EPIDEMIOLOGY AND NATURAL HISTORY OF URINARY INCONTINENCE IN WOMEN

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ABSTRACT

Understanding the epidemiology (distribution and determinants) of urinary incontinence (UI), as well as its natural history is a very important issue. In this article, we discuss prevalence, incidence, natural history, and the variations that may be related to race and ethnicity. We focus on epidemiologic population comprising community-dwelling women who are not institutionalized. Our review clearly shows that there is a lack of advanced epidemiologic analyses. Variables that better characterize UI include frequency measure, quantity of urine loss, duration, type, and severity. These factors should be incorporated into basic study design so that more advanced and informative analyses may be conducted.


The understanding of epidemiology—the study of the distribution and determinants of disease—is critical in the search for the risk and protective factors that lead to primary or secondary disease prevention. This article is based on work presented at the 2nd International Consultation on Incontinence (sponsored by the World Health Organization) by the subcommittee on epidemiology.† We review the current state of knowledge of the epidemiology of urinary incontinence (UI), including study designs, operational definitions, and research results.

This review uses only a fraction of the high-quality, population-based studies available. Lack of space precludes inclusion of topics such as fecal incontinence, pelvic organ prolapse, and pelvic floor weakness. We have included studies of overactive bladder as it relates to urge incontinence. The subcommittee’s file report, a more comprehensive version of this article, has recently been published.¹

BASIC EPIDEMIOLOGIC CONSIDERATIONS

Cohort studies and case-control studies are the most common types of observational studies in epidemiology. However, caution is always needed when interpreting the results from such studies because associations may not be the same as causes. Longitudinal designs are preferable but uncommon.

The levels of evidence used for therapeutic interventions cannot be used in epidemiologic studies because no uniform guidelines for assessing these results exist. The level of evidence in observational studies can be judged by how well statistical and other controls exclude alternative explanations. However, even the analyses of recent studies of UI are very simple. Often, only proportions or percentages are used to describe differences in the prevalence of UI in different subgroups. Analytical problems include controlling for confounders and a lack of stratification or use of multivariate techniques. There is an obvious need for more advanced epidemiologic analyses of risk factors and comorbidity, and the strength of associations should be determined by relative risks and odds ratios.

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† Deceased

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DEFINITIONS

Studies of disease frequency should rely on a very specific definition of the condition under investigation. The lack of a uniform definition of UI is a fundamental problem in assessing and comparing the findings in different studies.

Incontinence. The International Continence Society (ICS) defines incontinence as “the complaint of any involuntary leakage of urine.” Epidemiologic studies use definitions based on frequency of urine loss (e.g., >2 episodes in a month). Such definitions imply that these are studies of period prevalence.

Prevalence. Prevalence is defined as the probability of being incontinent within a defined population and at a defined point in time. The concept is important for establishing the distribution of the condition in the population and for projecting the need for health and medical services. Prevalence of all causes of UI is estimated as the ratio of the number of incontinent respondents, identified in a cross-sectional survey, to the number of all respondents in the survey (both continent and incontinent). Prevalences of specific types and severity levels are estimated in an analogous manner.

Incidence. Incidence is defined as the probability of developing a condition under study during a defined period. Incidence is usually reported for 1-, 2-, or 5-year intervals.

Type. Epidemiologic surveys must often take a pragmatic approach and therefore define incontinence type based on symptoms alone. The classification can be done either by the researchers or by the respondent’s confirmation of a typical description. Clinical assessment allows more differentiation of subtypes.

Severity. Severity of incontinence is another important factor for the estimate of prevalence. Severity can be defined by factors like frequency, amount, and subjective bother.

RESULTS

PREVALENCE

Several reviews of epidemiologic studies of UI are available, including some fairly recent ones. Differences in sample, definition and measurement, and survey methodology continue to make reviews challenging. Table I lists some of the prevalence data reported for samples of women from community-residing populations, showing widely varying estimates.

More epidemiologic research is available on older women of all ages because UI is considered a health condition of older age. Reviews of several European and US epidemiologic studies of older women living in the community estimate the prevalence of any experience of UI at 10% to 40% and suggest a prevalence of 40% for UI overall.

These studies also suggest that the wide range can be attributed to the definition of UI, the sample, and potentially, to the format of the questions about UI.

The prevalence of any UI by age shows an intriguing pattern of an early prevalence peak in midlife and then a steady increase among the elderly population. A recent study of women of all ages finds a gradual increase of prevalence across adulthood until age 50, when prevalence reaches 30%, and then a stabilization or even slight decrease until age 70, when prevalence starts increasing again (Figure 1).

Prevalence has always been higher in institutions because the residents tend to be older and more impaired than community-residing women. A recent review suggests that institutional prevalence ranges anywhere from 6% to 72%. Several recent studies from around the world-some of which use samples of institutions rather than individual institutions—suggest a prevalence of ≥50%.

The range of prevalence in institutions is probably a consequence of the definition of UI and criteria for admission to residential care, which vary within countries and from facility to facility. For this reason, it is important to sample residential care facilities in the same manner as individuals in order to obtain representative results about prevalence in such facilities.

The process that results in the relatively high prevalence of UI in residential care facilities remains unclear. Thom et al. found that existing UI increases the risk of subsequent hospitalization and substantially increases the risk of admission into nursing homes, independent of age, sex, or the presence of any comorbid condition. The relative risk of admission to a nursing home was 2 times greater for incontinent women after adjustment for age, cohort factors, and comorbid conditions. These findings suggest that incontinence may con-

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Age (yr)</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varnel et al. (1981)</td>
<td>1000</td>
<td>≥17</td>
<td>45</td>
</tr>
<tr>
<td>Holst and Wilson (1988)</td>
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<td>≥18</td>
<td>31</td>
</tr>
<tr>
<td>Sommer et al. (1990)</td>
<td>414</td>
<td>20–79</td>
<td>40</td>
</tr>
<tr>
<td>Brocklehurst (1993)</td>
<td>2124</td>
<td>≥30</td>
<td>9</td>
</tr>
<tr>
<td>Sandvik et al. (1995)</td>
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<td>≥20</td>
<td>29</td>
</tr>
<tr>
<td>Swithinbank et al. (1999)</td>
<td>2075</td>
<td>≥18</td>
<td>69</td>
</tr>
<tr>
<td>Hannestad et al. (2000)</td>
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<td>≥20</td>
<td>25</td>
</tr>
<tr>
<td>Temmi et al. (2000)</td>
<td>1262</td>
<td>≥20</td>
<td>26</td>
</tr>
<tr>
<td>Bortolotti et al. (2000)</td>
<td>5488</td>
<td>≥40</td>
<td>11</td>
</tr>
<tr>
<td>Moller et al. (2000)</td>
<td>2860</td>
<td>40–60</td>
<td>72</td>
</tr>
</tbody>
</table>

TABLE I. Examples of prevalence of any urinary incontinence in studies of community-dwelling women
tribute to institutionalization. However, an alternative explanation cannot yet be excluded with confidence.

**Type**

Only symptoms can be registered in surveys based on questionnaires or interviews. Typically, stress incontinence is identified when the respondent reports UI to occur with physical activity and urge incontinence when it occurs in the context of a sudden urge to urinate. Certain diagnoses (e.g., motor urge incontinence or genuine stress incontinence) require the use of urodynamic equipment and therefore cannot be based on data from questionnaires or interviews alone.

Proportions of types of UI differ with age (Figure 2). A recent study of women of all ages demonstrates a fairly regular increase in prevalence of mixed incontinence across the age range and a regular decrease in prevalence of stress incontinence (Figure 3). In general, studies indicate that approximately half of all incontinent women are classified as stress incontinent, making this group the largest among urge, mixed, and stress types. A smaller proportion is classified as mixed incontinent, and the smallest group is classified as urge incontinent.

The use of self-reports in epidemiologic studies has long been in question, given their low accuracy. Sandvik et al. validated diagnostic survey

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**FIGURE 1.** Prevalence of urinary incontinence (any leakage) in women ≥20 years of age. (Reprinted with permission from J Clin Epidemiol.)

**FIGURE 2.** Distribution of different types of urinary incontinence by age group. (Reprinted with permission from J Clin Epidemiol.)
questions against a final diagnosis made by a gynecologist after urodynamic evaluation. After using validity (sensitivity and specificity) as the basis for correcting the type distribution, the percentage of stress incontinence increased from 51% to 77%, mixed incontinence was reduced from 39% to 11%, and urge incontinence increased from 10% to 12%. Mixed incontinence may be overreported in epidemiologic surveys, and correction for validity indicates that a larger majority of women than previously reported may have pure stress incontinence.\textsuperscript{35} However, there are also some limitations in the use of urodynamics in documenting the presence of involuntary detrusor contractions, with both false-positive and false-negative results occurring. Therefore, the use of urodynamic testing as a “gold standard” may not be entirely appropriate in establishing the true prevalence of the different types, especially urge incontinence.

Unfortunately, not all studies have carefully assessed the different types (and even fewer have examined their correlates). Therefore, proportions of stress, urge, and mixed types among women are difficult to estimate, and estimates vary considerably. There are intriguing differences between the different types that suggest that the types may reflect quite different pathologies and that differentiating the types in future research might prove useful.

\textbf{Severity}

The characterization of severity has been made using several methods, including (1) a simple attempt to operationalize the frequency of urine loss, where severe incontinence is defined by weekly or more frequent loss; and (2) the use of quantity of loss, as well as perception differences, personal hygiene, and coping ability. Typically, slight incontinence denotes leakage of drops a few times a month, moderate incontinence daily leakage of drops, and severe incontinence larger amounts at least once a week.

Some studies have explicitly combined a frequency and a quantity measure.\textsuperscript{13,36} The Sandvik severity index is calculated by multiplying the reported frequency (4 levels) by the measured amount of leakage (dichotomized to 2 levels).\textsuperscript{13,37} The resulting index value is further categorized into slight, moderate, and severe. A recent validation concludes that the severity index is a simple, reliable, and sensitive measure of female UI for routine use.\textsuperscript{38}

The severity of incontinence varies between the different types. The fraction of severe incontinence is much lower in the stress group compared with the urge and mixed groups. In a major study, slight incontinence was found in 53% of the stress group, 39% of the urge group, and 31% of the mixed group. Within each type of incontinence, severity increased with increasing age (Figure 3).\textsuperscript{15}

Prevalence is also dependent on thresholds for diagnosis or severity. For example, Sandvik et al.\textsuperscript{13} found that nearly 50% of cases were classified as slight incontinence and only 27% as severe. Studies also investigated the “bother” factor and found that different levels of bother significantly affected the prevalence estimates and that approximately 20% of incontinent women have severe incontinence, if only moderate or severe incontinence and an indication of bother are considered.\textsuperscript{13,15}

Although the definition of severe or “significant” UI varies among investigators, its prevalence is
considerably less variable across different studies than the prevalence of “any incontinence” (all incontinent women). Prevalence estimates range between 3% and 17%. The lesser variance among these estimates suggests that severe incontinence is less easy to deny and better understood by participants than any incontinence and thus may represent a more reliable figure.

**Incidence, Remission, and Natural History**

Few epidemiologic data are available on the development or natural history of UI and its types and severity levels. Data are needed on the transition from continence to various levels of severity and type of incontinence.

Very few studies have reported on the incidence of UI. A study of community-dwelling women aged ≥60 years found that 20% of the originally continent women had developed some level of UI during the 1-year study period. Burgio et al. studied a cohort of healthy middle-aged women for 3 years. Of the previously continent women, 8% reported at least monthly leakage; higher rates have been found in the older population. In another study, 1-year incidence rates of 6% and 3% were reported for young and middle-aged women, respectively.

Similarly, rates of remission (the probability of becoming continent among previously incontinent women) vary considerably across the few studies that have investigated them; 1-year rates ranged between a maximum of 38% to a minimum of 6% among middle-aged and younger women, and 10% for older women. What is very clear from these findings is that substantial incidence rates are paralleled by equally substantial remission rates. It is not clear whether the level of remission reflects active treatment or intervention or whether it is part of the natural course of incontinence. Although questions about causal factors had been investigated in the studies, scant relevant findings emerged.

**Racial and Ethnic Differences**

Most epidemiologic studies of UI have been conducted in white populations. Research on other populations shows a wide variation in prevalence. These studies have used different methods and definitions, and the quality is mixed. Therefore, the results are difficult to compare, and most of the studies do not lend themselves easily to cross-cultural or cross-national comparisons.

Some data for black women exist, and they indicate that white women may be more susceptible to UI than black women. Black South African women rarely develop stress incontinence, and they develop the related disorder of the pelvic floor prolapse at a rate 80 times lower than whites, which may be a function of differing urethral pressures and length, as well as pubococcygeal muscle strength. No difference in the prevalence of minor nulliparous stress incontinence among white (46%), Indian (42%), and black South African nurses (40%) was demonstrated. In the United States, clinical data suggest that black women have higher urethral closure pressure, larger urethral volume, and greater vesical mobility compared with white women.

This difference in physiologic subtypes was supported by a recent presentation of similar studies, confirming a significant difference in the predominance of stress incontinence in white women. However, the difference may be explained by racial differences in help-seeking behavior because it involved clinical groups. Racial differences have also been reported among pregnant women. However, the differences were evident only for stress incontinence, and not for urge incontinence or other types of urine leakage. Recently, several large population-based studies have reported findings similar to the clinical studies.

**Variability in Prevalence Estimates**

Investigations of incontinence are plagued with problems that ultimately result in variations in prevalence estimates. Sampling and nonresponse issues, self-selection and attrition, definition, and measurement issues have all been proposed as confounders to survey and epidemiologic research. Reviews of measurements and methodology in investigating UI are available. The use of different definitions and measurements in UI research is a major contributor to varying prevalence estimates. Objective demonstration of urine loss is notoriously difficult to achieve outside the clinical setting. Defining UI as a “social or hygienic problem” is difficult because of the subjective aspect of this phrase. Differing severity levels used in definitions also contribute to the variation in estimates. Some of these complications come from the nature of the condition. UI starts slowly and can occur irregularly before it becomes fully established. Once people become accustomed to their UI, their perceptions of it change, which can interfere with assessment.

Another factor that accounts for some of the variation is in sample methodology. Sample populations for UI studies are found in a number of ways, including using patients in health organizations, general practice, or institutions, the inclusion or exclusion of which can account for biased sampling frames.

Rate of response is another obvious factor in biasing prevalence estimates. Incontinent women may ignore UI queries or deny having UI, or they
may respond in greater numbers because they are drawn to the subject. We do not currently know how these factors affect prevalence estimates.

Methods of collection also greatly affect the final estimate of UI in a study. Some data are collected using postal questionnaires, and some investigators conduct personal or telephone interviews. Although postal queries usually have lower response rates, interview responses may be more susceptible to social desirability bias.

CONCLUSIONS

Prevalence estimates for female incontinence across studies show a wide range of some degree of UI. The inconsistency may be explained by such factors as different definitions of UI, study sample and survey procedure variances, or variation in the effects of intervention. The median level of prevalence estimates gives a picture of increasing prevalence during young adult life (prevalence, 20% to 30%), a broad peak around middle age (30% to 40%), and then a steady increase in the elderly population (30% to 50%). The prevalence of severe or significant incontinence is consistent, ranging between 3% and 17%, with most studies reporting between 6% and 10%.

Similarly, proportions of types of UI are difficult to estimate, and estimates vary considerably. Approximately half of all incontinent women are classified as stress incontinent. A smaller proportion are usually classified as mixed incontinent, and urge incontinence is the smallest category. Little is known about the risk factors and demographic correlates of the different types, but the types probably reflect different pathologies and etiologies. Differentiating types of UI in future research may prove very fruitful.

There is still little knowledge about prevalence, incidence, and other epidemiologic data in developing countries. Crude prevalence studies (descriptive epidemiology) from the United States and Europe are abundant. Further studies should be done only with recommended and validated questionnaires. They should also combine data from prevalence studies with studies of cofactors and predictors.

There also remains a paucity of published information on UI in nonwhite women worldwide. The data suggest a higher prevalence of UI among white women, which may be caused by racial or ethnic differences in the prevalence of stress UI.

Other areas in which studies should be encouraged are incidence and remission. Incidence studies are very scarce. Incidence rates are not insubstantial, but we lack established predictors for incident UI. We know that remission occurs, but we understand little about the rates of remission or its predictors. Such studies will also provide a better understanding of the dynamics between risk factors and the onset of UI.

These variations in definitions and measurement issues are fundamental research issues and lead to problems with assessing findings in epidemiologic studies. We therefore recommend that all epidemiologic studies contain a minimum data set, including a statement of any involuntary urine loss, frequency measure, quantity of urine loss, duration, type, and severity. In addition, we recommend that validated measures of bother/quality of life and urinary symptoms other than UI should be included in studies, but not in the general definition of UI.

REFERENCES