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Pelvic organ prolapse and anal incontinence in women: screening with a validated epidemiology survey

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Abstract

Purpose—The primary objective of this study was to determine the prevalence of pelvic organ prolapse (POP) and anal incontinence (AI) in a Minnesota population using the Epidemiology of Prolapse and Incontinence Questionnaire (EPIQ). The secondary objective of this study was to determine the association of POP and AI with parity, age, smoking status, body mass index (BMI), and co-morbidities.

Methods—Women ≥ 18 years old attending the 2018 Minnesota State Fair were asked to fill out a web-based version of the EPIQ. Multivariable logistic regression models were used to investigate the association of POP and AI with the variables of interest.

Results—A total of 1426 women were included in the analysis. There was a 4.9% prevalence of POP and 14.9% prevalence of AI. POP was significantly associated with parity and higher BMI ($p < 0.01$ and $p = 0.02$, respectively). In this cohort, POP was not associated with older age, smoking, or presence of co-morbid conditions. Anal incontinence was associated with older age ($p < 0.01$), smoking status ($p = 0.01$), and presence of co-morbid conditions ($p = 0.01$) but was not associated with parity or higher BMI.

Conclusion—POP and AI were associated with some, but not all, of the variables tested, which differs from prior studies. In addition, the prevalence of POP and AI were different than rates reported in similar studies. This may suggest regional differences in prevalence of POP and AI.

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Author contribution MGG: protocol/project development, data collection, data analysis, manuscript writing/editing. KMT: data analysis, manuscript writing/editing. CSF: data analysis, manuscript writing/editing. NN: data analysis, manuscript writing/editing. MCO: data collection, data analysis, manuscript writing/editing. JF: protocol/project development, data collection, data analysis, manuscript writing/editing.

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Keywords

Epidemiology of Prolapse and Incontinence Questionnaire; Pelvic organ prolapse; Anal incontinence; Flatal incontinence; Fecal incontinence

Background

Female pelvic floor disorders (PFD) including urinary incontinence (UI), pelvic organ prolapse (POP), and anal incontinence (AI) are common and can severely affect quality of life. In the next decade, the United States female population is expected to increase to 180 million, with almost a quarter being over the age of 65 [1]. Studies have predicted that the total number of women who will undergo surgery for POP disorders will increase 48.1% by 2050 due to the aging population [2]. Given this growth, it is important to understand the current rate of PFD in women and predict the future need for PFD treatment. Data regarding the prevalence of PFD are variable with estimates of less than 1–39% for AI, and from 16 to 46% for POP depending on the population studied and definition of the conditions used [3, 4]. There are several factors that can affect prevalence estimates of PFD, including asymptomatic disease, not seeking medical attention, or lack of access to medical care. The lack of a single standardized and validated instrument to screen for pelvic floor disorders in a large population has further hampered efforts to determine their prevalence. Determining the prevalence of female PFD is important to inform the needs of providers and secure resources to care for these women.

Several tools have been used to screen for PFD such as the PFDI (Pelvic Floor Distress Inventory), PFIQ (Pelvic Floor Impact Questionnaire), and ICIQ-VS (International Consultation on Incontinence Questionnaire Vaginal Symptoms) [5, 6]. However, these tools are validated in women presenting for PFD symptoms and do not assess for risk factors for PFD such as medical, surgical, and obstetric history. In addition, these tools are not optimal for large-scale population screening.

The epidemiology of prolapse and incontinence questionnaire (EPIQ) is one validated screening instrument that may be better suited for population-based screening and was established for epidemiologic research. The reported EPIQ-positive predictive value and negative predictive value for POP was 76% and 97%, and for AI, it was 61% and 91%, respectively [7]. It has been shown to have good internal consistency and test–retest reliability between both web and paper-based administration [7, 8]. However, the population used to validate the EPIQ was representative of the population in Southern California Kaiser system, and prevalence of these disorders may vary depending on the population studied. We administered a web-based version of the EPIQ among women attending the Minnesota State Fair in 2018. The goal of this article is to determine the prevalence of POP and AI. The secondary objective of this study was to determine the association of POP and AI with parity, age, smoking status, body mass index (BMI), and co-morbidities.

Methods

The study population included women ≥ 18 years old who attended the University of Minnesota Driven to Discover (D2D) Booth at the 2018 Minnesota State Fair, which ran from August 23, 2018 to September 3, 2018. The Minnesota State Fair was chosen, because it attracts a diverse population; 2 million people attend the State Fair per year from both urban and rural Minnesota. The D2D booth is a yearly component of the State Fair that was designed to allow researchers to recruit participants for various research studies. Women who presented to the D2D booth were asked to complete a web-based version of the EPIQ. Participants reported data using iPads connected to a secure web-based system, Research Electronic Data Capture (REDCap) [9, 10]. REDCap is a secure, web-based software platform designed to support data capture for research studies, providing an interface for data capture and data downloads to common statistical packages.

Institutional review board (IRB) approval was obtained from the University of Minnesota for this cross-sectional survey study and was IRB exempt. Verbal informed consent was obtained from participants prior to distributing the survey. Exclusion criteria include age < 18, inability to provide verbal consent to take the survey, and inability to speak or understand English.

Statistical analysis

Descriptive statistics were used to summarize demographic information, medical, and surgical history. Univariable logistic regression models were used to determine the association between AI or POP and post-menopausal status, history of hormone replacement therapy (HRT) use, and history of hysterectomy. Multivariable logistic regression models were used to investigate the association between each outcome and variable (age, smoking status, parity, BMI, and co-morbidities), after adjusting for other variables. Due to non-response for some questions, the total N varies for each variable depending on the outcome. All reported p values are two-sided and a significance level of 0.05 was used. All analyses were performed using R (version 3.6.1, R Core Team) and SAS (version 9.4, SAS Institute Inc., Cary, North Carolina).

Results

A total of 1568 female participants completed all or part of the survey; 125 participants were excluded for missing age and 17 participants were excluded due to pregnancy. A total of 1426 participants were included in the analysis. Table 1 lists the clinical characteristics of this study cohort. The mean age in this cohort was 46.1 years and mean BMI was 27.1 kg/m^2. This cohort was overall healthy, with only 15% of participants reporting a diagnosis of diabetes, asthma, lung disease, or neurologic disease (e.g. stroke, spinal cord injury, Parkinson's, Multiple Sclerosis, Lou Gehrig's disease). In addition, 171 participants (12%) had a history of hysterectomy and 612 participants (44.6%) were post-menopausal, which we defined as absence of menses for 12 months or surgical removal of both ovaries.

Overall, 70 participants (4.9%) reported POP symptoms (Table 2), which was defined as responding in the affirmative to the following survey question "Do you have a sensation

that there is a bulge in your vagina or that something is falling out from your vagina?". Approximately 37% of participants asked for help from a doctor, nurse, or other healthcare provider for POP symptoms. Of all women surveyed, 17 participants (1.2%) had a history of surgical treatment for POP. Of the participants who underwent surgical treatment, 7 (41.2%) reported still having POP symptoms after surgery.

To evaluate for AI, participants were asked the following questions: (1) "Do you lose stool beyond your control if your stool is loose or liquid?", (2) "Do you lose well-formed stool beyond your control?", and (3) "Do you lose gas from your rectum that is beyond your control?". Fecal incontinence was defined as answering in the affirmative to (1) or (2) and symptoms occurred more than once per month. Flatal incontinence was defined as answering in the affirmative to (3) and symptoms occurred more than once per month. Flatal incontinence was reported by 182 (12.8%) participants and fecal incontinence was reported by 60 (4.2%) participants. AI was defined as answering in the affirmative to one of the above and symptoms occurred more than once per month. In all, 212 participants (14.9%) met criteria for anal incontinence. Only 16.6% of participants asked for help from a doctor, nurse, or other healthcare provider for treatment of fecal or flatal incontinence. Surgical treatment for flatal or fecal incontinence was undertaken by three participants (0.2%). One participant reported continuing to have flatal and fecal incontinence after surgery.

The data were analyzed to determine the association of POP, AI, fecal incontinence, and flatal incontinence with variables of interest (Table 3). There was a statistically significant association of POP with parity and BMI ($p < 0.01$ and $p = 0.02$, respectively). Older age and smoker status were not associated with POP in this cohort ($p > 0.05$).

AI was associated with older age, smoking history, and presence of co-morbid conditions (all $p < 0.05$). There was no association of AI with parity or BMI. Fecal incontinence was associated with age and co-morbid conditions, while flatal incontinence was associated with older age and smoking history (all $p < 0.05$).

Finally, the association of AI and POP with menopausal status and history of hysterectomy was assessed (Table 4). POP was not associated with either variable, while AI was associated with both ($p < 0.01$ and $p = 0.05$, respectively). This is in line with our findings that older age is associated with AI but not POP. The association of AI with history of hysterectomy is controversial in the literature, with some authors finding a correlation and others not finding a correlation. [11, 12].

Discussion

The EPIQ was developed to screen large populations for the presence of PFDs. In this study cohort, the prevalence of POP was 4.9%, AI was 14.9%, flatal incontinence was 12.8% and fecal incontinence was 4.2%. The prevalence of POP and AI varies greatly in the literature depending on the definition use. The prevalence of flatal incontinence is not well studied but is estimated to affect 18% of women [13]. Lawrence et al. found a 6% prevalence of POP and a 25% prevalence of AI [12]. In contrast, through the National Health and Nutrition Examination Survey (NHANES), Nygaard et al. found a 9% prevalence of fecal

incontinence and a 2.9% prevalence of POP [14]. The study population in the NHANES had a similar BMI and age distribution to our cohort, but we found a higher prevalence of POP and lower prevalence of fecal incontinence. These findings may reflect regional differences in the prevalence of PFDs.

Consistent with prior studies, POP in this cohort was associated with parity and obesity and was not associated with history of hysterectomy [15–19]. In addition, AI was associated with post-menopausal status, history of hysterectomy, older age, smoking status, and co-morbid conditions, which is consistent with other studies [3, 20–22]. However, we did not find an association of POP with older age, smoking status, or co-morbid conditions, and did not find an association of anal incontinence with parity or higher BMI. These differences may be due to the population sampled which was young and healthy; 75% of this cohort was < 60 years old, only 4% were current smokers, and only 15% had a co-morbid conditions. However, these findings may reflect the regional populations surveyed and warrants further research.

The strength of this study is the large number of participants, which increases the reliability of the results. This study is limited by selection bias. Women who participated in the survey were typically younger and healthier. In addition, the web-based nature of the survey may have deterred older women from participating. This affects the external validity of this study because older women were not adequately sampled.

Conclusion

In conclusion, the EPIQ provides an opportunity to determine the prevalence of self-reported POP, AI, fecal incontinence, and flatal incontinence. It is important to identify the prevalence of these disorders to identify the future need for providers and resources to care for these women. The prevalence of POP symptoms in this cohort was higher than in previous studies, while the prevalence of AI, fecal incontinence, and flatal incontinence was lower than in other studies. As expected, POP was associated with parity and higher BMI symptoms and anal incontinence was associated with older age, smoking, and presence of co-morbid conditions. However, we did not find an association of POP with older age, smoking or presence of co-morbid conditions, and AI was not associated with parity or higher BMI. Further research is needed to determine if there are regional differences in the prevalence of PFDs and their association with these variables.

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Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to restrictions from the Institutional Review Board of the University of Minnesota.

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Table 1

Clinical characteristics of study cohort

Variable	Value (N = 1426)[a]
1 + co-morbidity	212 (15.0%)
Mean BMI (kg/m^2)	27.1 (± 6.3 kg/m^2)
Obesity (BMI ≥ 30 kg/m^2)	366 (26.6%)
Mean age (years)	46.1 (± 16.1 years)
Age (years)	
18–39	491 (34.4%)
40–59	575 (40.3%)
≥ 60	360 (25.2%)
Smoking status	
Non-smoker	1141 (80.6%)
Former smoker	220 (15.5%)
Current smoker	54 (3.8%)
Parity	
Nulliparous	598 (47.8%)
C-section only	97 (7.8%)
1 vaginal delivery	125 (10.0%)
2 vaginal deliveries	234 (18.7%)
≥ 3 vaginal deliveries	196 (15.7%)
Post- Menopausal	612 (44.6%)
History of HRT use[b]	221 (15.9%)
History of hysterectomy	171 (12.0%)

[a]Of the 1426 women analyzed, 48 were missing BMI data, 11 were missing smoking data, 176 were missing childbirth data, 1 had unknown hysterectomy status, 63 had unknown menopausal status or hormonal replacement therapy use

[b]Former or current use of HRT (hormone replacement therapy)

Table 2

Pelvic floor disorder characteristics and treatment history

	n **(%)[a]**
Pelvic organ prolapse	70 (4.9)
Sought help from a healthcare provider for POP	28 (36.8)
History of surgery for POP	17 (1.2)
1 procedure	16 (100.0)
≥ 2 procedures	0 (0.0)
POP symptoms after surgery	7 (41.2)
Anal incontinence	212 (14.9)
Sought help from a healthcare provider for AI	52 (16.6)
History of surgery for fecal or flatal incontinence	3 (0.2)
1 procedure	2 (66.7)
≥ 2 procedures	1 (33.3)
Flatal incontinence after surgery	1 (33.3)
Fecal incontinence after surgery	1 (33.3)

Data is presented as the number of participants with pelvic organ prolapse or anal incontinence, with subgroup analysis to show treatment history for each disorder

POP pelvic organ prolapse, *AI* anal incontinence

Table 3

Prevalence rates of pelvic floor disorders by variables in non-pregnant women

Variable	Flatal incontinence (*n/N* = 147/1194)		Fecal incontinence (*n/N* = 49/1194)		Anal incontinence (*n/N* = 173/1194)		Pelvic organ prolapse (*n/N* = 66/1193)	
	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)
Age								
18–39	6.8	Reference	1.8	Reference	7.9	Reference	4.0	Reference
40–59	12.9	1.58 (0.95, 2.64)	4.4	2.53 (1.02, 6.27)*	15.0	1.63 (1.01, 2.63)*	5.7	0.55 (0.26, 1.13)
≥ 60	20.6	2.92 (1.72, 4.96)*	7.5	4.17 (1.64, 10.58)*	24.7	3.02 (1.84, 4.98)*	7.9	0.74 (0.34, 1.61)
p value		**< 0.01**		**0.01**		**< 0.01**		0.24
Smoking status								
Non-smoker	10.6	Reference	3.5	Reference	12.5	Reference	5.0	Reference
Past smoker	21.8	1.80 (1.16, 2.78)*	7.1	1.57 (0.77, 3.19)	25.9	1.88 (1.24, 2.83)*	7.1	1.17 (0.59, 2.31)
Current smoker	14.6	1.52 (0.66, 3.53)	6.2	2.00 (0.58, 6.98)	14.6	1.27 (0.55, 2.94)	10.4	2.09 (0.76, 5.77)
p value		**0.02**		0.30		**0.01**		0.35
Parity								
Nulliparous	9.0	Reference	3.5	Reference	10.7	Reference	2.4	Reference
C-section only	17.0	1.60 (0.83, 3.08)	2.3	0.46 (0.10, 2.04)	18.2	1.43 (0.76, 2.69)	3.4	1.63 (0.44, 5.99)
1 vaginal delivery	11.8	0.98 (0.51, 1.90)	0.8	0.15 (0.02, 1.12)	11.8	0.78 (0.41, 1.50)	2.5	1.25 (0.34, 4.59)
2 vaginal deliveries	18.6	1.48 (0.90, 2.44)	5.9	0.95 (0.44, 2.07)	20.5	1.33 (0.83, 2.14)	9.5	5.29 (2.35, 11.87)*
≥ 3 vaginal deliveries	13.2	0.98 (0.56, 1.71)	6.9	1.13 (0.52, 2.47)	19.0	1.23 (0.74, 2.02)	13.2	7.89 (3.55, 17.53)*
p value		0.31		0.30		0.42		**< 0.01**
BMI								
< 30	11.0	Reference	3.4	Reference	12.9	Reference	4.5	Reference
≥ 30	16.0	1.38 (0.93, 2.03)	6.1	1.50 (0.80, 2.81)	18.8	1.35 (0.94, 1.95)	8.3	1.93 (1.13, 3.32)*
p value		0.11		0.21		0.11		**0.02**
Co-morbidity								
No	11.6	Reference	3.4	Reference	13.1	Reference	5.4	Reference
Yes	16.5	1.29 (0.81, 2.05)	8.0	2.02 (1.02, 3.97)*	22.7	1.71 (1.12, 2.60)*	6.2	0.92 (0.46, 1.86)
p value		0.29		**0.04**		**0.01**		0.82

Bold indicates statistically significant overall *p* value

[*] indicates statistically significant comparison against the reference group

BMI Body Mass Index

[a] *N* varies for each test depending on the variable due to non-response for some questions

Table 4

Association of medical and surgical history with prolapse, fecal incontinence, or flatal incontinence

Variable	POP, *n* (%)[a]	*p* value	AI, *n* (%)[a]	*p* value
Menopausal status		0.20		< **0.01**
Post-menopausal	35 (5.7)		130 (21.2)	
Pre-menopausal	32 (4.2)		73 (9.6)	
History of hysterectomy		0.81		**0.05**
Yes	9 (5.3)		34 (19.9)	
No	61 (4.9)		178 (14.2)	

Bold indicates statistically significant *p* value

POP pelvic organ prolapse, *AI* anal incontinence, *HRT* hormone replacement therapy

[a] *n* varies for each test depending on the variable due to non-response for some questions