## ORIGINAL ARTICLE

**Gunilla Tegerstedt · Marianne Maehle-Schmidt**
**Olof Nyrén · Margareta Hammarström**

# Prevalence of symptomatic pelvic organ prolapse in a Swedish population

**Abstract** Our aim was to estimate the prevalence of symptomatic pelvic organ prolapse (POP) in a Swedish urban female population. The cross-sectional study design included 8,000 randomly selected female residents in Stockholm, 30–79-year old. A postal questionnaire enquired about symptomatic POP, using a validated set of five questions, and about urinary incontinence and demographic data. Of 5,489 women providing adequate information, 454 (8.3%, 95% confidence interval 7.3–9.1%) were classified as having symptomatic POP. The prevalence rose with increasing age but leveled off after age 60. In a logistic regression model that disentangled the independent effects, parity emerged as a considerably stronger risk factor than age. There was a ten-fold gradient in prevalence odds of POP with parity, the steepest slope (four-fold) being between nulliparous and primiparous women. The prevalence of frequent stress urinary incontinence was 8.9% and that of frequent urge incontinence 5.9%. Out of the 454 women with prolapse, 37.4% had either or both types of incontinence.

**Keywords** Cross-sectional study · Questionnaire · Pelvic organ prolapse · Prevalence · Urinary incontinence · Stress urinary incontinence

G. Tegerstedt · M. Hammarström
Department of Obstetrics and Gynaecology,
Karolinska Institutet, Stockholm Söder Hospital,
118 83 Stockholm, Sweden

M. Maehle-Schmidt
Statisticon, Uppsala, Stockholm, Sweden

O. Nyrén
Department of Medical Epidemiology and Biostatistics,
Karolinska Institutet, Stockholm, Sweden

G. Tegerstedt (✉) · O. Nyrén · M. Hammarström
Department KI, Clinical Epidemiology Unit,
Söder Hospital, Stockholm, Sweden
E-mail: Gunilla.Tegerstedt@sodersjukhuset.se
Tel.: +44-8-6162646
Fax: +44-8-6162640

**Abbreviations** POP: Pelvic organ prolapse · CI: Confidence interval · OR: Odds ratio · POPQ: Pelvic organ quantification system

## Introduction

Pelvic organ prolapse (POP) accounts for a sizeable proportion of gynaecological inpatient and outpatient care [1, 2]. Confirmed data about risk factors, incidence and prevalence, natural history and treatment results are sparse and inconsistent [3–9]. The relative scarcity of such data has contributed to uncertainty about indications and timing of surgical treatment. Research in this field has previously been hampered by a lack of widely accepted definitions. In 1996, the International Continence Society published a standardized system of terminology for description of female POP, the POP quantification system (POPQ) [10]. However, while aberrations of pelvic floor anatomy can now reproducibly be described, laywomen will only note—and potentially suffer from—pelvic floor dysfunction that gives rise to symptoms. This results in a diagnostic problem since the anatomic stage of POP is not invariably related to symptoms [11–13]. Nonetheless, valid information on the prevalence of symptomatic POP is important not only for the planning of gynecological health care, but also for a perspective of the clinical finding of genital organ prolapse in an individual patient.

The purpose of this study was to estimate the prevalence of symptomatic POP in a Swedish urban population.

## Materials and methods

The study was cross-sectional in a representative sample of a well-defined source population. Eight thousand women, 30–79-year old and residents of Stockholm city,

were randomly selected from the computerized and continuously updated Swedish population register. A validated five item questionnaire about presence of symptomatic prolapse [14] was mailed to all selected women. The answers to the questions were assigned scores (Table 1) that were added. A total score above 30 indicated presence of symptomatic prolapse. The five questions, supplemented with information about age, provide essentially all of the discriminatory power of an original set of 13 questions. The sensitivity and specificity was 66.5% and 94.2%, in a test set consisting of 239 women with verified presence and 43 with absence of prolapse, respectively, upon standardized examination according to POPQ [14]. We supplemented the questions about prolapse with questions about the presence of stress urinary incontinence and five questions about background data such as previous gynaecological surgical procedures. The questions are listed in Table 1.

We sent reminders to non-responders after 1 and 2 months. Moreover, we tried to contact 100 randomly sampled non-responders after two reminders for a short telephonic interview.

## Statistical methods

Age-specific prevalence in 10-year age strata was expressed as the number of subjects with a questionnaire score exceeding our predefined criteria [14] divided by the total number who provided interpretable responses in the respective age stratum. We calculated 95% confidence intervals (CI) according to the method proposed by Altman et al. [15]. Statistical testing of trends across age groups and parity groups was performed using the Cochran–Armitage test for trend [16, 17]. The effects of age, parity, and history of prior gynecological surgery were first estimated in univariate logistic regression models with the odds of POP as the dependent variable. The associations were expressed as odds ratios (OR) with 95% CI. To disentangle the independent effects of age and parity, with an adjustment for prior surgeries, we also fitted multivariate logistic regression models. Since the effect of age seemed to be non-linear, we further fitted generalized additive models. Nested multivariate models were tested against each other using the deviance as a test for goodness-of-fit. All tests performed were two-sided at the 5% significance level.

The study was approved by the Ethics Committee South at Karolinska Institutet. All subjects received written information before enrolment.

## Results

Of the 8,000 selected women 1,795 never responded and 697 women actively declined participation. Eight

**Table 1** Questions used in the mailed questionnaire with answers and scores

| Validated questions about prolapse | Response alternatives | Score |
|---|---|---|
| Do you have a sensation of tissue protusion (vaginal bulge) from vagina? | Yes, often | 50 |
| | Sometimes/infrequently | 30 |
| | Never | 1 |
| Does it happen that you suffer from scraping in your vagina/vulva? | Yes, often | 5 |
| | Sometimes/infrequently | 2 |
| | Never | 1 |
| Does it happen that you have to lift the anterior vaginal wall to start or complete voiding? | Yes,often/sometimes/infrequently | 11 |
| | Never | 1 |
| Do you suddenly feel the urge to go to the toilet and then accidentally leak urine? | Yes, often | 7 |
| | Sometimes/infrequently | 5 |
| | Never | 1 |
| If you answer in the affirmative to any of the questions above, do your symptoms become worse during physical strain, for example lifting heavy objects? | Worse | 10 |
| | Unchanged/better | 1 |
| *Questions about urinary incontinence* | | |
| Do you leak urine when you cough, sneeze or lift heavy objects? | Yes, often | |
| | Sometimes/infrequently | |
| | Never | |
| *Other questions* | | |
| Age | Age < 50 | 1 |
| | Age > 70 | 3 |
| | 50 < age < 70 | 2 |
| Did you have any delivery? | Yes | |
| | No | |
| If yes, how many deliveries have you had? | | |
| Did you have any previous gynecological abdominal surgical procedure? | Yes | |
| | No | |
| Did you have any previous surgical procedure for prolapse? | | |
| Did you have any previous surgical procedure for urinary incontinence? | | |

Scores > 30 positive response for prolapse

questionnaires were returned unopened due to erroneous address information. Hence, 5,500 women (69%) returned more or less complete answers. Eleven of these women were excluded because of inconsistencies in the age information, leaving a total of 5,489 women available for the analysis.

We identified 454 women who gave self-reports consistent with POP, corresponding to an overall prevalence of 8.3% (95% CI 7.3–9.1%). Forty-seven women could not be classified due to incomplete answers.

The prevalence of symptomatic POP increased with age up to 60 years (Table 2). Among women who were 30–39, 40–49, and 50–59 years of age the prevalence was 4.1, 6.2, and 11.8%, respectively. Thereafter, the prevalence became a constant. Among women aged 60–69 and 70–79 the prevalence was 12.2 and 11.0%, respectively. Using 30–39 year old women as the reference, the unadjusted OR of POP increased to around three after age 50 and remained in this level among those who were older. The increasing age trend was statistically significant ($P$-value for the Cochran–Armitage test $< 0.001$).

The number of age categories could be reduced from the original five to two, 30–49 and 50–79 (deviance = 7.06, $P = 0.07$), but not further. This indicates that the age–prevalence relationship consisted of two disparate linear trends, below and above the age of about 50–60 years.

The number of full term pregnancies was even more strongly linked to POP prevalence than to age (Table 2); the prevalence odds increased almost four-fold between women with no and those with one full term pregnancy. Then, the odds increased monotonically to more than ten among women with five or more pregnancies.

The independent effects of age and number of births were modeled with bivariate logistic regression (Table 3). There was a twofold gradient in odds of POP with age when adjusting for parity and an eightfold gradient in the odds of POP with parity when adjusting for age. The bivariate logistic regression model could not

be reduced to a univariate model. Twenty-five women did not answer the parity question, but 20 of them stated that they had at least one child. Imputing the mean number of children for these women's age group did not change the result.

Previous gynecological laparotomies were not associated with the presence of symptomatic POP. However, 26 (31%) out of 84 women who had undergone any incontinence operation reported symptomatic POP (adjusted OR = 3.5; 95% CI 2.2–5.7). No less than 45 (42%) of 107 women who had previously undergone surgery for prolapse reported symptoms consistent with current POP with mutually adjusted prevalence OR = 6.1, 95% CI 4.0–9.11 relative to women without prior prolapse surgery

Since age seemed to have a non-linear effect, generalized additive models were fitted to the data [17]. In Fig. 1 the effect of age on symptomatic POP is shown. The risk increases with increasing age and levels off at around 60. The non-linearity was conformed by a formal test.

Pointwise OR for age in 5 years intervals were calculated [16] with 30 years as the reference age. As in

**Table 3** Bivariate logistic regression model that disentangles the independent effects of age and parity on the prevalence of symptomatic POP

| Factor | OR | 95% CI |
|---|---|---|
| Agegroup | | |
| 30–49 | 1.0 | Ref. |
| 50–79 | 2.0 | 1.6–2.5 |
| Term parity | | |
| No term pregnancy | 1.0 | Ref. |
| 1 | 3.4 | 2.3–5.1 |
| 2 | 3.8 | 2.6–5.5 |
| 3 | 4.7 | 3.1–7.0 |
| 4 | 6.1 | 3.7–10.2 |
| >4 | 8.2 | 4.5–15.0 |

**Table 2** Prevalence of symptomatic POP by age and parity

| Factor | Number of cases with POP | Prevalence (%) | 95% CI | Unadjusted OR | 95% CI | Mutually adjusted OR | 95% CI |
|---|---|---|---|---|---|---|---|
| *Age group years)* | | | | | | | |
| 30–39 | 62 | 4.1 | 3.2–5.2 | 1.0 | Ref. | 1.0 | Ref. |
| 40–49 | 75 | 6.2 | 5.0–7.7 | 1.6 | 1.1–2.2 | 1.2 | 0.8–1.7 |
| 50–59 | 142 | 11.8 | 10.1–13.7 | 3.1 | 2.3–4.3 | 2.3 | 1.7–3.2 |
| 60–69 | 97 | 12.2 | 10.1–14.7 | 3.3 | 2.4–4.6 | 2.3 | 1.6–3.2 |
| 70–79 | 78 | 11.0 | 8.9–13.5 | 2.9 | 2.1–4.1 | 2.0 | 1.4–2.8 |
| *Term parity*[a] | | | | | | | |
| No term pregnancy | 35 | 2.4 | 1.7–3.3 | 1.0 | Ref. | 1.0 | Ref. |
| 1 | 95 | 8.8 | 7.2–10.6 | 3.9 | 2.6–5.8 | 3.4 | 2.3–5.1 |
| 2 | 185 | 9.8 | 8.6–11.3 | 4.4 | 3.1–6.4 | 3.7 | 2.5–5.3 |
| 3 | 86 | 12.2 | 10.0–14.8 | 5.6 | 3.8–8.4 | 4.6 | 3.0–6.9 |
| 4 | 32 | 15.9 | 11.5–21.6 | 7.7 | 4.6–12.7 | 6.1 | 3.6–10.1 |
| >4 | 20 | 20.8 | 13.9–30.0 | 10.7 | 5.9–19.3 | 8.3 | 4.5–15.3 |

[a]Information missing from one subject
Prevalence OR with 95% CI derived from univariate logistic regression models and from a bivariate model with mutual adjustments for age group and parity
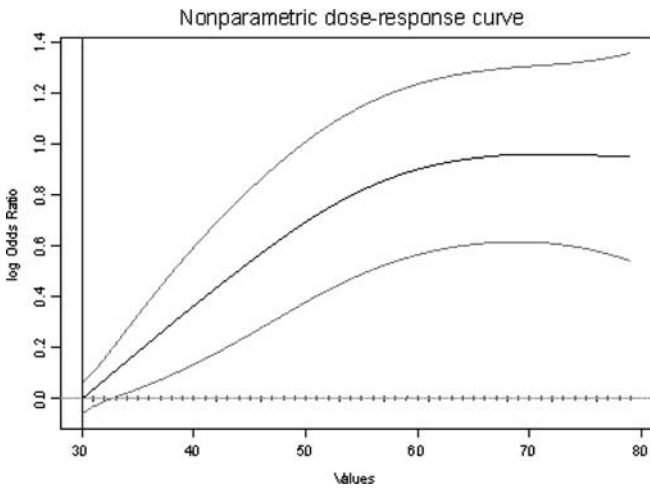
Fig. 1 The log odds ratio curve for age in the GAM model

univariate modeling, effects of age levelled off at age around 60 years (Fig. 1). Previous surgeries for prolapse and incontinence were statistically significant when included in the model (data not shown).

The number of women who described any (often/sometimes/infrequently) urinary leakage during physically straining activities, and any urge incontinence was 3,444 (63.2%, 95% CI 61.9%–64.4%) and 2,756 (50.5%, 95% CI 49.2–51.8%), respectively. The prevalence of frequent (equal to the "often" response alternative) stress incontinence was 8.8% (95% CI 8.1–9.6%) and of frequent urge incontinence 5.8% (95% CI 5.2–6.5%). The prevalence of both types of urinary incontinence increased with age, but while the prevalence tended to increase monotonically for urge incontinence (Fig. 2) the pattern for stress incontinence was similar to that seen for POP, with a knee in the prevalence curve coinciding approximately with age 50–60 (Fig. 3). The presence of two types of frequent urinary incontinence overlapped substantially (Fig. 4). The prevalence of urinary incontinence of both types simultaneously was 3.2% (95% CI 2.7–3.6%), of isolated frequent urge incontinence 2.7% (95% CI 2.3–3.1%) and of isolated frequent stress incontinence 5.7% (95% CI 5.1–6.3%).
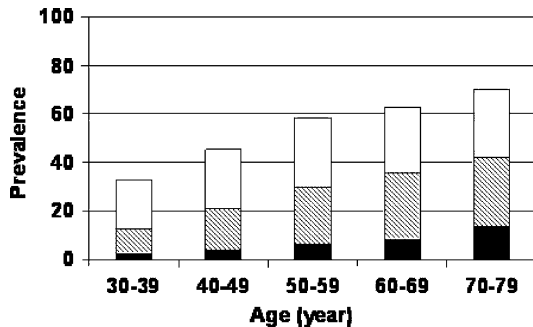


Fig. 2 Prevalence of urge incontinence according to age group. Black often, hatched sometimes, white occasionally
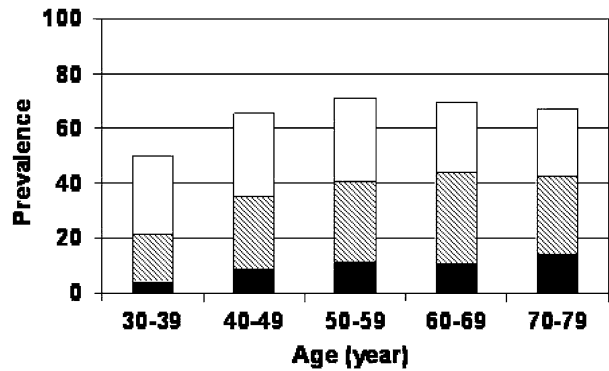


Fig. 3 Prevalence of stress incontinence according to age group. Black often, hatched sometimes, white occasionally

Moreover, there was a considerable overlap between occurrence of urinary incontinence and POP (Fig. 4). Of the 454 women classified as having POP, 170 (37.4%) had either or both types of incontinence; 130 (28.6%) had frequent stress incontinence and 102 (22.5%) frequent urge incontinence. Frequent stress and urge incontinence was reported by 7.1% (95% CI 6.4–7.8%) and 4.3% of the women (95% CI 3.8–4.9%), respectively, among the 4,988 who were classified as not having POP.

To explain possible effects by non-response, we analyzed prevalence of POP by the readiness to participate, assuming that women who answered first after two reminders were more similar to non-responders than those who answered without delay. In the groups of women who answered after 0, 1 and 2 reminders the prevalence rates were 8.0, 8.6, and 10.5%, respectively. On the other hand, median age among women who failed to respond after two reminders (42 years) was lower than among our responders (49 years). The highest median age (56 years), however, was noted among the 697 women who actively declined participation. Of the 100 non-responders selected for the telephonic interview, 55 did not have telephone, 22 refused to answer, and no more than 23 accepted. None in the last group had symptoms of prolapse, but ten women had urge incontinence.

## Discussion

In this northern European urban population, one woman out of 12 reported symptoms consistent with POP. The prevalence rose with age up to age around 60, but after that there was no further increase. Symptomatic POP coincided with frequent urinary incontinence in approximately one-third of the cases. The number of full term parities was a stronger determinant of symptomatic POP than age. However, since symptomatic POP was present in 2.4% of nulliparous women, childbirth was not a necessary condition for the development of symptomatic POP.

**Fig. 4** A Venn diagram describing the overlap between symptomatic POP, frequent stress incontinence and frequent urge incontinence
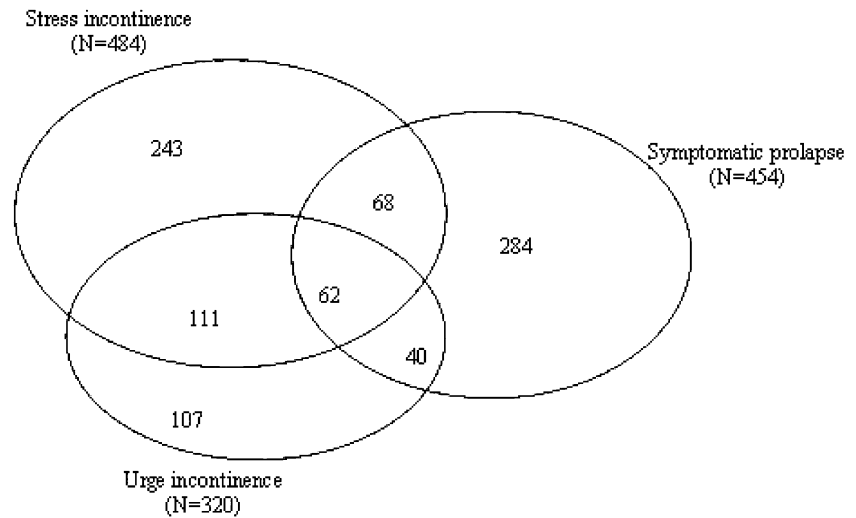


The sensitivity of our self-reporting instrument was only 66.5%. If the sensitivity had been perfect, the prevalence would have been 50% higher (but a perfect specificity would deduct about 7%). In our validation study [14] 72.5% of the missed cases had asymptomatic stage I prolapse, clinical significance of which is doubtful but unknown at present [5, 18, 19]. The sensitivity in detecting stage II disease or higher was 84.5%. The impact of the lack of sensitivity on effects of age and parity depends on extent to which this lack was differential. We believe that it was mainly non-differential and therefore the effects of age and parity were probably slightly underestimated.

In other epidemiological studies that used self-reports [7, 20] the prevalence was of similar magnitude as in our study despite vast cultural differences. Most studies were, however, limited by non-validated questions and selected populations [2–4, 6, 9, 16, 21]. Several of these were not POPQ-based. Although POPQ has been validated [21, 22], it has been used in few population-based studies. A Swedish study [5] with physical examinations of a representative sample of a female population found a considerably higher prevalence of prolapse than that reported by us, but most women had minor abnormalities and only a minority had symptoms.

Although age is widely recognized as an important determinant for the prevalence of POP, few studies have provided detailed and precise data by premenopausal and postmenopausal age. Thus, the previous literature can neither confirm nor refute our finding of a distinct knee on the age–prevalence curve coinciding approximately with the age of menopause. One study [3], however, observed a similar knee in the age–prevalence curve for stage II prolapse among women seeking routine gynaecologic health care, whereas stage III prolapse continued to increase after an age of 50. Other studies were unable to confirm a change in the trend around an age of 50, but they were either based on consulting patients [2, 6, 23] who may not be representative of the population at large, or did not have a sufficient number of observation points above age 50 to clearly refute a plateau [5].

Urinary incontinence may occur as a solitary symptom or as part of a complex when pelvic support is deficient. Genuine stress incontinence is the most common symptom of pelvic floor dysfunction. In an epidemiological study from Sweden only half of the female population considered themselves to be fully continent. In our study, no more than 2,009 of 5,489 (37.8%) women reported that they were always and completely continent when physically active, and 2,705 out of 5,461 (49.5%) reported complete absence of urge incontinence. Women with symptomatic POP according to our criteria had urinary incontinence more often than women without prolapse symptoms. As stress and urge incontinence seem to be more common if there are concomitant symptoms of prolapse, it is reasonable to assume that these symptoms, when occurring together, may be manifestations of insufficient pelvic support. Therefore, care should be taken when and if an operation is suggested. It was reported that 14% of the women treated with anti-incontinence operations like colposuspension for genuine stress incontinence developed a prolapse within a few years [24]. Conversely, there seems to be an increased risk of stress incontinence following surgery for POP [25].

With the possibility of differential misclassification of POP and/or differential non-response, as well as possible birth cohort effects, our cross-sectional data seem to indicate that once a woman reaches the age of 50–60 the risk of new symptomatic POP is very small. This statement can probably be extended to say that asymptomatic stage I POP (which was often missed in our questionnaire) at the time of menopause is very unlikely to develop into clinically significant symptomatic disease. Therefore, prophylactic surgical corrections of asymptomatic low-grade POP in postmenopausal women may not be advisable.

Our questionnaire was not designed to discriminate between prolapse stages. Therefore, we cannot exclude the possibility that women above the age of 50–60 had successively more advanced POP stages with increasing age, leading to an increasing number of gynaecological consultations, in line with the findings of others [3]. Another possibility is that older people might have a generally higher threshold for reporting any kind of symptoms [26] and that the observed plateau reflects this increased threshold rather than a genuine prevalence plateau. However, a possibly increasing threshold with age does not explain the distinct knee of the curve.

The importance of this study includes the strictly random sample of the population and the use of a validated instrument [14] for self-reports of symptomatic POP. Important caveats are the fairly high non-response rate and the limited sensitivity of the self-reporting instrument. Non-responders were, on average, younger than the participants, and young age was linked to low prevalence. The slight shift towards higher mean age among participants may have inflated the overall prevalence, but the age-specific rates are unlikely to have been importantly affected. If reluctant responders are assumed to be more representative of non-responders rapid responders in comparison to, the prevalence of POP among non-responders should be higher than in the responding sample; those who did not respond until after two reminders had a prevalence that was 27% higher than our overall estimate among all participants. On the other hand, telephonic interviews with factual non-responders disclosed zero prevalence, but they represented a probably biased fourth of the randomly selected non-responders. Hence, we failed to obtain an unequivocal indication of the POP prevalence among the non-responders. With the extreme assumption in a sensitivity analysis that the prevalence among non-responders was 50% lower than the 8.3% observed among the responders, the overall prevalence would have been 7.0% (95% CI 6.4–7.6%). If we assume that the prevalence of POP among non-responders was 50% higher than that observed, the overall prevalence would have been 9.6% (95% CI 8.9–10.2%). The impact of non-response on the effects of age and parity completely depends on whether or not it was differential, i.e., if the excess or deficit of POP among the non-responders varied systematically across the strata of age or parity. It seems unlikely that there was such an important variation, and therefore, we believe that the observed associations of age and parity with the odds of having POP are valid.

In conclusion, symptomatic POP affects a sizeable number of adult and elderly women, notwithstanding that our data indicated a lower overall prevalence compared to some prior studies that captured all anatomical deviations from the perfectly normal. It appears that parity is the strongest driving force in the development of symptomatic POP, but it is not a necessary cause. Age per se—or factors linked to age—carries additional risk, particularly in middle-aged women.

After menopause, however, the prevalence appears to level off.

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