; NH, nursing home; U, unclear; Y, yes.