Peer review
The link between chronic conditions and urinary incontinence

Abstract
Urinary incontinence is commonly associated with chronic diseases. Strong associations exist between continence problems, impairments outside the lower urinary tract and activity limitations. These associations also occur in diseases that directly affect the neurological control mechanism for continence. The World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) provides a paradigm for thinking about disease and its consequences, including urinary incontinence. This paper reviews the association between disease, impairment and activity limitation for some common chronic diseases and for older adults. The complexity of the relationships between different aspects of urinary incontinence has important implications for the assessment and management of urinary incontinence in chronic disease and for older adults.

Keywords: Urinary incontinence, chronic disease, functional impairment, continence mechanism

Introduction
Urinary incontinence can occur as an isolated condition but it can also occur in the context of other health problems. This context can be quite complex and a useful way of thinking about urinary incontinence is the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF), which provides a paradigm for thinking about disease and its consequences for the individual and for society.

The classification is made up of a hierarchy, interactions between different levels of the hierarchy and the relationship with factors outside an individual. Figure 1 summarises the relationships in this classification.

A pathological process or disease is the tissue- and organ-related damage caused by deterioration or an outside agent such as injury or infection. Impairment is a loss or abnormality of body structure or of a physiological function, for example loss of a limb or loss of vision. Detrusor overactivity is an example of continence-related impairment. An activity is the nature and extent of functioning at the level of the person. Activities may be limited in nature, duration and quality. Activity limitation corresponds to the term ‘disability’ in the earlier version of ICF, the International Classification of Impairments, Disabilities and Handicap (ICIDH).

Limitations of mobility (transferring from bed to chair, sit to stand, ambulation on level surfaces and climbing steps), dressing, grooming (shaving, make-up, brushing teeth and hair), feeding oneself and continence and toileting tasks are activity limitations with respect to basic activities of daily living. Limitations of meal preparation, shopping, housework and clothes washing, getting out of the house and managing financial matters are activity limitations with respect to advanced (sometimes called instrumental) activities of daily living.

Participation is the nature and extent of a person’s involvement in life situations in relation to impairments, activities, health conditions and contextual factors. Participation may be restricted in nature, duration and quality, such as participation in community activities and obtaining a driving licence. Participation restriction corresponds to the term ‘handicap’ in the earlier version of the ICF.

Contextual factors include physical conditions such as climate or terrain, as well as aspects of the social and human-built environment, such as social attitudes, laws, policies and social and political institutions. Contextual factors relevant to continence may include the location and access to toilets in private dwellings and in public spaces.

This classification is useful because it emphasises the individual in their social context and it is not a purely medical model as it emphasises the multiple ways in which disability, in the wider sense of the word, can be approached.
This classification does not distinguish the time course of a particular health condition and can apply both to new, self-limited, conditions as well as conditions that continue for some time. For the purposes of this paper, however, we will consider conditions that last for 6 months or longer. This is concordant with the Australian Bureau of Statistics’ definition of ‘chronic’ and also with the New Zealand requirements for the provision of publicly-funded disability support services.

To illustrate the application of this model of disability in relation to chronic conditions and urinary incontinence we will discuss stroke, dementia, Parkinson's disease (PD) and multiple sclerosis, as examples of nervous system diseases; osteoporosis, osteoarthritis and low back pain, as examples of musculoskeletal disorders; and diabetes mellitus. Finally we will consider urinary incontinence and older age.

**Conditions affecting the nervous system**

**Stroke**

Overall stroke is the most common neurological cause of disability. Although three-quarters of new strokes affect people older than 65 years, stroke is also an important cause of disability in younger people. The incidence of stroke increases with age. The annual incidence is 1:1000 for people aged 54 to 64 but increases to 1:30 for people aged 85 years and older.

New Zealand data shows the incidence of new stroke is around 190 per 100,000 per year. The 1-year survival rate for stroke is around 60%. In addition to those with new stroke there are around 430 survivors of stroke from previous years per 100,000 population. The prevalence of urinary incontinence in the acute phase of stroke is between 50 and 70%; however, the prevalence in survivors of stroke at 6 months is around 15%.

Around 50% of 1-year survivors of stroke also have a mobility activity limitation. Besides urinary incontinence, bothersome lower urinary tract symptoms are very prevalent amongst stroke survivors. A Swedish study found the prevalence of nocturia was 76%, urgency of 70% and daytime frequency of 59%.

The severity of the symptoms was worse in those with lower limb impairments. A strong association has also been found between overall outcome after stroke, urinary incontinence and the need for help with transfers. Cognitive function, including attention impairment, is also associated with poor outcome after stroke and with urinary incontinence.

Detrusor overactivity is an important bladder impairment related to urinary incontinence after stroke; however, normal urodynamic studies have also been found in stroke survivors with urinary incontinence. Thus impairments, other than those affecting the bladder and activity limitations, are important determinants of urinary incontinence after stroke.

Although attention impairment and mobility limitations seem to be important determinants of urinary incontinence, other mechanisms may be important in individual patients. Strokes affecting the frontal lobe may lead to difficulties with the ‘social’ aspects of inhibition of voiding; those of the parietal lobes to difficulties with sensing the bladder is filling. In addition parietal lobe abnormalities may give rise to difficulty with language, the left parietal lobe in most people, so that reading toilet signs is difficult. There may be difficulties with finding the way to the toilet, undressing and recognising a toilet, when there are difficulties with praxis (doing) and gnosis (knowing) related to the integrative sensory and motor functions of, usually, the right parietal lobe. Motor deficits can also create difficulties with undressing for toileting.

**Dementia**

Dementia is a syndrome of global cognitive impairment in the absence of delirium. The most common forms of dementia are Alzheimer's disease (AD), vascular brain disease, the combination of the two, and diffuse Lewy body disease. Dementia affects about 0.5 to 1% of people in their 60s; however, the prevalence rises steeply with age, so that by the mid 80s around one-third of older adults have at least moderate dementia.

AD affects many areas of the brain, including parietal, temporal and frontal lobes. Urinary incontinence reaches a prevalence of 100% as the dementia becomes severe. All people with AD have a progressive course, but that of vascular dementia is less predictable. Detrusor overactivity has been demonstrated in about half of study participants with urinary incontinence and dementia. Activity limitations are strongly associated with continence problems in those with dementia and, in particular, mobility limitations. In addition it seems likely that, as for stroke, in individual patients other aspects of cognitive function, such as difficulties with planning, parietal lobe function and memory that accompany dementia also have an important impact on continence.

**Parkinson's disease**

Parkinson's disease (PD) is a relatively uncommon disorder affecting about 1% of older adults. The prevalence of urinary incontinence in PD and the underlying bladder abnormalities are not well understood. A registry-based study of PD in Germany found a 20% prevalence of urinary incontinence. A longer duration of disease was associated with a greater prevalence of urinary incontinence. While it seems likely that those with PD have an increased rate of detrusor overactivity,
some authors suggest that disorders of dexterity, in particular fine motor movements and speed of mobility may be more relevant to the development of incontinence. Some support for this comes from a study that found a strong association between falls in PD, reflecting worse motor and balance impairments and urinary incontinence.

**Multiple sclerosis**

This is the most common non-traumatic nervous system disorder affecting younger adults. The prevalence seems to increase in countries some distance north (United Kingdom) and south (Australia and New Zealand) of the equator. The prevalence in New Zealand is around 50 to 80 per 100,000 with an incidence of new diagnoses of around 5 per 100,000. About 70% of those with multiple sclerosis (MS) have either a relapsing, remitting pattern of disease or a progressive pattern of disease. Urinary symptoms are very common in those with MS and in cross-sectional studies urinary incontinence affects about 25% of people. The lower urinary tract impairments in MS may be quite complex. In addition to detrusor overactivity, lesions which interrupt pathways between the pontine micturition centre and the sacral sensory and motor centres mediating lower urinary tract function may lead to detrusor-sphincter dyssynergia, where the detrusor contracts against a closed external urethral sphincter. Lesions directly affecting the region of the sacral spinal cord related to bladder function may give rise to sensory abnormalities and deficits on bladder muscle contraction. Lower limb impairments and urinary symptoms are associated in MS. While it seems likely that issues of impairments of dexterity and speed of mobility relevant for PD and stroke are also relevant to MS, these do not feature in non-experimental studies of urinary incontinence in MS.

**Conditions affecting the musculoskeletal system**

**Osteoporosis**

Osteoporosis is a disease characterised by reduced bone mineral density, micro-architectural deterioration in bone structure and an increased risk of fracture. The lifetime prevalence of vertebral crush fractures in men and women surviving into their 8th decade is around 35% for men and 45% for women. Fractures of the hip have a relatively low incidence and affect about 3 per 1000 men and 6 per 1000 women aged over 65 per year. A relationship has been found in a large cross-sectional study of women between a doctor’s diagnosis of osteoporosis and overactive bladder, although the poor definition of what constituted a diagnosis of osteoporosis in this particular study means it is not clear if this relationship was with any particular type of fracture.

The relationship between vertebral crush fractures and urinary incontinence has not been explored in detail. Incident vertebral fractures, detected by x-ray, are associated with both an increased rate of lower back pain and activity limitation, even in fractures that do not come to medical attention. Back pain may result in reduced ability to transfers, as suggested by its relationship with activity limitation, reducing the speed with which a person can move to a toilet in response to urinary urgency.

The relationship between hip fracture and urinary incontinence has been explored in several non-experimental studies. Hip fracture is associated with urinary incontinence, although the relationship is complex. A study of community-dwelling, older women found an increased hazard of hip fracture with urge urinary incontinence, but not stress urinary incontinence. The authors hypothesised that the relationship was causal, namely that urinary urgency resulted in attempts to ambulate to toileting facilities at a speed that placed people at increased risk of falling. The same research group has also published evidence that a negative association exists between gait speed and the risk of urinary incontinence. A recent systematic review has also found an association between falls and overactive bladder symptoms but not with stress incontinence.

Other authors have found a similar association between incontinence and hip fracture. Evidence also exists that having had a hip fracture leads to an increased risk of urinary incontinence. Within the population of women who have had a hip fracture, pre-fracture dependence on others for ambulation and use of a wheel chair or device for walking, are associated with developing urinary incontinence after hip fracture repair. Another powerful moderating factor in this study for the development of urinary incontinence was cognitive.
improvement. A prospective study to determine the risk of residence in a long-term care facility followed women after hip fracture and found that incontinence, dependence in ambulation and cognitive impairment were independently associated with an increased risk of moving into care 39.

A network of relationships may relate osteoporosis and, in particular, fragility fracture, to urinary incontinence. Impairments related to mobility activities, such as back pain, decreased balance, speed of muscular contraction and transfer abilities, mean that those with urinary urgency are more likely to be continent. Impairments of bladder function, such as detrusor overactivity or inadequate bladder emptying, in a person who can only increase their speed of transfers or ambulation by increasing their risk of falls, can lead to fractures. Fractures, in turn, by causing muscular weakness, pain and limited range of motion, lead to mobility disorder, which makes those with urinary urgency more likely to be continent. Important moderators of these relationships include cognitive function and medication use. As a particular example opiates are commonly used for pain relief but are associated with an increased risk of constipation.

**Osteoarthritis**

Osteoarthritis is a very common disorder affecting older adults. Survival into later older age is invariably accompanied by radiographic evidence of osteoarthritis although there is a weak association between radiographic changes and symptoms. A typical estimate for the prevalence of osteoarthritis in older adults is that around 15% of older adults have clinically important hip or knee osteoarthritis 40. This figure is higher amongst older adults with activity limitation 41. A relationship probably exists between osteoarthritis and urinary incontinence. One survey of patients with arthritis found nearly half of those with osteoarthritis reported difficulty with urinary continence, particularly in those who took longer to get to the toilet and in those with greater mobility disability 42. Urinary continence problems can result from the direct effects of osteoarthritis of the spine, for example lumbar spinal stenosis 43.

Although the evidence for the association between osteoarthritis and urinary incontinence is not extensive, this prevalent disorder is associated with impairments related to ambulation, for example difficulty in transfers related to reduction in hip and knee range of movement, decreased speed of ambulation related to pain, muscle weakness and balance disorders. This in turn suggests osteoarthritis, particularly of the lower limb, may predispose to urge urinary incontinence.

**Low back pain**

Low back pain, even in the absence of an established diagnosis of osteoporosis or osteoarthritis, may also be associated with urinary incontinence 44, 45. Although speculative, there may be a relationship between dysfunction of abdominal musculature, altered biomechanics related to the development of kyphosis and kyphoscoliosis and increased abdominal cavity pressure induced by these same anatomical abnormalities. All these may predispose to urinary incontinence.

**Diabetes mellitus**

This important metabolic disorder is of increasing concern in Australia and New Zealand. Type 1 diabetes mellitus (DM) is an autoimmune disorder where insulin-producing pancreatic islet cells are destroyed, leading to an absolute requirement for insulin. Type 2 DM is associated with obesity and insulin resistance. Type 2 DM is a prevalent disorder, particularly among older adults affecting as many as 10% of those aged over 65 years. Both type 1 and type 2 DM are associated with urinary incontinence. Over 65% of women with type 1 DM report any urinary incontinence 46. Type 2 DM is also associated with urinary incontinence 47-51 as is impaired fasting glucose 52.

The mechanisms by which DM is causally related to urinary incontinence are not well understood. DM is associated with an increased risk of peripheral and autonomic neuropathy, as well as macrovascular disease such as stroke. DM, particularly type 2, is also associated with obesity which in itself is a risk factor for urinary incontinence. Poorly controlled DM is characterised by persistent blood glucose levels that exceed the renal threshold for excretion, leading to polyuria and nocturia. DM is also a risk factor for urinary tract infections.

Type 1 DM in conjunction with neuropathy, retinopathy and nephropathy was associated with a higher risk of urinary incontinence than in patients without these diabetic complications 46. A similar association between diabetic complications and neuropathy and nephropathy has also been found in type 2 DM 52. An interesting association has also been found between urinary incontinence and low back pain with radiculopathy-like symptoms in DM 31.

In contrast to osteoporosis and osteoarthritis, it seems likely that the association between DM and urinary incontinence operates at an impairment level, rather than at the level of activity limitation. In those with diabetes-related complications that affect lower limb function, such as peripheral vascular disease and lower limb amputation, or stroke, DM may be related to urinary incontinence by means of impairments that affect ambulation.

**Older age and urinary incontinence**

The association between urinary incontinence and older age highlights the complex way that multiple diseases, impairments and activity limitations interact.

Non-experimental studies show strong associations between urinary incontinence, multiple diseases, including those discussed earlier in this paper, impairments and activity limitations. The *Health and Retirement* study has found a strong association between multiple diseases, cognitive impairment,
urinary incontinence and activity of daily living limitation in community-dwelling older adults. Other research has also defined associations between developing urinary incontinence and reduced lower limb strength and mobility limitation and between urinary incontinence and activity limitation and also between multiple diseases and urinary incontinence.

This association has also been found in older adults who live in residential care in the United States and Australia. These associations in our view are best conceptualised using the ICF because of the complex way in which disease, impairments and activity limitations interact. For example, an older adult may have bladder impairment such as detrusor overactivity. This may be associated with a particular disease, such as stroke, or may occur as an ‘isolated’ phenomenon. Strength and balance impairment and painful joints may lead to difficulty with transfers on and off the toilet and speed of access to toilets when a detrusor contraction occurs, leading to urinary incontinence. A number of different diseases could lead to these impairments. However, painful joints and fear of falls may lead to an older adult limiting their mobility and losing strength and aerobic fitness from inactivity. In addition, inactivity can lead to worsening osteoporosis and increase the risk of fracture. Constipation from the use of opiates for pain may directly lead to bladder impairment, such as inadequate bladder emptying, which might worsen the detrusor overactivity.

This paper has not highlighted the role of participation restriction or environmental and contextual factors for urinary continence. The presence of urinary incontinence might discourage adults with disabling diseases and older adults from their usual participation. This may lead to depression and constipation (impairments) and further aggravate continence problems. If public toilets aren’t readily available and accessible, an environmental context, then participation of those with continence problems may be further reduced.

Conclusion

Important chronic health conditions are associated with an increased risk of urinary incontinence. This is best understood by relating the diseases to impairments and activity limitations, but also in understanding the complex way that these can interact, as illustrated by the WHO ICF.

The implications for practitioners are:

- Ask about continence problems in people with chronic health conditions.
- Consider issues outside lower urinary tract function in assessment and management.
- Consider using multidisciplinary strategies to address multiple dimensions of continence in those with chronic health conditions and in older adults.

References

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