

PREVALENCE OF URINARY INCONTINENCE AND ITS ASSOCIATION WITH DECLINED COGNITIVE AND PHYSICAL FUNCTION AMONG COMMUNITY DWELLING OLDER ADULTS: A REVIEW

Resshaya Roobini Murukesu¹, Devinder Kaur Ajit Singh¹ and Suzana Shahar²

¹Physiotherapy Programme, School of Rehabilitation Sciences, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Malaysia

²Community Rehabilitation and Aging Research Centre, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Malaysia

Corresponding Author: Devinder Kaur Ajit Singh

Email: devinder@ukm.edu.my

ABSTRACT

In this review we aimed to determine the prevalence of urinary incontinence (UI) and its association with declined cognitive and physical function among community dwelling older adults. Literature review was performed using multiple online databases including MEDLINE, Science Direct and Wiley Online Library from June 2000 to April 2017. Hand searching of bibliographies of relevant studies was also carried out. The studies included of those conducted from within the last 17 years; assessed and compared according to population characteristics, definition of urinary incontinence, prevalence and its association with cognitive and physical functional decline. Nine studies met the eligibility criteria of this review. Prevalence rates of UI among community dwelling older adults ranged from 10% to 53% (median 32%). Physical functional decline in terms of mobility, locomotion and activities of daily living interruptions were found to be correlated with UI. Although limited, the existing evidence also showed an association between declined cognitive function and UI.

Keywords: community dwelling; older adults; geriatrics; urinary incontinence; cognitive function; physical function; risk factors.

INTRODUCTION

Urinary incontinence (UI) is lower urinary tract dysfunction defined by the International Continence Society (ICS) as an involuntary loss of urine resulting in social or hygienic problems¹. UI has been characterized as a 'cardinal geriatric syndrome' affecting at least 19% and 10% older women and men respectively^{2,3,4}. The prevalence of UI increases with age⁵. Although, found to be more prevalent in women, it reaches a point of equivalence above the age of 80 in both genders^{6,7,8}.

UI among older adults is often unaddressed due to the misconception that it is a part of natural ageing process. UI is associated with institutionalisation among older adults. This is due to its debilitating nature which results in increased socioeconomic and health burden; depression and frailty in older adults^{9,10}. UI is associated with cognitive and physical impairments in frail institutionalised older adults with dementia^{9,11}.

The presence of cognitive and physical impairments, collectively termed as 'functional incompetence' appear to be common among older adults dealing with UI¹². The importance of these functional domains in the aim of maintaining continence has been established in the 'Chain of Continence'¹³. High motivation and good mental status is vital in providing inhibition to void, followed by sufficient mobility to use the toileting facility independently in time.

There is an evident underrepresentation of community dwelling older adult population in addressing the association of UI with declined cognitive and physical function. Current knowledge of the prevalence of UI among community dwelling older adults is essential for prevention and management strategies, prolong independent living and reducing likelihood of institutionalisation. Hence, in this review we aimed to address two research questions: What is the 1) current known prevalence of UI and 2) association between UI and declined cognitive and physical function among community dwelling older adults?

METHODS

Search Strategy

Studies published in English language from June 2000 to April 2017 were included based on the eligibility criterion via research databases; namely Wiley Online Library, MEDLINE (through PubMed), The Cochrane Library, Google Scholar and Science Direct using MeSH terms and keywords. General terms pertaining the title of study were keyed in, generating a large primary search to avoid missing related articles. Terms used were "prevalence", "urinary incontinence", paired with, "community dwelling", "older adults", "association", "cognitive impairment", and/or "physical impairment". Hand searching was additionally executed via reviewing the bibliographies of the retrieved articles for related articles. Inclusion criteria were: studies conducted among community dwelling older adults reporting the prevalence of UI and studies associating declined cognitive and/or physical impairments with UI. Exclusion criteria were: studies involving subjects below age of 60, institutionalised older adults and experimental studies involving management of UI.

RESULTS

Selection Process

The flow chart in Figure 1 summarises the process of article selection in this review.

Sampling and Measurement

Included sample characteristics of the studies reviewed are as enlisted in Table I. Nine studies were reviewed and the sample size studies ranged from 223 to 23,447,726, with a median of 2866. The study with the largest populations was from the United States. The mean age of older adults, ranged from 69.7±6.8 to 80.1±7.2 years old.

Only two studies reported the response rate percentages at 77 and 84.8%^{14,15}. Most studies reported the prevalence of both genders; however, three studies included only women^{16,17,18} and one study included only men¹⁹. Exclusion criterion in some studies included age (<60, <65, or <75 years), gender and institutionalised older adults. Table II depicts the common significant risk factors found in previously conducted studies.

Measurement of UI was done subjectively using self-administered questionnaires. Only one study was found to use the validated International Consultation on Incontinence

Questionnaire-Short Form (ICIQ-SF) to measure UI¹⁹. Studies with the assessment of cognitive and physical function in association with UI is as described in Table III.

Prevalence of Urinary Incontinence

The overall prevalence of UI among community dwelling older adults ranged from 10% to 53% with a median of 32%. The summary of all reviewed studies can be found in Table 1. The commonly used definition of UI in these studies, was found to implicate leakage of urine. Logically, a trend or pattern could not be observed based on the country, gender, sample size or mean age due to the wide range of results reported. The prevalence of UI for women ranged from 3% to 53% and 12% to 39% in men. All but one study reported a higher prevalence in women compared to men¹⁴.

A total of fifteen risk factors were investigated cumulatively in the reviewed studies. The association and significance of these risk factors with UI were determined using statistical tests; namely, chi square test, chi square for trend and multivariate logistic regression analysis. Table II is a summary of the six risk factors of UI investigated and found to be significant in at least three studies.

Association between UI, declined cognitive and physical function

The characteristics of four studies which investigated declined cognitive and physical function as risk factors of UI for community dwelling older adults is summarised in Table III. The association between UI, declined cognitive and physical function were statistically analysed using logistic regression test and the results were reported with either P-value or odds ratio. Three studies distinguished between physical function and functional status as separate risk factors of UI; measuring both Activities of daily living (ADLs), and administering specific physical tests^{8,9}. However, functional status was clustered under physical function in this review, as execution of ADLs can be considered as physical tasks.

Table 1: Sample Characteristics and Prevalence of Urinary Incontinence among Community Dwelling Older Adults.

| Reference | Country | Sample Characteristics | | | Definition of UI | Prevalence of UI | | |
|-------------------------|-------------|------------------------|----------|------------------|-------------------------------|------------------|-----------------------|------------|
| | | Respondents (n) | Mean Age | Male/Female/Both | | Overall (%) | By Gender Male (%) | Female (%) |
| Anger et al. (2006) | USA | 23,477,726 | RA | Female | Difficulty controlling urine | 38 | - | 38 |
| Anger et al. (2006) | USA | 18,231,934 | RA | Male | Difficulty controlling urine | 17 | 17 | - |
| Du Moulin et al. (2008) | Netherlands | 2866 | 80.1±7.2 | Both | Involuntary leakage of urine | 46 | 39 | 51 |
| Fritel et al. (2013) | France | 1942 | 79.3±2.9 | Female | Involuntary leakage of urine | 43 | - | 43 |
| Huang et al. (2007) | USA | 6361 | 76.7±4.7 | Female | Involuntary leakage of urine | 53 | - | 53 |
| Iglesias et al. (2000) | Spain | 827 | 77.7±8.1 | Both | Involuntary leakage of urine | 36 | 29 | 42 |
| Maggi et al. (2001) | Italy | 2398 | 75.2±7.1 | Both | Any urinary incontinence | 18 | 12 | 22 |
| Sidik (2010) | Malaysia | 223 | 69.7±6.8 | Both | Problems with bladder control | 10 | 18 | 3 |
| Stoddart et al. (2001) | UK | 1540 | RA | Both | Any urinary incontinence | 27 | 23 | 31 |

RA: Only range of age reported, UI: Urinary Incontinence

Table 2: Risk Factors Associated with UI.

| Reference | Country | Gender | Age | Cognitive Function | Physical Function | Functional Status | Fecal Incontinence |
|-------------------------|-------------|-----------|-----------|------------------------------|------------------------------|-------------------|--------------------|
| Du Moulin et al. (2009) | Netherlands | p < 0.001 | p < 0.001 | p < 0.01 | p < 0.001 | p < 0.001 | p < 0.001 |
| Fritel et al. (2013) | France | - | NR | - | p < 0.001 | - | - |
| Huang et al. (2007) | USA | - | - | (OR = 1.6, 95% C.I.=1.1-2.2) | (OR = 1.3, 95% C.I.=1.1-1.6) | - | - |
| Iglesias et al. (2000) | Spain | p < 0.001 | p < 0.01 | - | - | - | - |
| Maggi et al. (2001) | USA | NR | p < 0.01 | - | p < 0.001 | p < 0.01 | - |
| Sidik (2010) | Malaysia | p < 0.05 | p < 0.05 | NR | - | p < 0.05 | - |

NR: p-value not reported. , OR: Odds ratio. , (-): Not assessed in study.

Table 3a: Characteristics of Studies Reporting the Association between Cognitive Decline, Physical Function Decline and UI

| Author(s) | Objective | Study Design | Inclusion Criteria | Instrumentation | | | Main Findings |
|-------------------------|---|-----------------------|--|--|--|--|---|
| | | | | UI | Cognitive Function | Physical Function | |
| Du Moulin et al. (2008) | To measure prevalence of UI in community dwelling older adults aged 65 years old receiving home care services. | Cross-sectional study | Living at home; Receiving home care; Aged 65 and above. | Standardised Questionnaire. | Dementia screened via standardized questionnaire, not specified. | 4-Point Response Scale 1=bed bound; 2=chair bound; 3=walking aids used; 4=ambulatory. *Questionnaire included questions pertaining ADL. | Dementia (P=0.014), poor mobility and ADL impairments (P<0.001) were associated with UI and older adults experiencing these have more reason for admission to home care services. |
| Fritel et al. (2013) | To assess the association between functional limitations related to mobility and urinary incontinence in elderly women. | Cross-sectional study | Women; Aged 75 to 85 years; Living near study venue; Community dwelling. | i. ICIQ-SF ii. Short form (SF-36) quality of life questionnaire | - | Mobility Test i. Timed Up and Go. ii. 6-meter walk. iii. Sit to stand. Balance Test i. Standing balance. ii. Walking balance. iii. Unipedal Stance. | Multivariate analysis of the mobility tests showed strong association of 6 meter walk test and balance tests with urge UI. Strong relationship exists between motor functional problems and UI. Decline in physical functionality is proportionate to severity of UI. |

Table 3b: Characteristics of Studies Reporting the Association between Cognitive Decline, Physical Function Decline and UI

| Reference | Objective | Study Design | Inclusion Criteria | Instrumentation | | | Main Findings |
|---------------------|---|-----------------------|--|----------------------------------|---|---|---|
| | | | | UI | Cognitive Function | Physical Function | |
| Huang et al. (2007) | To examine the association between cognitive decline, physical function decline, and urinary incontinence in older community-dwelling women | Observational study | Community dwelling; Female; Aged 65 and older. | Self-administered questionnaire. | i. Modified Mini Mental State Examination (MMSE). ii. Trails B Test. iii. Digit Symbol Substitution Test. | i. 6-meter walk test. ii. 5 Chair Stands. | Women with physical decline were more likely to report weekly incontinence. Women with cognitive decline were more likely to report that incontinence interfered with activities. Physical decline has been found to have a higher correlation with UI (p<0.001) as compared to cognitive decline (p=0.002). |
| Maggi et al. (2001) | To estimate the prevalence of UI in a community dwelling population of elderly Italians and to determine the associated physical, social and psychological factors. | Cross-sectional study | Community dwelling; 65 years and older. | Standardised questionnaire. | - | Self-reported: Mobility Disability i. Stair climbing. ii. 800m walk. ADLs Disability i. Bathing ii. Dressing iii. Getting out of bed. iv. Eating. | ADL disability and mobility disability were significantly associated with UI in both older men and women. UI negatively impacts the elderly's quality of life and general health status. |

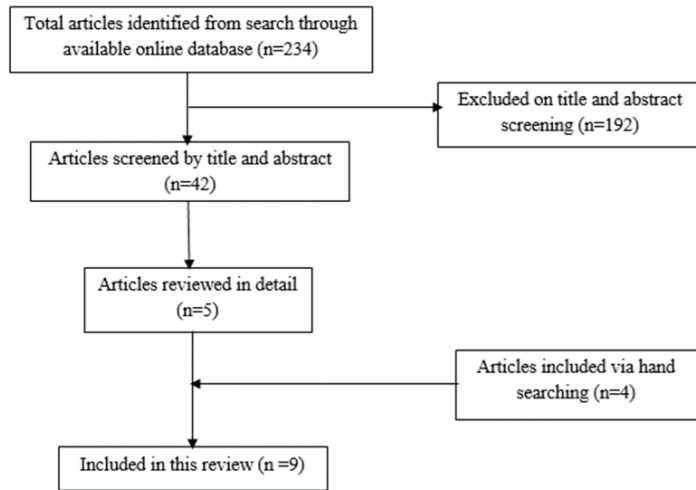


Figure 1: Flow chart of article selection process.

DISCUSSION

We aimed to determine the prevalence of UI and investigate the association between UI, declined cognitive and physical function among community dwelling older adults. UI was found to be a prevalent condition among community dwelling older adult population. An older adult with existing decline in cognitive and/or physical function was more likely to experience UI.

The prevalence of UI among community dwelling older adults ranged from 10% to 53%, which is lower compared with the prevalence rates among the institutionalised (43% to 77%). The lowest prevalence of UI was reported at 10%, set in Asia¹⁴. This may be influenced by the fact that participants in Asia are more ethnically conservative regarding delicate personal health concerns which are perceived to be sensitive¹⁴. This Asian study was the only study to report a contrast in the prevalence of UI whereby it was found to be higher among men compared to women¹⁴. These results may suggest underreporting of UI as information was obtained subjectively via interview.

The wide range in UI prevalence between studies could stem from the differences in

research methodology. A trend could be identified among studies based on the UI definition used. A higher prevalence rate (36% to 53%) was observed in studies that defined UI as “involuntary leakage of urine”^{17,18,19}. It was observed that prevalence rates were highest in studies where the lowest amount of urine leakage satisfied the definition. In three studies “difficulty controlling urine” and “problems with bladder control” was used^{14,16,19}. These definitions could have implied an absence of involuntary urine leakage. It could also be understood as a difficulty in restraining before reaching a toileting facility when the individual may not be experiencing incontinence per say. These ambiguous definitions used in investigating prevalence of UI may render its results less reliable, as it can be perceived and interpreted differently.

Though many validated and well-established UI assessment questionnaires exist, there is currently no gold standard subjective UI assessment instrument. In all the studies that we reviewed, information regarding UI was subjectively acquired. The self-administered questionnaires used to measure UI in each study were selected or created based on the definition of UI. Validity and reliability of

questionnaires to assess UI, its method of administration (face to face interview or via postal interview), participants' understanding of the questions asked, sensitivity of questions and the depth of content in the interview could also be related to the wide difference in reported prevalence²⁰.

Generally, prevalence of UI is found to increase as the population ages. Mean age of incontinent older adults was higher compared to those who were continent^{21,22}. However, it is not to be misconstrued as a natural consequence of ageing. It is more often a manifestation of other pre-existing age related medical conditions; commonly, diabetes mellitus, neurological disorders such as stroke or cerebrovascular accidents (CVA) and prostatic hyperplasia among men^{8,23}. Wetle et al. stated that this phenomenon of increasing prevalence with age, is explained by the correlates of aging, rather than just age as a single factor²².

Prevalence of incontinence by age group was found to be higher among women than in men within 80 to 90 years; but reached a point of equivalence after 90 years. The increase of prevalence with age is described by Iglesias et al. as approximately 5% per 5-year interval which implies an approximate increase of 1% annually²⁴. Gender has also shown to be a significant risk factor of UI in this review, being more prevalent among women than men. Both gender and age as risk factors can be explained with changes in the anatomy and physiology of urological system such as involuntary bladder contractions, prostatic enlargement with detrusor instability or overflow incontinence in men; and post-partum changes, atrophic vaginitis or declining oestrogen levels in women^{20,25}.

Several other risk factors of UI were reported. Anger et al. found ethnicity to be a risk factor with UI being more prevalent among older black men and white women^{16,19}. The results also demonstrated an association between socioeconomic status and the likelihood of experiencing UI, especially in population with lower income and without high school education¹⁶. Only one study showed an association between higher body mass index (BMI) and higher prevalence of UI²³. Higher BMI is linked to higher intra-abdominal and intravesical pressure leading to UI due to stress applied on the pelvic floor²⁶. Diabetes mellitus was associated with UI in two studies. Diabetes mellitus was found to be associated by 2.5-fold as a risk factor of UI; possibly due to the risk

of metabolic disturbances, neurological and/or vascular pathology²⁷. Moreover, UI had a negative impact on quality of life among older adults with UI. UI poses a negative psychosocial impact on older adults resulting in social limitations and interference with executing daily tasks^{15,18,24}.

Declined cognitive function was found to be significantly associated with UI in three studies in our review. In contrary, an association between cognitive status and UI was not established in an earlier study but depression was significantly associated with UI²². Though depression is not a cognitive impairment, it is a known related risk factor of cognitive decline²⁸. Depression should be considered when screening older adults as it could be an indicator of cognitive decline^{28,29}. In addition, UI was four times more prevalent among older adults with dementia as compared to those without cognitive impairments¹³. However, information about the association between UI and mild cognitive impairments (MCI) is limited. Such information is important in view of potentially reversing UI by addressing the risk factors early.

Physical performance has been found to decline with age, parallel to the deterioration of other physiological components required to maintain optimum function³⁰. Most studies in this review supported the importance of being independent in mobility and ADL as a core function of maintaining continence. Continent community dwelling older adults that are institutionalised have been found to become incontinent within a span of one year⁹. This illuminated the importance of maintaining physical mobility as a prevention of UI. Institutionalisation generally leads to high dependence on the caregivers to carry out basic ADLs, including toileting needs.

The results of our review showed that physical decline was a stronger predictor as compared to impaired cognition. It was concluded that women with declined physical function were more likely to deal with weekly incontinence¹⁸. Similarly, it was highlighted that impaired mobility and physical barriers had stronger association with UI⁴. This is further supported by an earlier study, reporting older adults with UI had functional impairment and were dependent in ADL².

One of the limitations of this review is that it only provides a descriptive summary of UI prevalence and its association with declined physical and cognitive function among

community dwelling older adults, rather than a statistical meta-analysis. Also, in all studies UI and its related symptoms were assessed subjectively via questionnaires. These studies could be subjected to under or inaccurate reporting and response bias. However, objective testing of UI requires appropriate clinical setting and does not guarantee the presentation of symptoms at time of testing, which renders it unfeasible in large community based studies. A lack of comparison between risk factors and its association with continent and incontinent community dwelling older adults should be noted as well.

As a recommendation for future research, UI definition should be standardised using the International Continence Society's one. This would enable easier study comparisons, understanding and inference. Secondly, valid and reliable questionnaires should be adapted in regard to instrumentation for UI assessment. Lastly, both genders should be included when investigating risk factors of UI as an aide for seamless healthcare practice.

CONCLUSION

Our review results highlights UI as a prevalent condition among both community dwelling older women and men. We also found declined physical function as a common determinant of UI. Although limited, the existing evidence highlights that declined cognitive function is related to UI. Routine screening of UI and identification of its associated risk factors among community dwelling older adults, especially cognitive and physical function, should be considered in health care practices to provide early and holistic management.

ACKNOWLEDGMENTS

This study is funded using a grant from Ministry of Higher Education Malaysia via Universiti Kebangsaan Malaysia (LRGS/BU/2012/UKM-UKM/K/01). We are also grateful to Mr Indarpal Singh Didar Singh for English editing and proof reading this paper.

Conflicts of interest: There is no conflict of interest.

REFERENCES

1. Abrams P, Anderson KE, Birders L. et al. 4th International Consultation Reccomendations of the International Scientific Committee: The Major Evaluation and Treatment of Urinary

- Incontinence, Pelvic Organ Prolapse and Faecal Incontinence. *Evauation and Treatment of Urinary Incontinence, Pelvic Organ Prolapse and Faecal Incontinence 2009*; 1767-820.
2. Holroyd-Leduc JM, Mehta KM, Covinsky KE. Urinary Incontinence and Its Association with Death, Nursing Home Admission, and Functional Decline. *Journal of the American Geriatrics Society 2004*; 51: 712-8.
3. Irwin DE, Milsom I, Hunskaar S. et al. Population-Based Survey of Urinary Incontinence, Overactive Bladder, and Other Lower Urinary Tract Symptoms in Five Countries: Results of the EPIC Study. *European Urology 2006*; 50(6): 1306-15.
4. Loh KY, Sivalingam N. Urinary Incontinence in the Elderly Population. *The Medical Journal of Malaysia 2006*; 61(4): 506-10.
5. Eshkoo SA, Hamid TA, Shahar S. et al. Factors related to urinary incontinence among the Malaysian elderl. *Journal of Nutritional Health Aging 2017*; 21(2): 220-26. doi: 10.1007/s12603-016-0779-x.
6. Ho CCK, Teo CY, Phang LF, Azizi NAN, Darwin FL, Mohd Ghazi NA, Tan GH, Goh EH, Singam P, Bahadzor B, Zainuddin ZM. Prevalence and Risk Factors Associated with Overactive Bladder. *Urotoday International Journal. 2012*; 5(1): 88.
7. Kuchel GA, Dubeau CE. Chapter 30 : Urinary Incontinence in the Elderly. *American Society of Nephrology 2009*; 1-5.
8. Maggi S, Minicuci N, Langlois J. et al. Prevalence rate of urinary incontinence in community-dwelling elderly individuals: The Veneto Study. *The Journals of Gerontology 2001*; 56(1):14-8.
9. Offermans M, Du Moulin M, Hamers J, Dassen T. et al. Prevalence of Urinary Incontinence and Associated Risk Factors in Nursing Home Residents: A Systematic Review. *Neurourology and Urodynamics 2009*; 28(3):288-94.

10. Yasmin S, Karim AJ, Rohaini M. et al. Prevalence of Urinary Incontinence and Associated Risk Factors in Postmenopausal Women. *Medical Science* 2013; 3(7): 66-70.
11. Williams M, Gaylord S. Role of Functional Assessment in the Evaluation of Urinary Incontinence. *American Geriatrics Society* 1990; 38(8): 296-9.
12. Bhagwath G. Urinary Incontinence in the Elderly: Pathogenesis and Management. *Indian Academy of Clinical Medicine* 2001; 2(4):270-5
13. Han D, Wang Y. Urinary incontinence in Dementia. *Incontinence Pelvic Floor Dysfunction* 2008; 2(2):63-6.
14. Sidik SM. The prevalence of urinary incontinence among the elderly in a rural community in Selangor. *Malaysian Journal of Medical Sciences* 2010; 17(2): 18-23.
15. Stoddart H, Donovan J, Whitley E. et al. Urinary incontinence in older people in the community: A neglected problem? *British Journal of General Practice* 2001; 51(468): 548-52.
16. Anger JT, Saigal CS, Litwin MS. The Prevalence of Urinary Incontinence Among Community Dwelling Adult Women: Results From the National Health and Nutrition Examination Survey. *The Journal of Urology* 2006; 175: 601-4.
17. Fritel X, Lachal L, Cassou B. et al. Mobility impairment is associated with urge but not stress urinary incontinence in community-dwelling older women: Results from the Ossebo study. *BJOG* 2013; 120(12): 1566-72.
18. Huang J, Brown JS, Thom DH. et al. Urinary incontinence in older community-dwelling women: the role of cognitive and physical function decline. *Obstetrics & Gynecology* 2007; 109(4): 909-16.
19. Du Moulin MF, Hamers JPH. et al. Prevalence of urinary incontinence among community-dwelling adults receiving home care. *Research in Nursing & Health* 2008; 31(6): 604-12.
20. Roberts R, Jacobsen S, Rhodes T. et al. Urinary Incontinence in a Community-Based Cohort: Prevalence and Healthcare-Seeking. *American Geriatric Society* 1998; 46:467-72.
21. Nakanish N, Tatara K, Naramura H. et al. Urinary and fecal incontinence in a community-residing older population in Japan. *Journal of the American Geriatrics Society* 1997; 45(2):215-9.
22. Wetle T, Scherr P, Branch LG. et al. Difficulty with holding urine among older persons in a geographically defined community: prevalence and correlates. *Journal of the American Geriatrics Society* 1995; 43(4): 349-55.
23. Anger JT, Saigal CS, Stothers L. et al. The prevalence of urinary incontinence among community dwelling men: results from the National Health and Nutrition Examination survey. *The Journal of Urology* 2006; 175: 2103-8.
24. Iglesias G, Pérez J, Valderrama E. et al. Prevalence and Psychosocial Impact of Urinary Incontinence in Older People of a Spanish Rural Population. *The Journals of Gerontology* 2000; 55(4): 207-14.
25. Dariah MY, Lily X, Belan I. et al. Postnatal Urinary Incontinence: Prevalence and Factors Associated with it in a Malaysian Population. *Med & Health* 2014; 9(1):22-32.
26. Noblett KL, Jensen JK, Ostergard DR. The relationship of body mass index to intra-abdominal pressure as measured by multichannel cystometry. *International Urogynecology Journal and Pelvic Floor Dysfunction* 1997; 8(6):323-6.
27. Izci Y, Topsever P, Filiz TM. et al. The association between diabetes mellitus and urinary incontinence in adult women. *International Urogynecology Journal and Pelvic Floor Dysfunction* 2009; 20:947-952.

28. Jorm AF. Is depression a risk factor for dementia or cognitive decline? *Gerontology* 2000; 46(4): 219-27.
29. Foong HF, Hamind TA, Ibrahim R. et al. Predicting cognitive function of the Malaysian elderly: a structural equation modelling approach. *Aging and Mental Health* 2016; 22(1):109-120.
30. Singh DKA, Pillai SGK, Tan ST. et al. Association between physiological falls risk and physical performance test among community dwelling older adults. *Clinical Interventions in Aging* 2015; 10: 1319-26.