Urinary Incontinence and Use of Anticholinergics Independently Impact Quality Measure Area Performance in Nursing Homes: A Targeted Literature Review and Expert Panel Review

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Abstract:
Approximately 70% of older adult residents of long-term care (LTC) facilities experience urinary incontinence (UI), which is often treated with anticholinergics and can negatively impact quality of life. To understand the associations between Nursing Home Quality Initiative (NHQI) long-stay quality measure areas in LTC facilities, UI, and the use of anticholinergic medications, we first performed a targeted literature search. Then, an advisory panel of 8 members with extensive experience in LTC received a summary of the literature review. Sessions were held to discuss their feedback. Panel members agreed UI was strongly associated with increased falls, urinary tract infection, catheter use, and depression/anxiety. Panel members also agreed that anticholinergics were associated with falls and dementia and greater antipsychotic medication use. Owing to the mixed evidence in the literature, members could not make definitive associations between anticholinergics and depression and between dementia and antipsychotics use. Both the UI literature review and advisory panel discussions highlight the need to increase education regarding anticholinergic burden for managing UI and lessening the adverse health outcomes assessed by NHQI quality measures.

Keywords: dementia; long-term care; Nursing Home Quality Initiative; overactive bladder

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Urinary incontinence (UI) is a common symptom of overactive bladder (OAB), which affects more than 30 million adults and is characterized by bothersome symptoms such as urgency and frequency.[1] The prevalence of UI increases with age[1,2] and is a leading factor for placement into long-term care (LTC) facilities[3]; approximately 70% of adults in LTC facilities aged ≥65 years experience UI compared with 44% of age-matched, noninstitutionalized adults.[3] Health-related quality of life can be negatively impacted, and patients with UI may experience substantial psychological impact, including depression, anxiety, shame, and embarrassment.[4-7]

Older adults with UI often present with multiple comorbid conditions[6,7] and have increased health care resource utilization (HCRU) compared with older adults without UI.[6,8] Complications associated with UI that contribute to increased health care costs include urinary tract infection (UTI), catheterization, and falls.[6] These complications can increase facility burden through increased hospitalizations, pharmacy costs, and all-cause health care costs.[6,8]

Guidelines for the treatment of OAB, including OAB with UI, recommend behavioral therapy with or without pharmacotherapy as first-line treatment. Oral anticholinergics and β3-adrenergic agonists are recommended as second-line treatment.[9] Although anticholinergics are efficacious in treating symptoms associated with UI, anticholinergic use is associated with increased falls and fractures,[10,11] as well as impaired cognitive function.[10] An increase in falls may increase hospitalizations and emergency department (ED) visits, which are associated with significant economic, caregiver, and personal burden.[12-15] Older adults in LTC facilities may have higher anticholinergic burden at baseline because of comorbid conditions and associated polypharmacy.[16] Anticholinergics are a mainstay of OAB and UI treatment[9]; thus, anticholinergic burden and associated adverse effects are important considerations.[11,17]

The high prevalence of UI in LTC facilities,[3] coupled with UI-related patient care needs, may increase facility burden. The Centers for Medicare & Medicaid Services Nursing Home Quality Initiative (NHQI) is a program designed to improve the quality of nursing home (NH) care through assessment and public reporting of predefined quality measures.[18,19] With the Five-Star Quality Rating System, each facility receives an overall 5-star rating and separate ratings for health inspections, staffing, and quality measures. Ratings are based on performance on 15 quality measures (eg, percentage of residents experiencing 1 or more falls with major injury, number of hospitalizations per 1000 long-stay resident days) and allows for consumers and providers to assess the quality of care in LTC facilities.

This targeted literature review and guidance from an advisory panel of experts summarizes how UI and anticholinergic medication use separately impact long-stay quality measure areas for residents of LTC facilities. We undertook this review to provide a comprehensive overview of what is known of the burden to patients of UI and anticholinergic medication use and to determine what clinicians feel is important from the treatment perspective.

Material and Methods

Literature Review

Among the clinical care and patient outcome domains assessed by the NHQI quality measures, we selected areas of care and patient outcomes potentially related to UI or anticholinergic medication use based on clinical expert review and a preliminary literature review. The selected areas included falls with major injury, hospitalizations, ED visits, UTI, pressure ulcers, catheter use, activities of daily living (ADL) decline, locomotion decline, depression, antianxiety medication use, and antipsychotic medication use (**Supplementary Table 1**).

We performed 2 analyses: (1) to understand the association between UI and LTC quality measure areas; and (2) to understand the association between anticholinergics and LTC quality measure areas. Using PubMed, we identified studies using discrete search strategies incorporating the quality measure area of interest, LTC, and either UI or anticholinergic (**Supplementary Table 2**). Articles published between 2010 and 2020 for hospitalizations and ED visits were included. The search was expanded to included articles published between the years 2000 and 2020 for the remaining search terms to allow more articles for review. Three researchers reviewed article abstracts and identified potentially relevant studies. Two senior researchers reviewed and confirmed the initial selection. Then, team members reviewed full articles to determine inclusion. Eligible articles for inclusion met the following criteria: (1) the study answered the relevant research questions; (2) the study population focused on or included the older adult population (aged ≥65 years); and (3) the study setting was a NH or other LTC setting. Included articles had to be peer reviewed with empirical evidence and were not limited by region if they met other inclusion criteria. The research team extracted and summarized relevant findings prior to sharing with the advisory panel for validation.

Advisory Panel

We invited a panel of health care professionals with expertise in LTC and NH care to validate the literature review conclusions and to provide perspective on everyday practice and appropriateness of quality measures in LTC facilities. The research team identified technical experts who had ≥1 of the following experiences and expertise: (1) clinical practice in nursing homes or other LTC facilities; (2) pharmacists with knowledge in care for the aging population; and (3) quality of care in LTC facilities. Of the 16 health care professionals invited to participate in the panel, 8 accepted, including pharmacists, physicians, nurses, and nurse managers.

Members of the advisory panel received the methods and conclusions of the literature review and a list of questions to assess their agreement with the literature review summary and to assess opinions regarding areas not covered in the review that may be affected by UI or anticholinergics. Members were given 1 week to respond. We compiled and summarized responses and held 2 separate, 2-hour sessions on different days. Panel members, except 1 pharmaceutical consultant, were blind to the study sponsor to minimize bias. Advisory panel members received honoraria for their time and input.

Results

Literature Search Findings and Overview of Advisory Panel Opinion

Of the 3175 abstracts reviewed, 194 articles met inclusion criteria (**Table 1**). UI and major injury from falls yielded the most results (n=42); results for anticholinergics and depression were sparse (n=12).

Table 1. Article Attrition

Quality Measure Area	Total Articles Identified	Relevant After Abstract Review	Relevant After Full Article Review	Available and Reviewed
UI				
Falls with major injury	637	67	55	42
Hospitalizations/ED visits	317	23	13	13
UTI	126	19	13	13
Pressure ulcers	221	31	24	17
Catheter use	98	10	8	6
ADL decline	192	17	14	14
Locomotion	103	9	7	7
Depression/anxiety	342	31	26	26
Anticholinergics				
Falls with major injury search 1	232	41	32	30
Falls with major injury search 2	255	8	0	0
Dementia	227	8	5	4
Dementia and antipsychotic medications	294	20	16	16
Depression	131	17	12	12

ADL, activities of daily living; ED, emergency department; UI, urinary incontinence; UTI, urinary tract infection.

Advisory panel members agreed with most general conclusions across quality measure areas, except for findings related to the relationship between anticholinergics and antipsychotic medication (**Table 2**).

UI and Quality Measure Areas

Falls With Major Injury

Through the literature search, we identified 42 articles for review; of these, 33 were observational studies, and 9 were reviews. Nearly all (38 of 42) articles identified a significant association between UI and an increased fall risk, with 16 identifying UI as a significant predictor of falls. Most studies did not examine falls with major injury specifically.

In 1 study, UI was an independent risk factor for recurrent falls over 1 year.[20] Advisory panel members agreed that UI is strongly associated with fall risk. OAB and nocturnal incontinence were 2 subtypes implicated by the advisory panel as being associated with falls in LTC facilities. Urge incontinence was implicated as a factor that may contribute to residents repeatedly getting up without help and falling. Panel members suggested that whether a fall resulted in a major or minor injury was largely due to luck.

Hospitalizations/ED Visits

We identified 13 articles for review (10 primary articles, 3 reviews). In the articles evaluated, UI was not found to directly cause hospitalizations; however, if UI was not managed properly, it can lead to adverse health outcomes including UTIs, falls, or skin infections that may result in hospitalizations. One study reported UI as an independent risk factor for unplanned hospitalizations.[21] Of the 13 articles, 8 demonstrated that when UI is well managed, adverse health outcomes may be prevented. All panel members agreed with the literature review conclusions.

UTIs, Pressure Ulcers, and Catheters

For UTIs, we identified 13 articles for review (6 primary, 7 reviews). All articles reported that residents with UI are at a higher risk of UTI. Improper UI management contributed to UTI development in 4 articles; long-term catheter or absorbent pad use contributed to UTI in 2 studies.[22,23] Residents of LTC facilities were significantly more likely to have a UTI compared with age-matched controls.[15] All panel members agreed that UI is associated with UTI. Some panel members suggested that UTIs are over diagnosed in LTC or are often coded and treated incorrectly and may be associated with the overprescribing of antibiotics. Panel members believed that catheterization increases risk of UTIs.

For UI and pressure ulcers, we identified 17 relevant articles (14 observational studies, 3 reviews). Approximately half (8 of 17) showed that UI was a risk factor for pressure ulcers; 5 showed that incontinence was a risk factor for pressure ulcers but did not specify fecal incontinence or UI. Most panel members agreed with these findings but commented

Table 2. Literature Review and Advisory Panel Findings

Quality Measure Area	Is UI Associated With the Quality Measure Area? (Literature Findings)	Advisory Panel Agreement With Findings
UI		
Falls with major injury	UI is strongly associated with increased risk of falls	All panel members agreed with literature findings
Hospitalizations/ ED visits	If UI is not managed properly, it can lead to adverse health outcomes that may result in hospitalization	All panel members agreed with literature findings
UTI	UI is associated with UTIs in nursing home residents	All panel members agreed with literature findings
Pressure ulcer	UI is associated with pressure ulcer development in the nursing home/LTC population	Most panel members agreed with the literature findings
Catheter use	UI is associated with overall catheter use and indwelling catheter use	Most panel members agreed with the literature findings
ADL decline	UI is associated with ADL decline in the nursing home/LTC population	Most panel members agreed with the literature findings
Locomotion decline	There is a relationship between UI and decline in locomotion	Most panel members agreed with the literature findings
Depression/anxiety	There is a strong association between UI and depression or anxiety	Most panel members agreed with the literature findings
Anticholinergics		
Falls with major injury	There is a strong relationship between anticholinergic medication and increased risk of falls	Most panel members agreed with the literature findings
Antipsychotic medication use	Anticholinergic medication usage or anticholinergic burden is associated with more antipsychotic medication use among the nursing home/LTC population	Panel members agreed that anticholinergic medication is associated with dementia/cognitive decline but were unsure whether cognitive decline leads to more antipsychotic medication use; members were unsure of the relationship between anticholinergic medication and antipsychotic use in the nursing home population
Depression	There is mixed evidence of an association between anticholinergic medication use and depression in older adults and the nursing home/LTC population	Panel members agreed with the literature review findings; members had not identified a connection between anticholinergic medication and onset or worsening of depression in nursing home residents

ADL, activities of daily living; ED, emergency department; LTC, long-term care; UI, urinary incontinence; UTI, urinary tract infection.

that medical complexity and frequent immobility of LTC residents complicates understanding the relationship between UI and pressure ulcers. Additional comments included that residents may stop eating or drinking to remain continent, which can contribute to skin breakdown.

For catheter use, we identified 6 articles for review (1 review, 5 best practices/guidelines). UI was associated with overall catheter use and indwelling catheter use. Although catheters may be inserted for residents who have pressure ulcers, who are in hospice, or who have urinary retention issues, guidelines suggest minimizing long-term use because of the risks of UTI and sepsis.[24] Panel members agreed that UI is associated with catheter use, and 1 member suggested that the catheter quality measure has been successful in changing practitioner behavior by reducing indwelling catheter use in LTC facilities.

ADL Decline and Locomotion

For ADL decline, we identified 14 articles for review (11 observational studies, 2 randomized controlled trials, 1 review). UI was associated with ADL decline; however, causality was challenging to establish. Most articles found a relationship between UI and ADL decline or lower ADL scores but did not control for other conditions. In 1 study, UI predicted dependence in total ADLs, toileting, and personal hygiene of residents.[25] Panel members expressed that it was difficult to parse out the relationship between UI and ADLs,

particularly among populations with comorbidities (eg, spinal cord injury, dementia).

For locomotion, we identified 7 articles reporting decline in independent mobility (walking or wheelchair) for review (6 observational studies, 1 review). These articles showed a relationship between UI and locomotion decline; however, additional research is needed to understand the relationship, which can be complicated owing to comorbidities. One study found that restoring continence was associated with improvements in walking.[26] Most panel members agreed with the literature review conclusions and suggested that a lack of locomotion can lead to incontinence owing to difficulty in getting to the bathroom.

Depression, Anxiety

The literature review included both the depression quality measure area and anxiety medication use quality measure area (**Supplementary Table 1**) to broadly assess mental health. We identified 26 articles for review (25 primary, 1 review). Of these, 22 articles revealed a strong association between UI and depression or anxiety. UI severity was associated with increased symptoms of depression and anxiety in 11 studies. OAB was the focus of 2 studies and 1 systematic review of 37 studies. These studies showed a positive association between OAB and depression and/or anxiety.[27-29] Most panel members agreed with the literature review findings, adding that other factors may contribute to the onset or worsening of depression or anxiety. Panelists commented that residents who are cognitively intact and more aware are more likely to experience depression or anxiety.

Anticholinergics and Quality Measure Areas

Falls With Major Injury

We identified 30 articles for review (27 primary, 3 reviews). Of these, 19 articles showed a relationship between anticholinergics and increased fall risk but not falls with major injury; however, 5 of the articles did not show an association. The literature review established a strong relationship between anticholinergics and increased risk of falls. Panel members emphasized that NHs would benefit from greater awareness of the relationship between anticholinergics and fall risk.

Dementia/Cognitive Decline, Antipsychotic Medication Use

For dementia or cognitive decline, we identified 4 articles for review (3 primary, 1 review). All articles reported that increased anticholinergic use or burden is associated with increased dementia or cognitive decline and that exposure to anticholinergics is common among LTC residents with dementia.[16,30-32] Additionally, all studies showed that the adverse effects of anticholinergics were disproportionately higher in older adults with dementia and that older adults with dementia had a greater likelihood of having higher anticholinergic burden than those without dementia.

A separate search was performed to identify whether LTC residents with dementia received antipsychotic medications, which identified 16 articles for review (14 primary, 2 reviews). Antipsychotics were commonly prescribed for residents of LTC facilities, including those with dementia. Panel members agreed that anticholinergic use is associated with greater antipsychotic medication use but were unsure whether cognitive decline leads to more antipsychotic medication use. The panel also agreed that antipsychotics were likely overprescribed in LTC facilities, and overprescribing may be worse in hospitals. Panel members expressed that two-thirds of LTC residents have dementia and that a reduction in anticholinergic prescribing should be prioritized.

Depression

We identified 12 studies for review (5 observational, 3 cross-sectional, 4 randomized controlled trials); 8 included participants with depression. Articles were reviewed for depression if they included the percentage of long-stay residents who have had symptoms of depression during the 2-week period preceding the assessment; however, this did not indicate all patients described were currently receiving treatment for depression. The literature review showed mixed evidence of an association between anticholinergic use and depression: 3 studies showed an association between anticholinergics and depression onset/worsening, whereas 5 reported an association between anticholinergics and reduced or improved symptoms of depression. Panel members agreed with the mixed findings and had not identified a connection between anticholinergics and onset/worsening of depression in LTC residents.

General Advisory Panel Feedback

Advisory panel members did not suggest any additional quality measure area/UI relationships to examine. However, regarding topics related to UI, panel members noted infection control and adverse effects from unnecessary or ineffective drugs were not covered by the current quality measures. For the anticholinergic and quality measure area reviews, panel members suggested that weight loss was a quality measure related to anticholinergics and that dehydration, constipation, fecal impaction, delirium, urinary retention, dementia, and dry eyes are not currently measured by a long-stay quality measure in LTC facilities but are adverse effects associated with anticholinergic use. Multiple panel members noted that they do not prescribe anticholinergics because of the adverse effects. Panelists expressed concern because anticholinergics continue to be prescribed in the LTC setting, and increased awareness of the associated adverse effects is needed.

Additionally, 1 member noted the need for an anticholinergic burden quality measure to aid monitoring of anticholinergic use and to minimize risks of adverse effects. Panel members agreed that the reduction of UI or anticholinergic use would improve the quality measure performance of a facility but would not be sufficient to change a facility's star rating. Panel members commented that hospitalizations, infection control, and antibiotic stewardship are other approaches to measuring and reporting quality or negative outcomes associated with UI or anticholinergic use.

Discussion

In this combined literature review and expert panel discussion, we assessed the associations between NH quality measure areas related to UI and anticholinergic use. Advisory panel members agreed with review findings that UI is associated with falls, UTI, pressure ulcers, and catheter use. The panel also agreed that if UI is not well managed, it can lead to adverse health outcomes that result in hospitalizations. Most members agreed on an association between UI and depression or anxiety, ADL decline, and decline in locomotion.

In general, panel members believed that improvement in pressure ulcers, depression/anxiety, ADLs, and locomotion may reduce UI; however, limited research is available to correlate reducing UI to improved outcomes. Panel members agreed that anticholinergics are associated with falls and with dementia or cognitive decline; however, they felt more research was needed to establish whether cognitive decline leads to more antipsychotic medication use or if anticholinergics are associated with depression. Members had not identified a connection between anticholinergics and onset or worsening of depression. More studies, and in particular controlled trials, are needed regarding the leading causes of antipsychotic prescribing, cumulative anticholinergic burden, and concomitant medications in the LTC setting to better support any associations between medication use and cognitive and psychiatric outcomes.

This analysis showed that among patients with UI, incidence of falls, UTI, and pressure ulcers may contribute to hospitalizations or ED visits, consistent with previous reports that indicate UI is associated with significant HCRU[6,33] and high costs,[8] which may be associated with falls and fractures, depression, and UTIs.[5,8,34] Additionally, adults with OAB with UI have higher overall HCRU, including hospitalizations, ED and outpatient vists,[6,8] suggesting that improved management of UI may decrease overall HCRU.

Because anticholinergics have been shown to contribute to increased fall risk,[11,35,36] care must be taken when prescribing residents in LTC facilities medications from this class. Panel members agreed that UI and anticholinergic use are associated with increased fall risk, as urge incontinence may contribute to LTC residents repeatedly getting up without help and falling.

The American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication Use in Older Adults[37] provides guidance for medication selection with a goal of reducing adverse events associated with medication use. Specifically, avoidance of anticholinergics is recommended because of the risk of confusion, dry mouth, constipation, and other anticholinergic effects. As anticholinergic burden increases with dose, the Beers Criteria further recommends minimizing the number of anticholinergics owing to increased risk of cognitive decline. The advisory panel remarked that Beers Criteria recommendations are not being followed in many circumstances, and anticholinergics are still being inappropriately prescribed in LTC facilities, consistent with previous studies.[38,39]

Given the increased HCRU associated with UI,[8] resident outcomes in the LTC facility may be negatively impacted by UI. F-tags assess deficiencies in LTC facilities and include metrics such as behavioral health, pharmacy services, and quality of care.[40] Although no formal anticholinergic-specific F-tag currently exists, use of anticholinergics could contribute to F-tag designations involving freedom from unnecessary drugs (F-tag 757). The advisory panel commented that there is a reluctance to deprescribe anticholinergics and emphasized the importance of educating clinicians about the newer classes of medications used to treat UI such as β3-adrenergic agonists.

A limitation of this literature review and analysis is the relatively small advisory panel that may not be representative of the views of all clinicians in the LTC field. Although the panel only included 8 members, members had diverse training, job titles, and experience that made each contribution meaningful, yet unique to their profession. Bias in quality measure selection may also be a limiting factor.

Conclusions

Both UI and use of anticholinergic medications can separately impact HCRU and resident outcomes assessed by some Centers for Medicare & Medicaid Services quality programs in LTC facilities. The results of this literature review and advisory panel discussions highlight the need to increase education about anticholinergic burden and improved management of UI. ■

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Urinary Incontinence and Use of Anticholinergics Independently Impact Quality Measure Area Performance in Nursing Homes: A Targeted Literature Review and Expert Panel Review

Supplementary Materials

Supplementary Table 1. Selected Quality Measure Areas for Literature Review

Long-Stay Nursing Home Quality Measure	Definition
Falls with major injury	Reports the percentage of long-stay residents who have experienced 1 or more falls with major injury in the target period or within 275 days before the target period
Hospitalizations	Reports the percentage of LTC residents who have had hospitalizations associated with UI in the target period
ED visits	Reports the ratio of outpatient ED visits (ie, ED visits that did not result in an inpatient hospital stay or outpatient observation stay) per 1000 long-stay resident days
UTI	Reports the percentage of long-stay residents who have had a UTI during the target period
Pressure ulcer	Reports the percentage of long-stay, high-risk residents with stage II–IV or unstageable pressure ulcers
Catheter use	Reports the percentage of low-risk, long-stay residents who have had an indwelling catheter in the last 7 days
ADLs	Reports the percentage of long-stay residents whose need for help with late-loss ADLs (ie, bed mobility, toileting, transfer, eating) has increased when compared with the previous assessment
Locomotion decline	Reports the percentage of long-stay residents who experienced a decline in independent locomotion (walking or wheelchair use) during the target period
Depression	Reports the percentage of long-stay residents who have had symptoms of depression during the 2-week period preceding the assessment
Antianxiety medication use	Reports the percentage of long-stay residents who used antianxiety medication in the target period
Antipsychotic medication use	Reports the percentage of long-stay residents who are receiving antipsychotic drugs in the target period

ADL, activities of daily living; ED, emergency department; LTC, long-term care; UI, urinary incontinence; UTI, urinary tract infection.

Supplementary Materials

Supplementary Table 2. Search Terms for Literature Review

Search Concept	Terms	Filters
Urinary incontinence		
Falls with major injury	(falls AND urinary incontinence) OR (falls AND urinary incontinence AND nursing home) OR (falls AND urinary incontinence AND long term care) OR ((falls OR injury OR fracture) AND urinary incontinence AND long term care) OR ((falls OR injury OR fracture) AND urinary incontinence AND nursing home)	Date: 2000-2020
Hospitalizations/ ED visits	(hospitalization OR emergency department OR healthcare utilization) AND urinary incontinence AND (nursing home OR long-term care)	Date: 2010-2020
UTI	(urinary incontinence AND (urinary tract infection OR UTI) AND nursing home) OR (urinary incontinence AND (urinary tract infection OR UTI) AND long term care)	Date: 2000-2020
Pressure ulcer	(pressure ulcer AND OAB) OR (pressure ulcer AND urinary incontinence) OR (pressure ulcer AND OAB AND nursing homes) OR (pressure ulcer AND urinary incontinence AND nursing home) OR (pressure ulcer AND OAB AND long term care) OR (pressure ulcer AND urinary incontinence AND long term care)	Date: 2000-2020
Catheter use	(catheter AND overactive bladder AND nursing home) OR (catheter AND urinary incontinence AND nursing home) OR (catheter AND overactive bladder AND long term care) OR (catheter AND urinary incontinence AND long term care)	Date: 2000-2020; language: English
ADLs	((ADL OR activities of daily living) AND urinary incontinence) OR ((ADL OR activities of daily living) AND urinary incontinence AND nursing home) OR ((ADL OR activities of daily living) AND urinary incontinence AND long term care)	Date: 2000-2020
Locomotion decline	((locomotion OR mobility) AND urinary incontinence AND nursing home) OR ((locomotion OR mobility) AND urinary incontinence AND long term care)	Date: 2000-2020
Depression/ anxiety	((depression OR anxiety OR mental health) AND urinary incontinence) OR ((depression OR anxiety OR mental health) AND urinary incontinence AND nursing home) OR ((depression OR anxiety OR mental health) AND urinary incontinence AND long term care)	Date: 2000-2020
Anticholinergic medication		
Falls with major injury	Search 1: (falls AND anticholinergics) OR (falls AND anticholinergics AND nursing home) OR (falls AND anticholinergics AND long term care) OR ((falls OR fracture OR injury) AND anticholinergic AND nursing home) OR ((falls OR injury OR fracture) AND anticholinergic AND long term care)	Date: 2000-2020
	Search 2: (falls AND (anticholinergics OR antimuscarinics) AND United States) OR (falls AND (anticholinergics OR antimuscarinics) AND long term care AND United States) OR ((falls OR fracture OR injury) AND (anticholinergic OR antimuscarinics) AND long term care AND United States) OR ((falls OR fracture OR injury) AND (anticholinergic OR antimuscarinics) AND United States)	Date: 2000-2020
Antipsychotic medication use	Search 1: ((dementia OR cognitive impairment) AND (anticholinergics OR antimuscarinics)) OR ((dementia OR cognitive impairment) AND (anticholinergics OR antimuscarinics) AND nursing home) OR ((dementia OR cognitive impairment) AND (anticholinergics OR antimuscarinics) AND long term care)	Date: 2000-2020
	Search 2: (dementia AND antipsychotics AND nursing home) OR (dementia AND antipsychotics AND long term care)	Date: 2000-2020
Depression	(depression AND (anticholinergics OR antimuscarinics)) OR (depression AND (anticholinergics OR antimuscarinics) AND nursing home) OR (depression AND (anticholinergics OR antimuscarinics) AND long term care)	Date: 2000-2020

ADL, activities of daily living; ED, emergency department; UTI, urinary tract infection.