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**ARTICLE**

# *The estimated economic burden of urinary incontinence-related complications in older adults Canada*

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***Backgrounds:*** *Urinary incontinence (UI) is increasingly prevalent, particularly in older adults. UI management is frequently under-resourced and is associated with the development of potentially avoidable complications, placing a significant burden on the patient and on the healthcare system. This study aimed to estimate the cost of UI-related complications in Canada.*
***Methods:*** *We conducted a comprehensive literature review using PubMed, Canadian Institute for Health Information (CIHI) data and citation mining to identify the prevalence of UI, UI-related complications, and associated treatment costs across each of acute care, long-term care (LTC), homecare and self/family care. UI-related complications quantified included: urinary tract infections (UTI), catheter-associated UTI, incontinence-associated dermatitis (IAD), UI-related pressure ulcers (PU), slips and falls, and fall-related injuries. The total economic burden to the Canadian healthcare system was estimated using UI prevalence, complication rates, and costs of treating complications in each setting.*
***Results:*** *The estimated number of older Canadians with UI totaled 2,338,503 with an annual economic burden of UI-related complications up to $1,654,875,326. Acute care had the highest cost (up to $1,190,494,315), driven by skin-related complications (up to $525,692,182 for PU and $471,461,636 for IAD). Fall-related injuries, followed by UTIs, imposed the highest cost in LTC, homecare and self/family care, totaling up to $309,141,175 and $126,305,519, respectively. LTC had the lowest overall complication burden (up to $49,408,153), roughly one-third the cost in homecare, and one-fifth the cost in self/family care.*
***Conclusions:*** *UI and its associated complications represent a substantial economic burden to the Canadian healthcare system. This underscores the need for improved UI management strategies to contain associated costs.*

**Key Words:** Urinary incontinence, urinary tract infection, dermatitis, pressure ulcer, falls, economic burden of disease

## Introduction

Urinary incontinence (UI), defined as the involuntary loss of urine,[1] is a common condition, especially in older adults and women.[2] In the Canadian population, the prevalence of UI continues to increase as the population contains a growing proportion of older adults.[2] UI has a significant impact on the quality of life, psychological well-being, and social functioning of individuals and their caregivers.[3] UI also imposes a substantial economic burden on the person, society and the healthcare system incurring direct, attributable to care and treatment, indirect, due loss of work productivity, and intangible, for example costs related to social isolation, costs.

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Direct costs of UI include the expenses associated with assessment, diagnosis, treatment, and management. The most significant costs reported are spent on routine care and UI management.[4]

The costs attributable to managing complications associated with UI remain poorly quantified and understood across healthcare settings. UI management is often poorly resourced and underprioritized. For many, UI is considered either a lifestyle problem or hygienic challenge rather than a medical condition,[5] despite WHO acknowledgement.[6] The most common complications related to UI are skin breakdown, including incontinence-associated dermatitis (IAD) and pressure ulcers (PU), falls and fractures, urinary tract infections (UTI) and/or catheter associated urinary tract infections (CAUTI), which can lead to delirium.[7–10] The economic burden of UI-related complications in Canada has not been quantified to date. This economic review aimed to use available epidemiological data to estimate the cost of each complication across different health care settings for the UI population.

## Methods

A targeted literature search was conducted to estimate the prevalence of UI segmented across acute care, long term care (LTC), homecare and self/family care. Here, acute care refers to patients admitted to hospital; LTC consists of long-term care including nursing homes, continuing care facilities and residential care homes where facilities provide health and personal care to residents requiring access to 24-h care; homecare includes people receiving services at home including nursing or health care from individuals who are not family, friends or neighbours; and self/family care includes those living at home not receiving homecare services and are either caring for themselves or receiving care from their family.

This paper quantified the economic burden associated with: UTI, CAUTI, IAD, PUs and fall-related injuries, as their prevalence and cost are adequately defined in literature. Although multiple complications may occur simultaneously, each complication was modeled independently based on data that was available and for analytical consistency. CAUTI was included as a subset of UTI and not factored into the final calculations. Additionally, although the prevalence of slips and falls was quantified, only severe "injurious falls" resulted in significant healthcare costs and was included in the final economic calculation. Complications that were poorly defined and/or poorly quantified in literature were excluded (e.g., deliria), as well as indirect and intangible costs such as expenses relating to informal care, transportation, lost wages, associated depression, etc. Acute care complications were defined as those that were reported as being acquired in hospital included adults under 65 years old for certain estimates where age stratified data were unavailable.

A comprehensive literature search was conducted using PubMed, Canadian Institute for Health Information data, and citation mining for each UI complication to capture prevalence and cost data, segmented by care settings. Due to the immense variation in reported values for both prevalence and costs, a prioritization strategy was developed to utilize the most accurate and relevant data for each value rather than use a data range. Canadian publications and Canadian national data (e.g., CIHI) were prioritized when available. The search included publications after 2000, with most recent publications utilized when possible. A decision to adopt conservative estimates of prevalence and cost burden was made to avoid the potential inflation of complication costs. Exceptions were made based on expert consultation and limitations of the data.

Prevalence and costs were then applied to the population data to get estimates of prevalence of complications within each care setting as well as total costs of treatment for each care setting. Cost estimates are reported in 2025 Canadian dollars, using the OECD health and hospital services purchasing power parity when necessary, and inflated using the Bank of Canada Inflation Calculator.[11]

## Results

### *Prevalence of urinary incontinence*

The estimated number of older Canadians living with UI was 2,338,503 with prevalence varying across care setting (Table 1). LTC had the highest reported prevalence (66.7%), but the lowest UI total population (132,199) compared to the others. Acute care had the lowest prevalence of UI (10.5%), but a larger total population (320,445), similar to homecare (303,666). However, the greatest UI population was in the self/family care group with an estimated 1,582,193 individuals.

### *Prevalence of complications*

Prevalence estimates of each complication across care settings are presented in Table 2. Slips and falls and UTIs affected the greatest number of people (707,641 and 784,620, respectively). A high prevalence for both complications is seen across each care setting, except

TABLE 1. **Prevalence of UI in each care setting**

| | Acute care | LTC*,** | Homecare**,*** | Self/Family care (65+) | Total |
|---|---|---|---|---|---|
| **Population** (number) | 3,051,855[12] | 198,200[13] | 946,000[14] | 6,675,921[13–15] | 10,871,976 |
| **UI (%)** | 10.5%[16] | 66.7%[17] | 32.1%[18] | 23.7%[2] | – |
| **UI (Number)** | 320,445 | 132,199 | 303,666 | 1,582,193 | 2,338,503 |

Note. LTC, long-term care. UI, urinary incontinence.
*The LTC population is assumed as number of long-term care beds reported in Canada. **The UI prevalence consist of individuals reporting "frequently incontinent" and "incontinent" in residential and community settings, respectively (excludes hospital-based care). ***The homecare population excludes Canadian Territories.

in acute care; here IAD represented the most frequent complication (21.68%). In acute care, 41.6% of UTIs were attributed to CAUTI. UI-related PU was least prevalent across healthcare settings (3.3–3.8%).

### *Economic costs associated with treating UI-related complications*

Costs per complication across the defined healthcare settings are presented in Table 3 and consist of UTI, IAD, PUs, and fall-related injuries. The cost of treating complications was highest in acute care, across all complications. The cost for treating UTI, stage 4 PU, and fall-related injuries was the same in LTC, homecare and self/family care, assuming the cost of antibiotics and a general practitioner visit for UTI, and that stage 4 PU would require acute care treatment. The highest complication cost ($43,198) was for a hospital-acquired pressure injury. This cost represented a weighted average across PU stages.

### *The total economic burden of UI-related complications on the older Canadian population*

The total annual cost burden of UI in Canada is presented in Table 4. The total economic burden of all complications was estimated to be up to $1,654,875,326. Over 70% of this total economic burden was borne in acute care with PU being the costliest complication followed by IAD, highlighting the burden of skin-related injuries. Due to the inherent correlative nature of these data, a sensitivity analysis was performed (Figure 1), to highlight the range of costs that could be attributed directly to UI vs. confounding factors.

## Discussion

This paper aimed to quantify the impact of UI-related complications for older adults across Canadian healthcare settings, to inform healthcare leaders and policymakers. With an aging population, a growing shift towards non-hospital care, and an ongoing healthcare worker shortage, effective UI management is increasingly important. While this analysis focuses on the older adult population, data limitations required inclusion of some adult populations—particularly in acute care—likely leading to underestimates of both prevalence and cost. Compared to adult populations, older adults may have an increased risk of complications due to poorer overall health, skin fragility, immobility, and more concomitant comorbidities, leading to prolonged treatment times, inpatient length of stay and associated costs.

Acute care bore the highest total economic burden with an estimate of up to $1.1 billion in costs annually for treatment of UI complications. Contributing factors include higher hospital overhead, more skilled healthcare workers, and sicker, more complicated patients. The costliest complications in acute care were skin related injuries (IAD and PUs), with IAD having the highest prevalence. UI isn't typically seen as a direct cause of pressure ulcers, but prolonged exposure to moisture can weaken the skin and significantly increase its vulnerability to injury, especially in immobile patients.[20,34] Attributable causes include inappropriate overuse of all-in-one absorbent pads,[35] as well as diapers and briefs which may contribute to skin breakdown and IAD, particularly in older adults with reduced dermal integrity and delayed wound healing. Understaffing and a lack of knowledge of skin related UI complications can also limit proper patient care. As the awareness of IAD prevalence and cost burden increases, devices like external urinary collection devices and condom catheters offer an alternative to pads.[36–38]

PU treatment represented the single largest economic complication burden across all healthcare settings, largely driven by the cost to treat it in the acute care setting. The sensitivity analysis in Figure 1, shows that even if 50% of PU estimated costs are

TABLE 2. **Prevalence of UI complications**

| | Acute care | LTC | Homecare | Self/Family care | Total |
|---|---|---|---|---|---|
| **UTI** | | | | | |
| % | 2.5%[19] | 42.6%[8] | 54.5%[8] | 30.2%[8] | – |
| Number | 8011 | 56,317 | 165,498 | 477,822 | 707,641 |
| ***CAUTI (% defined as subset of UTI)**** | | | | | |
| % | *41.6%*[19] | *5.6%*[17] | *4.6%*[18] | *N/A* | – |
| Number | *3329* | *3154* | *7613* | *N/A* | *14,095* |
| **IAD** | | | | | |
| % | 21.68%[20] | 7.9%[8] | 9.2%[8] | 6.7%[8] | – |
| Number | 69,476 | 10,444 | 27,937 | 106,007 | 213,864 |
| **UI-related PU**** | | | | | |
| % | 3.8%[16] | | 3.3%[21] | | – |
| Number | 12,169 | 4363 | 10,021 | 52,212 | 78,765 |
| **Slips and falls***** | | | | | |
| % | 1.45%[22,23] | 47.1%[8] | 71.7%[8] | 31.6%[8] | – |
| Number | 4652 | 62,266 | 217,729 | 499,973 | 784,620 |
| **Fall-related injuries****** | | | | | |
| % | 30.0%[22,23] | 37.37%[8] | 38.77%[8] | 20.89%[8] | – |
| Number | 1396 | 23,267 | 84,419 | 104,425 | 213,507 |

Note. *CAUTI, catheter-associated urinary tract infections; IAD, incontinence-associated dermatitis; LTC, long-term care; PU, pressure ulcer; UI, urinary incontinence; UTI, urinary tract infection.*
**CAUTI in LTC and homecare is calculated as percentage of individuals reported to have a catheter in these settings vs. actual CAUTI rates. Assumes no self-catheterization in self/family care so no potential CAUTI in this setting. **PUs in continuing care, homecare and self/family care come from survey of acute, LTC and rehab incontinent patients (urinary and fecal). Estimate consists of facility-acquired, not device-related and occurring on pelvic site PUs. ***Slips and falls prevalence estimates for acute care were calculated using rate of inpatient falls per patient day, the average length of stay of a patient in acute care and percentage of falls related to toileting activities to ensure that it captures UI-relevant slips and falls. ****Fall-Related injuries consist of falls that result in injury. This estimate is not additive to slips and falls, but a further subset.*

attributed to UI, it is still costing the Canadian healthcare system $354 million annually. PU treatment costs varied greatly by stage and predominantly stemmed from increased length of stay (LOS), nursing time, materials and fixed hospital overhead. Stage three PU involves full thickness skin loss, sometimes extending into the subcutaneous tissue layer, with stage four continuing to bone.[39] And, although rare, such severe cases can require surgical intervention and negative pressure wound therapy[39] contributing to the large treatment cost. The cost of treating hospital acquired pressure injuries in our analysis (up to $43,198 CAD 2025) was considerably higher than an alternative estimate found, $10,706 USD ($12,416 CAD 2025) by Padula and Delarmente,[29] when accounting for the same PU staging weights. However, these cost estimates had no age restriction, whereas Chan et al.[30] included only adults 65 years of age and older, which may have led to additional costs due to more fragile skin and more health conditions than in younger adults. Data from Chan et al.[30] was used as it comprised Canadian data, adding considerable value to this paper.

While hospital-acquired UTIs have been well studied (mainly attributable to financial penalties for hospital-acquired infections in US hospitals), this economic analysis suggests that relative to IAD and PU, UTIs are over 40× less costly to the hospital setting (up to $11 vs. $0.47 billion, respectively). Indwelling urethral catheters, commonly used in acute care, increase the risk of CAUTI (accounting

TABLE 3. **Cost to treat each episode of UI complications (CAD 2025)**

| Complication | Acute care | LTC | Homecare | Self/Family care |
|---|---|---|---|---|
| **UTI*** | $1413[24] | | | $181[25] |
| **IAD** | $6786[26] | $127[27,28] | | $17[27,28] |
| | | $984[31] | $480[31] | $282[31] |
| **UI-related PU**** | $43,198[29,30] | ***Costs of stage 4 PUs presenting to acute care for care/Treatment*** | | |
| | | | | $35,916[30,31] |
| **Fall-related injuries***** | $15,478[22,32] | | | $1457[33] |

Note. *IAD, incontinence-associated dermatitis; LTC, long-term care; PU, pressure ulcer; UI, urinary incontinence; UTI, urinary tract infection.*
**UTI costs were weighted to account for responsiveness to initial treatment. Assumed that LTC, homecare and self/family care populations are seeking treatment for their UTI through a physician-initiated treatment plan. **PU costs were weighted by staging prevalence across healthcare settings. LTC PU costs assumed daily nursing visits, homecare assumed nursing visits 1–3 times a week depending on staging, and self/family care assumed no nursing visits. ***Acute care fall-related injuries were weighted to account for proportion of fracture (excluding hip fracture) and non-fracture injuries.*

TABLE 4. **Total estimated cost burden of UI complications in Canada (CAD 2025)**

| Complication | | Acute care | | LTC | Homecare | Self/ Family care | Total |
|---|---|---|---|---|---|---|---|
| **UTI** | | $11,309,451 | | $10,166,898 | $29,877,349 | $86,261,272 | **$137,614,970** |
| **IAD** | | $471,461,636 | | $1,326,879 | $3,549,430 | $1,848,761 | **$478,186,707** |
| | | $525,692,182 | | | | | |
| **UI-related PU*** | *Stage 4 from Long-term care* | *Stage 4 from homecare* | *Stage 4 from self/Family care* | $4,003,750 | $4,483,797 | $13,721,700 | **$708,330,011** |
| | $10,509,388 | $24,140,381 | $125,778,813 | | | | |
| **Fall-related injuries** | | $21,602,463 | | $33,910,627 | $123,036,687 | $152,193,861 | **$330,743,638** |
| **Total** | | **$1,190,494,315** | | **$49,408,153** | **$160,947,263** | **$254,025,594** | **$1,654,875,326** |

Note. *IAD, incontinence-associated dermatitis; LTC, long-term care; PU, pressure ulcer; UI, urinary incontinence; UTI, urinary tract infection.*
**Assumed Stage 4 PUs from LTC, homecare and self/family care will be hospitalized with a primary reason for treatment of PU. Costs from these patients are included in the acute care setting.*

for 41.6% of all UTIs in acute care setting), and this risk increases the longer the catheter remains in place. The cost of treating UTI in acute care ($1413/episode) stems from antibiotics, diagnostic tests and inpatient costs, and is weighted for patients unresponsive to initial treatment. Hospitalized patients are particularly vulnerable to antimicrobial resistant bacteria,[40] complicating treatment and raising costs. Emerging catheter-management approaches, such as early removal protocols and same-day catheter-free discharge strategies, may decrease complication rates and associated costs in the acute care setting by reducing catheter-related risks and shortening inpatient exposure.[41]

In non-acute settings, UTI prevalence ranges from 30.2% to 54.5% and costs up to $126 million. Although the prevalence of UTI was greater in LTC and homecare settings compared to self/family care, the total economic burden was highest in the latter, up to $86 million annually, amounting to over 60% of the total annual spend. This is mostly attributable to the number of people living at home (1,582,193). The cost of treating UTI at home is low ($181), which includes the cost of antibiotics and a general practitioner visit.[25] Individuals with UI living at home who develop a UTI typically present to their family physician, placing added strain on a Canadian-primary care system already facing significant shortages in Canada. The development of associated delirium,

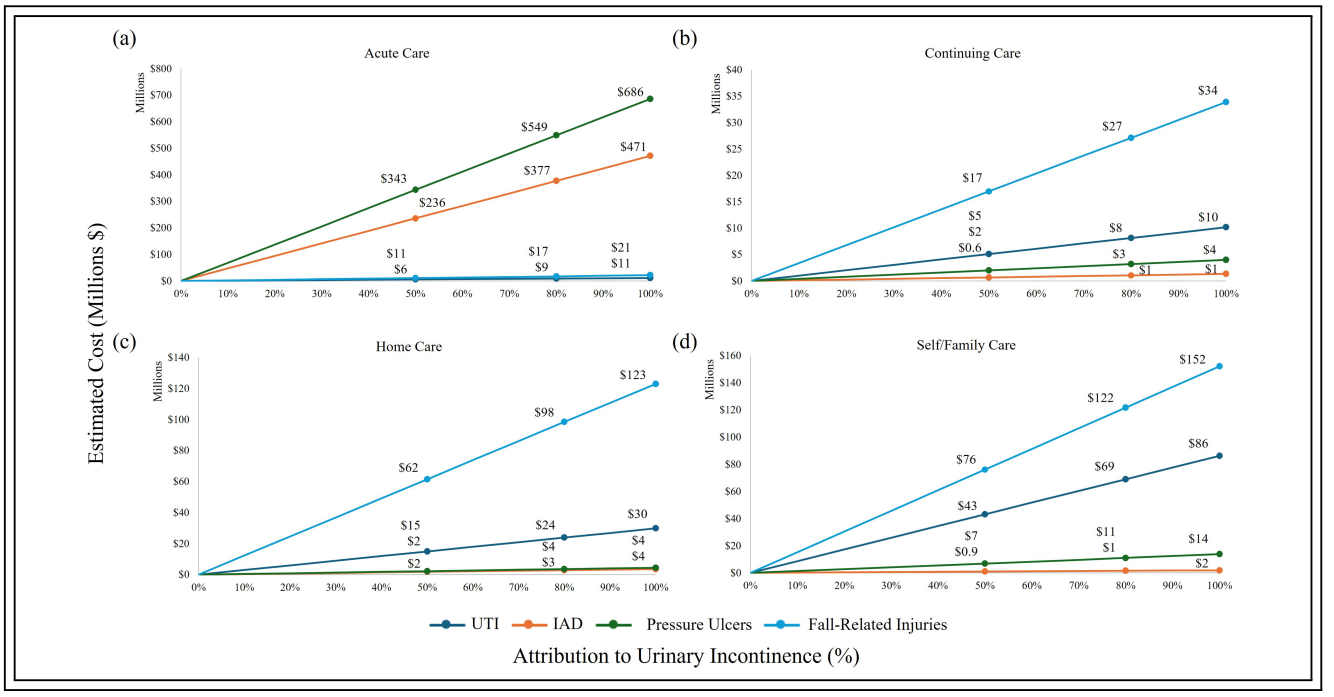


**FIGURE 1.** Sensitivity analysis of the economic burden by proportion attributed to urinary incontinence, segmented by (a) acute care (b) continuing care (c) homecare, and (d) self/family care

which can lead to emergency department visits, could not be quantified. However, delirium requires expensive diagnostic testing; complicated treatment and is associated with prolonged hospital stays, further increasing healthcare costs and resource demand.[10]

Generally, the cost of managing UI at home (self/family care) is associated with the lowest economic burden, as there is no healthcare worker involved.[41] One study in a Canadian nursing home found that the mean nursing time spent each day managing incontinence represented over 83% of incontinence management costs.[42]

Where healthcare staff are increasingly in short supply, limited staffing has been associated with an increase in hospital harm events. Specifically, CIHI reported an increase in UTI prevalence during and post COVID-19 pandemic associated with a decrease in hospital staffing (increase in non-physician in patient service hours, i.e., staff overtime).[43] UI complications could therefore be reduced by appropriate hospital staffing, and as well as adopting innovative technologies that minimize complication risk, and enabling best practice, assuming funding/reimbursement allows.[44]

Fall-related injuries had the highest cost in the self/family care setting (up to $152 million annually), accounting for about half the total complication cost to the healthcare system. Homecare accounted for up to $123 million in annual costs, attributable to a lower population base. Although the connection between UI and falls is largely associative, UI is more common with frailty and impaired mobility.[9] Some hypothesize that a strong desire to void could change gait parameters, increasing fall risk.[45] There is a strong association between nocturia and risk of falling.[46] Few studies have addressed fall reduction as an outcome of continence management and there remains a research gap.[47]

There are many indirect and societal costs not considered in this paper, such as those associated with LTC admission, estimated to account for 14% of the total UI cost.[5] Intangible costs were not included in our analysis. UI care threatens patient dignity,[48] and contributes a negative impact on psychological and social wellbeing, all risk factors for ill health.[4] Severity of depression is also associated with increased UI severity in female patients.[49] Additionally, UI is associated with decreased labour productivity, adding to cost.[50] Moreover, UI and its complications have a large societal burden on family caregivers, whose emotional burden worsens as patient complications increase.[51] This further underscores the need to reduce complications aside from the motives of economic burden alone.

## Limitations

Although this paper provides a starting point to understand the economic impact of UI complications, there are many limitations to this analysis.

Firstly, because of the paucity of Canadian data, some US and international data were used assuming that complication rates are similar across countries. However, there may be differences in policies leading to underestimation of complications. For example, in Canada, hospitals are not financially penalized for hospital acquired infection, which may lead to stronger efforts to minimize UTIs in the US vs. Canada. Secondly, in some healthcare settings it was not possible to directly attribute complication prevalence rates to UI. For example, for falls in acute care, general toilet-related fall rates were used which may not be solely reflective of the UI population. This paper highlights the burden of complications in urinary incontinence populations, primarily based on correlative research of urinary incontinence and the associated complications. The sensitivity analysis in Figure 1 aims to acknowledge these limitations and presents estimates of costs with varying attribution of complications to UI.

Costs related to PU treatment and IAD were reported per day[27,28,31] and the time to heal these wounds varies significantly by severity. Conservative estimates of treatment length were adopted, potentially underestimating the true burden. Furthermore, IAD and stage 2 PU definitions sometimes blur in clinical practice and one can be misdiagnosed as the other,[20] potentially resulting in double counting. Furthermore, IAD may increase the risk of PU; however, this relationship is not captured in the data, which reflects only a single timepoint, rather than tracking progression.

This analysis, through the use of prevalence data, does not account for the cost of multiple concurrent complications, repeat complications in any year or potential progression of complications such as IAD which potentially increase the risk of PU. This underestimates the associated cost. There was an absence of economic papers directly linked to UI attributable complications, so some costs reflect all patients who experienced that complication regardless of UI status. As UI is correlated to other complications that may increase the cost of treatment, we may have underestimated those total costs.

Despite these limitations, our analysis offers critical insights into the economic burden of UI on the Canadian healthcare system. Conservative approaches were utilized, establishing a strong foundational understanding of burden for healthcare stakeholders. While some estimates may underrepresent the total cost of UI complications, the study successfully underscores the overlooked impact of certain UI complications in an aging population, bringing to light the need for innovation and funding towards UI patient care.

## Future Directions

As healthcare systems transition to more cost-effective models, funding must be directed towards addressing staffing, supporting appropriate products and devices and best practices in continence care to reduce these complications. The adoption of innovative technologies such as smart sensors and external catheters has the potential to improve care delivery and reduce caregiver burden. Investing in these solutions is crucial in ensuring that older adults receive safe, effective, and compassionate care across all settings. Additionally, our study highlights the paucity of Canadian specific data on UI complications, calling attention to the need for more research in UI populations to catalyze improvements in patient care.

## Conclusion

With an estimated 2.3 million Canadians with UI, resulting complications were estimated to levy a total annual $1.65 billion economic burden to the Canadian healthcare system. This study highlights the need for targeted innovation to reduce the burden of UI associated complications.

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## Author Contributions

The authors confirm contribution to the paper as follows: Conceptualization, Crystal Su, Casandra Gardner, Andrea Shepherd and Adrian Wagg; method, Crystal Su, Casandra Gardner and Andrea Shepherd; formal analysis, Crystal Su and Barrett Carley; writing—original draft preparation, Crystal Su, Barrett Carley and Casandra Gardner; writing—review and editing, Crystal Su, Casandra Gardner and Adrian Wagg; supervision, Adrian Wagg. All authors reviewed and approved the final version of the manuscript

## Availability of Data and Materials

Data available within the article.

## Ethics Approval

Not applicable.

## Conflicts of Interest

Crystal Su, Barrett Carley, Casandra Gardner and Andrea Shepherd at the time of publication draft, are employees of Becton Dickinson Medical Affairs. Adrian Wagg: speaker honoraria: Astellas Pharma, Becton-Dickinson. Research support: Essity Hygiene and Healthcare AB, Becton-Dickinson.

## Abbreviations

| | |
|---|---|
| CAUTI | Catheter-associated urinary tract infection |
| CIHI | Canadian institute for health information |
| IAD | Incontinence-associated dermatitis |
| LTC | Long-term care |
| PU | Pressure ulcer |
| UI | Urinary incontinence |
| UTI | Urinary tract infection |

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