URINARY INCONTINENCE AND QUALITY OF LIFE: A LONGITUDINAL ANALYSIS FROM THE ENGLISH LONGITUDINAL STUDY OF AGEING

Nicola Veronese[1], Lee Smith[2], Damiano Pizzol[3], Pinar Soysal[4], Stefania Maggi[5], Petre-Cristian Ilie[2], Ligia J. Dominguez[1], Mario Barbagallo[1]

1 Geriatric Unit, Department of Internal Medicine and Geriatrics, University of Palermo, Palermo, Italy;

2 Centre for Health, Performance and Wellbeing, Anglia Ruskin University, Cambridge, UK;

3 Italian Agency for Development Cooperation – Khartoum, Sudan.

4 Department of Geriatric Medicine, Faculty of Medicine, Bezmialem Vakif University, Istanbul, Turkey;

5 Aging Branch, Neuroscience Institute, National Research Council, Padua, Italy.

Corresponding author: Nicola Veronese. Geriatric Unit, Department of Internal Medicine and Geriatrics, University of Palermo, Via del Vespro, 141, 90127 Palermo, Italy. Email: nicola.veronese@unipa.it

ABSTRACT

Objectives: To explore the longitudinal association between urinary incontinence (UI) and quality of life (QoL) in the English Longitudinal Study on Ageing, a large study of older UK adults with ten years of follow-up.

Study design: Cohort study.

Main outcomes interest: To determine the presence of UI, participants reported whether they had lost urine beyond their control in the last 12 months. Participants also reported whether UI lasted more than one month, indicating a more chronic problem. QoL was measured using the CASP (control, autonomy, self-realisation and pleasure)-19, with higher values indicating a higher QoL.

Results: Of the 8,028 participants (mean age: 65.2 years; 56.7% females) included, 1,172 reported UI at baseline. No significant differences in CASP-19 score were found at baseline (p=0.24). In people with UI, a significant decline in CASP-19 score (from 34.3±14.0 at baseline to 30.9±16.1 in wave 7) (p=0.016) was observed. The results were stronger in men than in women and with a longer duration of UI.

Conclusion: UI was associated with poor QoL over ten years of follow-up in a large cohort of UK participants. Our findings further suggest the importance of UI as a potential risk factor for poor QoL.

Keywords: urinary incontinence; quality of life; ELSA; ageing; longitudinal; cohort

INTRODUCTION

Urinary incontinence (UI) is a common clinical problem, often defined as a geriatric multifactorial syndrome characterized by any involuntary leakage of urine [1-3].However, it is important to note that UI has also been observed in younger adults.[4] UI affects several million people across the globe, with important and, often, underestimated negative consequences on the quality of life.[5] As widely known, UI affects more frequently women than men, but the prevalence of UI in women is still likely underestimated.[5] Although the precise prevalence rate is not known, at least one in four people are affected by UI in their lifetime.[6, 7]

One of the most important aspects of UI, especially in older non-disabled adults, is that it is seldom reported by the patient to the physician. This is likely owing to UI being considered a natural consequence of ageing and also feelings of of shame in relation to UK.[8, 9] Therefore, often people not only deny, but also hide this problem, that may result in physical and psychosocial limitations to enjoyment in life. [9] The main consequences might include loss of self-confidence and social isolation in addition to other negative outcomes, such as decreases in sexual activity and daily physical activity.[10]

All the potential consequences of UI, including mood disorders, are associated per se with poor quality of life (QoL), a comprehensive term that includes various domains in human life that describes the expectations of an individual or society for a good life.[11] However, despite increasing research indicating the importance of QoL and the high prevalence of UI, only a few studies have reported on the association between UI andQoL. A recent systematic review and meta-analysis including 23 studies and 24,983 participants confirmed that UI is associated with poor QoL.[12] However, these studies were mainly of a cross-sectional or case-control nature that have inherent limitations, such as the presence of a

potential reverse causation. On the contrary, longitudinal studies regarding the impact of UI on QoL are still limited.

Given this background, we aimed to investigate whether UI was associated with poorer QoL in the English Longitudinal Study on Ageing, a large study in older adults in the UK with over ten years of follow-up, in order to identify a potential risk factor for poor QoL, often not considered in clinical practice.

MATERIALS AND METHODS

Study population

This research is based on the data of the English Longitudinal Study on Ageing (ELSA) including the waves between wave 2 (2004–2005) and wave 7 (2014–2015). The ELSA is a prospective and nationally representative cohort of participants living in England.[13] The ELSA was approved by the London Multicenter Research Ethics Committee (MREC/01/2/91). Informed consent was obtained from all participants.

Exposure: urinary incontinence

In the ELSA study, the presence of UI at baseline and during follow-up was confirmed by asking participants whether they lost urine beyond their control in last 12 months. Moreover, it was asked whether UI lasted greater than one month, indicating a chronic problem.

Outcomes: quality of life

The QoL measure used in the ELSA is CASP (control, autonomy, self-realisation and pleasure)-19. [14] It is a self-completion questionnaire and spans four derived dimensions based on Likert scaled items. CASP-19 has an overall summary measure on a 0–57 scale, with higher scores corresponding to greater well-being.[14]

Covariates

The following variables were considered as potentially important covariates and included in the ELSA database: educational level, as years of schooling (continuous); marital status, categorized as married vs. other options; body mass index, categorized using the World Health Organization criteria[15]; smoking status (present vs. other status); disability in one or more of five activities of daily living; physical activity level [16], categorized as sedentary, low, moderate or high level; the presence of comorbidities, categorized as >2 vs. less, as

commonly used in geriatric medicine [17] (the prevalence of the most important diseases is also reported for descriptive purposes); ethnicity, categorized as whites vs. others.

Statistical analyses

The data were weighted using the person-level longitudinal weight, core sample, wave 2 (http://www.ifs.org.uk/ELSA). Means and standard deviations (SD) were used to describe quantitative measures, while percentages and counts were used for categorical variables. Normal distributions of continuous variables were tested using the Kolmogorov–Smirnov test. Characteristics of the study participants at the baseline evaluation (wave 2) were compared according to the presence or not of UI, considering the Chi-squared or Fisher exact tests for categorical variables, and generalized linear models after testing for homoscedasticity (Levene test) or Wilcoxon rank sum test for the continuous variables.

The association between UI at the baseline and the changes of CASP-19 during follow-up was evaluated using a generalized linear model with repeated measures. For missing data regarding CASP-19, a multiple imputation method was used, with a maximum of 20 interactions.[18] We also reported sensitivity analyses, including data according to duration of UI (more than one month, less than one month, no UI), sex, and only people having all data regarding CASP-19 during follow-up.

All statistical tests were two-tailed, and a p-value < 0.05 was considered to be statistically significant (the correction proposed by Bonferroni was used for the analyses regarding the duration of UI). All analyses were performed using SPSS 20.0 software.

RESULTS

Of the 9,432 participants in wave 2 (baseline) of the ELSA study, 139 were removed owing to having no data regarding UI, and 1265 were removed owing to missing data on CASP-19, leaving 8,028 participants eligible for this study.

The mean age of participants was 65.2±10.1 years (range: 17-90) and 56.7% were female. Among the 1,172 participants reporting UI (14.6% of the entire sample), 771 reported a duration of UI more than one month. **Table 1** shows the baseline characteristics according to the presence or not of UI. Compared to 6,856 participants not reporting UI, those with UI were significantly older, more frequently females, and had a lower level of education. Moreover, people with UI were more frequently obese, disabled, and sedentary than those without UI. People with UI reported a significant higher prevalence of comorbidities, except for diabetes and Parkinson' disease. When stratified by sex, men having UI were less educated, whilst women with UI were more likely to be present smokers that their counterparts (**Supplementary Table 1**). Finally, we did not observe any significant difference in baseline CASP-19 between UI and controls (34.3±14.0 vs. 35.0±12.8; p=0.24) (**Table 1**) or when using the criteria ofUI present for more than one month (p=0.10), or when stratified by sex (p=0.13 in men; p=0.63 in women).

Figure 1 and Table 2 shows the changes in CASP-19 during the ten years of follow-up. During the ten years of follow-up, among the 6,856 not reporting UI at the baseline, 1,512 (=22.1%) became incontinent. In people with UI, we observed a significant decline in CASP-19 (from 34.3±14.0 of baseline to 30.9±16.1 of wave 7) vs. a change from 35.0±12.8 to 32.0±14.7 in people without UI. Therefore, using a generalized linear model with repeated measures, we identified a significant difference between people with UI and those without at the baseline (p=0.016).

Next, sensitivity analyses were run to strengthen results. First, the presence of UI for more than one month was associated with the worse QoL scores: taking people without UI as control group, people with a longer history of UI reported significant lower values of CASP-19 during follow-up (30.4±16.2; p=0.008). Second, we divided the participants by sex. In this case, we observed that UI at the baseline was associated with a significant decline in QoL in men (p=0.002), but not in women (p=0.54), taking people without UI as reference group (full details in **Table 2**). On the contrary, longer presence of UI was not associated with poorer QoL in either sex (p=0.99 in men, p=0.09 in women). Finally, comparing the people with complete data during follow-up (593 with UI vs. 3,585 without UI), the difference in QoL during follow-up remained statistically significant (p=0.03).

DISCUSSION

In the present study, involving more than 8,000 participants followed-up for ten years, we found that UI was associated with worse QoL estimates compared to those without UI, but no difference was observed between baseline values. Our results were stronger in men than in women and when UI lasts more than one month over the previous year in the sample as whole. We believe that these findings are novel in several ways.

Before this study, studies summarizing the association between UI and QoL were mainly based on cross-sectional or case-control evidence. Approximately ten years prior to the time of writing, one review [19] reported that females affected by UI reported significantly lower QoL than their counterparts; another systematic review found that overactive bladder was associated with lower QoL.[20] More recently a meta-analysis indicates that UI was associated with poor QoL in 23 studies and approximately 25,000 participants.[12] These works clearly advanced knowledge regarding this important topic, however, the nature of these studies is an important limitation, particularly for the possible presence of reverse causation. To the best of our knowledge the present study is the first study assessing longitudinally the potential association between UI and poor QoL in the general population.

Several hypotheses can justify the present findings. First, as reported in this study, people with UI usually exhibit more comorbidities and were more likely to have a disability than those without UI. Many risk factors are reported in the association between UI and poor QoL, but the most important seem to be female sex, age, the presence of comorbidities, and disability.[21] Second, it is possible that people having UI use diapers and the use of diapers may lead to the Incontinence-Associated Dermatitis (IAD).[22] IAD, as other dermatological conditions, is associated with a poor QoL.[23] Unfortunately, in the ELSA study this information is missing and therefore this is a speculation regarding the potential mechanisms

justifying the present findings. Third, it is also possible that people with UI can decrease their social contacts due to the shame of having episodes of UI, therefore subsequently decreasing their QoL.[24] Finally, another important point is that shame usually presents in these individuals leading to a negative change in lifestyle and habits[25] (e.g., decrease in physical activity) and to the development of mood disorders, such as depression [25] and anxiety. [26]

Another important finding of the present study is that the association between UI and poor QoL is stronger in men than in women, although UI is more prevalent in women. In a large cross-sectional study, UI was associated with poor QoL in both sexes, however, the design of the study prevents determination of any casual relation hypothesis.[27] Our findings further underline the importance of early detection of UI in men, particularly among those that have important risk factors for UI, such as prostatectomy or prostate problems. It has been demonstrated that in men undergoing radical retropubic prostatectomy QoL is reduced immediately after the surgery, but improves over time and eventually returns to the preoperative level.[28] To the contrary, a recent multicentre study carried out in Italy found that in patients undergoing radical prostatectomy for prostate cancer, the decline in urinary function had a significant impact on QoL 24 months after diagnosis.[29] Therefore, more research is needed to confirm or refute the present findings.

The findings of our study should be interpreted within its limitations. First, the rate of dropout was high. This may introduce a selection bias, but in which direction this bias can modify the findings is unclear, however, to mitigate this risk of bias a multiple imputation method was employed. Moreover, analyses involving only people having completed data did not significantly modify the present findings. Second, the information regarding UI were reported and important data, such as specific exams or the use of diapers were not recorded. Third,

types of UI were not evaluated. It is possible that the different types of UI will have differential associations with QoL. Finally, it would be interesting to compare the altered dimensions in men and in women, for example autonomy and pleasure, but this important information is unfortunately not available for CASP-19.

In conclusion, in this study including more than 8,000 participants followed for ten years, UI was associated with poor QoL. This association was stronger in men than in women and when UI was experienced over a long period of time. These findings further underline the importance of UI as a potential risk factor for poor QoL. Early detection and appropriate management of UI is important in order to improve QoL over the time in this at risk population.

Contributors

Nicola Veronese conducted the statistical analysis and contributed to the preparation of the first draft of the paper.

Lee Smith critically revised the paper.

Damiano Pizzol contributed to the preparation of the first draft of the paper.

Pinar Soysal contributed to the preparation of the first draft of the paper.

Stefania Maggi critically revised the paper.

Petre-Cristian Ilie critically revised the paper.

Ligia J. Dominguez contributed to data interpretation.

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Ethical approval

The ELSA was approved by the London Multicentre Research Ethics Committee (MREC/01/2/91). Informed consent was obtained from all participants.

Provenance and peer review

This article was not commissioned and was externally peer reviewed.

Research data (data sharing and collaboration)

The study protocol and statistical analysis plan for this project are available on request from the corresponding author. Data are available from the UK Data Service for researchers who

meet the criteria for access to confidential data. Data are from waves 2 to 7 of the ELSA study. Data and contact details may be obtained via the website **http://www.adls.ac.uk/find-administrative-data/linked-administrative-data/english-longitudinal-study-of-ageing/**

Declaration of competing interests

The authors declare that they have no competing interests.

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Highlights

- Urinary incontinence is a common condition and associated in cross-sectional and case-control studies with a poor quality of life.
- In the English Longitudinal Study of Ageing (ELSA) study, urinary incontinence, versus absence, at baseline was associated with a significant decline in quality of life over 10 years of follow-up.
- The association was stronger in men than in women.

Table 1. Participants' characteristics at the baseline according to the presence of urinary incontinence (weighted data)

	Urinary incontinence		
	Yes	**No**	
	(n=1172)	**(n=6856)**	**p-value**
Age, y, mean (SD)	68.4 (10.4)	65.8 (9.7)	<0.0001
Sex, male, n (%)	252 (23.2)	3162 (49.6)	<0.0001
Whites, n (%)	1060 (97.5)	6203 (97.3)	0.76
Years of education (SD)	6.4 (6.9)	7.0 (6.9)	0.006
Married, n(%)	654 (60.2)	4269 (67.0)	<0.0001
Present smokers, n(%)	899 (82.9)	5400 (84.8)	0.09

	Urinary incontinence		
	Yes	**No**	
	(n=1172)	**(n=6856)**	**p-value**
BMI, n (%)			<0.0001
<18.5 kg/m^2	11 (1.1)	39 (0.7)	
18.5-24.9 kg/m^2	222 (22.3)	1485 (25.9)	
25.0-29.9 kg/m^2	356 (35.7)	2418 (42.1)	
≥30 kg/m^2	334 (40.9)	1510 (31.3)	
Disability in 1 or more ADL, n (%)	391 (36.0)	1076 (16.9)	<0.0001
Physical activity level, n (%)			<0.0001
Sedentary	103 (9.5)	305 (4.8)	
Low	358 (32.9)	1482 (23.3)	
Moderate	479 (44.0)	3311 (52.0)	
High	147 (13.5)	1272 (20.0)	
Comorbidities (>2 comorbidities), n (%)	758 (69.8)	3176 (49.8)	<0.0001
Cardiovascular diseases, n(%)	382 (35.5)	1803 (28.2)	<0.0001
Diabetes, n(%)	98 (9.0)	493 (7.7)	0.23
Hypertension, n(%)	533 (49.1)	2717 (42.6)	<0.0001
Lung disease, ever diagnosed, n (%)	100 (9.3)	433 (6.8)	0.006

	Urinary incontinence		
	Yes	**No**	
	(n=1172)	**(n=6856)**	**p-value**
Asthma, ever diagnosed, n (%)	204 (18.8)	742 (11.6)	<0.0001
Arthritis, ever diagnosed, n (%)	595 (54.8)	2204 (34.6)	<0.0001
Osteoporosis, ever diagnosed, n (%)	119 (11.0)	385 (6.0)	<0.0001
Cancer, ever diagnosed, n (%)	113 (10.4)	416 (6.5)	<0.0001
Parkinson's Disease, ever diagnosed, n (%)	9 (0.83)	30 (0.47)	0.31
Psychiatric disorder, ever diagnosed, n (%)	184 (16.9)	542 (8.5)	<0.0001
Alzheimer's Disease, ever diagnosed, n (%)	2 (0.18)	4 (0.06)	0.03
Dementia or memory impairment, ever diagnosed, n (%)	9 (0.83)	36 (0.56)	0.55
CASP-19 baseline value (mean SD)	34.3 (14.0)	35.0 (12.8)	0.24

Table 2. Association between urinary incontinence and quality of life changes during follow-up, in the sample as whole and by sex.

	Wave 2		Wave 3		Wave 4		Wave 5		Wave 6		Wave 7		p-value
Urinary incontinence	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	
All sample	34.3 (14.0)	35.0 (12.8)	33.4 (14.9)	33.5 (13.8)	32.7 (15.5)	32.9 (14.3)	32.9 (15.2)	33.8 (13.2)	31.9 (15.4)	33.0 (13.8)	30.9 (16.1)	32.0 (14.7)	0.016
Men	33.6 (15.5)	35.2 (12.9)	31.9 (16.0)	33.7 (13.7)	31.2 (16.4)	32.9 (14.3)	31.6 (16.5)	33.9 (13.2)	30.5 (16.8)	33.3 (13.8)	31.0 (16.8)	32.3 (14.8)	0.002
Women	34.5 (13.6)	34.8 (12.8)	33.5 (14.8)	33.1 (14.1)	33.0 (15.3)	32.5 (14.6)	32.0 (15.1)	32.6 (14.0)	30.9 (15.9)	31.8 (14.6)	30.9 (15.9)	31.8 (14.6)	0.54

Data are reported, for each wave, as mean with correspondent standard deviations in people with or without urinary incontinence. P-values are reported as result of the generalized linear model, repeated measures.

Figure 1. Changes of CASP-19 during follow-up, by the presence of urinary incontinence at the baseline

The data are reported as mean with their standard errors.

Supplementary Table 1. Characteristics at the baseline according to the presence of urinary incontinence, by sex (weighted data)

	Men			Women		
	Yes (n=260)	**No (n=3213)**	**p-value**	**Yes (n=912)**	**No (n=3643)**	**p-value**
Age, y, mean (SD)	70.9 (9.6)	64.9 (9.1)	<0.0001	67.6 (10.5)	66.8 (10.1)	0.04
Whites, n (%)	243 (96.4)	3064 (96.9)	0.71	817 (97.8)	3139 (97.7)	0.99
Years of education (SD)	6.7 (6.9)	8.1 (6.8)	0.001	6.3 (6.9)	5.9 (6.8)	0.16
Married, n(%)	191 (75.8)	2387 (75.5)	0.50	463 (55.5)	1882 (58.6)	0.64
Present smokers, n(%)	40 (15.9)	510 (16.1)	0.99	147 (17.6)	458 (14.3)	0.01

	Men			Women		
	Yes (n=260)	**No (n=3213)**	**p-value**	**Yes (n=912)**	**No (n=3643)**	**p-value**
BMI, n (%)			0.003			<0.0001
<18.5 kg/m^2	1 (0.4)	16 (0.6)		10 (1.2)	24 (0.8)	
18.5-24.9 kg/m^2	51 (21.4)	621 (22.1)		178 (22.2)	884 (29.6)	
25.0-29.9 kg/m^2	100 (42.0)	1345 (47.9)		274 (34.2)	1105 (37.0)	
≥30 kg/m^2	108 (41.5)	1231 (38.3)		450 (49.3)	1630 (44.7)	
Disability in 1 or more ADL, n (%)	109 (41.9)	492 (15.3)	<0.0001	297 (32.6)	600 (16.5)	<0.0001

	Men			Women		
	Yes (n=260)	**No (n=3213)**	**p-value**	**Yes (n=912)**	**No (n=3643)**	**p-value**
Physical activity level, n (%)			<0.0001			<0.0001
Sedentary	32 (12.6)	132 (4.2)		71 (8.5)	174 (5.4)	
Low	72 (28.5)	619 (19.6)		286 (34.3)	862 (26.8)	
Moderate	116 (45.8)	1646 (52.1)		363 (43.5)	1665 (51.8)	
High	33 (13.0)	762 (24.1)		114 (13.7)	510 (15.9)	
Comorbidities (>2 comorbidities), n (%)	176 (67.7)	1475 (45.9)	<0.0001	632 (69.3)	1865 (51.2)	<0.0001
CASP-19 baseline value (mean SD)	33.5 (15.7)	35.0 (13.2)	0.13	34.4 (13.8)	34.7 (13.0)	0.63