Title: Benchmarking outcomes in maternity care: peripartum incontinence - A framework for standardised reporting

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Conflict of interest

None declared.

Ethical approval

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Clinical trial registry

None.

Abstract

Objective: To evaluate a framework to facilitate standardised reporting of perinatal incontinence.

Design: An exploratory, prospective, observational cohort study.

Setting: One Australian tertiary maternity referral centre.

Participants: Data from 309 pregnant women collected between August 2017 and January 2019.

Measurements and findings: A framework was developed using consensus-based terminology and definitions, measures and data-collection time-points. The ICIQ-UI SF and the Wexner Scale were administered during pregnancy (<27 and 36-weeks) and postpartum (6- and 26-weeks). Incidence, trajectory and group differences for urinary incontinence subcategories were evaluated. Stress urinary incontinence was the largest contributor of urinary incontinence during pregnancy (39.2%) followed by mixed (11.3%) and urgency incontinence (7.4%). Factors associated with incontinence subcategories during pregnancy were multiparity (stress: RR 1.74), co-existing anal incontinence (mixed: RR 3.51) and early pregnancy urinary incontinence (stress: RR 2.79; mixed: RR 2.85). Factors postpartum included primiparity (urgency), vaginal birth (stress), induction of labour (stress: RR 2.99; urgency: RR 0.2), waterbirth (urgency: RR 2.66), coexisting anal incontinence (urgency: RR 3.55) and late pregnancy urinary incontinence (mixed: RR 3.97). Low numbers of women with anal incontinence prohibited subcategory analysis.

Key conclusions

Findings offer preliminary support for the effectiveness of the framework for the measurement and reporting of urinary incontinence in childbearing women. Future research is needed to evaluate the framework in larger and more diverse maternity populations.

Implications for practice

A framework for standardised measurement and reporting of perinatal incontinence will facilitate improved synthesis of research findings with the potential to improve the quality of evidence-based clinical guidelines.

Keywords:

International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF)

Wexner Scale

Pregnancy

Postpartum

Anal incontinence

Core outcome set

Word count: 4996

Introduction

Urinary and anal incontinence are prevalent conditions associated with impaired maternal quality of life (Van der Woude et al., 2015) with effects negatively impacting the long-term health of women (Milsom et al., 2016). Urinary incontinence (sometimes termed bladder incontinence) can be severe (Kwon et al., 2010), with even mild urinary leakage associated with reduced quality of life (Krhut et al., 2018). The psychosocial and economic impact of urinary incontinence is significant (Kwon et al., 2010; Sinclair and Ramsay, 2011), associated with sexual dysfunction, relationship problems, social and recreational withdrawal (Sinclair and Ramsay, 2011), financial burden, depression and anxiety (Milsom et al., 2016; Sinclair and Ramsay, 2011). Prevalence of urinary incontinence in pregnant women is reported to be between 40 and 65 percent with rates increasing with gestational age (Davidson and Kruger, 2018). Following birth prevalence is less, ranging from six to 40 percent, dependent on parity and birth type (Thom and Rortveit, 2010). Figures are likely underestimates as urinary incontinence remains a hidden problem and few women seek help (Australian Institute of Health and Welfare, 2013; Daly et al., 2018).

Anal incontinence, a broad term that generally represents both flatus and fecal incontinence (Abrams et al., 2002), represents one of the most psychologically and socially debilitating conditions in women (Ferzandi, 2016). Mirroring urinary incontinence, prevalence rates of anal incontinence varies considerably depending on definitions and outcome measures used but is reported to be between two and 24 percent (Macmillan et al., 2004) in community-based adult samples. Fecal incontinence is reportedly less prevalent and varies between 0.4 and 18 percent (Macmillan et al., 2004). While less is known about anal incontinence in community samples of pregnant and postpartum women, global prevalence is reported to be 10.3 percent (Solans-Domènech et al., 2010). The economic costs associated with incontinence are significant. In 2010, the total health system expenditure on incontinence in

Australia (where the current study is conducted) was estimated at A$271 million, with costs expected to rise to A$450 million by 2020 (Deloitte Access Economics, 2011). Heterogeneity in health economic evaluation research conducted in 13 countries, prevent meaningful comparison across studies (Zwolsman et al., 2019).

In view of the high prevalence, high impact and poor reporting of incontinence across the lifespan of women, primary prevention may play an important role in improving the long-term health of women (Wesnes and Lose, 2013). Improving these outcomes relies on the ability to accurately measure incontinence and subsequently compare and pool data. In response to the significant heterogeneity of incontinence research methodology, several authors have called for standardisation in research design and reporting to improve data synthesis (Hawthorne, 2006; Botlero et al., 2008; Milsom et al., 2016; Abrams et al., 2017; Davidson and Kruger, 2018). Furthermore, there is growing consensus advocating the standardisation of health research outcomes and measures using core outcome sets (COMET [Core Outcome Measures in Effectiveness Trials]; CROWN [Core Outcomes in Women's and Newborn Health]; Williamson et al., 2017). Core outcome sets represent a minimum set of outcomes and measures for a specific disease or population within a specified setting (Prinsen et al., 2016). In 2016, the International Consortium for Health Outcomes Measurement (ICHOM) published a core outcome set to measure value in maternity care (ICHOM, 2016) and included the Wexner Scale (Jorge and Wexner, 1993) and the ICIQ-UI SF (International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form) (Avery et al., 2004). Until recently, these measures had not been sufficiently evaluated in maternity populations. The ICHOM working party called for validation studies to address this gap in evidence (Nijagal et al, 2016). Furthermore, no standardised terminology or case definitions for incontinence were recommended by ICHOM to enable effective application of the core outcome set. Lack of guidance in this area will inevitably contribute to inconsistent reporting and potential research wastage. To facilitate inclusion of the incontinence scales within the core outcome set, psychometric evaluation with a maternity population was required. Further, it was felt that a framework that outlined case definitions according to consensus-based definitions and terminology would guide consistent reporting, and enable future benchmarking, comparison and shared-learning.

To address this identified gap in knowledge, a two-phase study was designed. Phase one was a psychometric evaluation of the Wexner Scale and the ICIQ-UI SF in one community cohort of Australian childbearing women (N = 309) who completed the scales at four time-points during pregnancy and postpartum (see Slavin et al., 2019). Prevalence of broad category urinary incontinence was highest during late pregnancy (50%) and lowest at 26-weeks postpartum (21.4%). In women with urinary incontinence, the ICIQ-UI SF demonstrated good internal consistency reliability, significant change over three time-points and was sensitive to group differences in terms of age and obesity. Prevalence of anal incontinence was lower ranging from 11.8% in early pregnancy to 6.7% postpartum, and generally reflected flatus incontinence. Fecal incontinence was rare at all time-points, reported by only 4-6 women. The Wexner Scale was therefore unsuitable for psychometric analysis due to insufficient numbers of women with anal incontinence. Until future evidence becomes available regarding the psychometric performance of the Wexner Scale in perinatal samples, the reporting of individual items was recommended (Slavin et al., 2019). Confirming the ICIQ-UI SF to be a robust measure of urinary incontinence, and with recommendations on the clinical application of the Wexner Scale, the aim of Phase two was to develop and evaluate a framework to facilitate the future consistent reporting of the ICIQ-UI SF and Wexner Scale in the context of childbearing women.

Materials and methods

The current exploratory study is part of a larger program of work conducted in one large tertiary referral centre in a metropolitan area of Queensland, Australia with around 5,200 births in 2018. The MoMeNT Study (**Mo**dels **Me**eting **N**eeds Over **T**ime), is a prospective, longitudinal cohort design which aims to compare maternal outcomes according to model of care and assess the feasibility of the ICHOM core outcome set (see Slavin et al., 2019). Sample size calculations were based on prevalence estimates for primary outcomes relating to the evaluation of two broad models of maternity care on maternal mental health and wellbeing. We aimed to recruit 252 participants allowing for 20% attrition (Slavin et al., 2019).

Sample

Consecutive women attending their first midwife appointment (maternity care booking visit) or subsequent antenatal visit, aged 18 years or more, with good command of English and 27-weeks pregnant or less at recruitment, were invited to participate. Consenting women who completed or partially completed the first survey formed the study cohort. Of the 359 consenting women, baseline surveys were completed by 309 women.

Measures

ICIQ-UI SF

The ICIQ-UI SF assessed the incidence of urinary incontinence (UI) subcategories (Avery et al., 2004). One multiple-response question was asked, '*When does urine leak?*' It offered eight responses to inform the type of incontinence: (1) 'never – urine does not leak', (2) 'leaks before you can get to the toilet', (3) leaks when you cough or sneeze', (4) 'leaks when you are asleep', (5) leaks when you are physically active/exercising', (6) leaks when you have finished urinating and are dressed', (7) 'leaks for no obvious reason', and (8)'leaks all the time'. Each response was classified according to the definitions presented in *Figure 1.*

Wexner Scale

The Wexner Scale (Jorge and Wexner, 1993) assesses the incidence and class of anal incontinence. Three questions were posed; '*How often do you have accidents to well-formed stool?*', '*How often do you have accidents to liquid stool/diarrhea?*', '*How often does the gas escape without your knowledge or control?*'. Each response was classified according to the definitions presented in *Figure 1*.

Administrative data

In line with recommendations (ICHOM, 2016), routinely collected electronic hospital data were collected at 6-weeks postpartum. All midwives who attend births at the study site document a comprehensive report of the birthing woman's pregnancy, and intrapartum care and outcomes in an electronic perinatal database (Maternity Information System [MATIS]) (www.meridianhi.com). Casemix variables as recommended by ICHOM were collected including maternal age, parity, and body mass index. Birth related outcome data included mode of birth, labour onset, epidural, waterbirth, episiotomy and infant birth weight.

Terminology, definitions and framework for standardised reporting

Female-specific, consensus-based definitions and terminology were used to classify incontinence based on symptomology (see *Figure 1*). Columns 1 and 2 present the broad classification and subcategories, and related symptoms of urinary and anal incontinence as described by Haylen et al., (2010). Column 3 presents the associated case definition for urinary incontinence as recored by the ICIQ-UI SF and consistent with the literature (Chang et al., 2014; Rotar et al., 2009). The framework for standardised reporting (*Figure 2)* outlines the instrument, classification, symptoms, and case definition presented in *Figure 1*. Further, details regarding casemix variables and data collection time-points as defined by ICHOM (2016) are outlined within the framework.

Figure 1

Definitions for broad and subcategories of urinary and anal incontinence, symptoms and case-definitions.

Classification **Broad category** Subcategories	Symptoms	Case definition
Urinary incontinence (UI)	Complaint of involuntary loss of urine	Positive response to screening question: '*Yes I leaked urine'* **AND** any positive response to '*When does urine leak?' (*ie, excludes '*never – urine does not leak*'
Stress urinary incontinence (SUI)	Complaint of involuntary loss of urine on effort or physical exertion (e.g., sporting activities), or on sneezing or coughing.	Positive response to **EITHER** '*Leaks when you cough or sneeze*' **OR** '*Leaks when you are physically active/exercising*'
Urgency urinary incontinence (UUI)	Complaint of involuntary loss of urine associated with urgency	Positive response to **EITHER** '*Leaks before you can get to the toilet'* **OR** '*Leaks when you have finished urinating and are dressed*' **OR** '*Leaks when you are asleep*'
Postural urinary incontinence	Complaint of involuntary loss of urine associated with change of body position, for example, rising from a seated or lying position	Not defined[±]
Nocturnal enuresis	Complaint of involuntary urinary loss of urine which occurs during sleep	Positive response to: '*Leaks when you are asleep*'[a]
Continuous urinary incontinence	Complaint of continuous involuntary loss of urine	Positive response to: '*Leaks all the time*'[b]
Mixed urinary incontinence (MUI)	Complaint of involuntary loss of urine associated with urgency and also with effort or physical exertion or on sneezing or coughing.	Positive response to: **EITHER** '*Leaks when you cough or sneeze*' **OR** '*Leaks when you are physically active/exercising*'; **AND, EITHER** '*Leaks before you can get to the toilet'* **OR** '*Leaks when you have finished urinating and are dressed*' **OR** '*Leaks when you are asleep*'

Other[#]		Positive response to **EITHER** '*Leaks for no obvious reason'* **OR** '*Leaks all the time*'; **AND** Negative response to '*Leaks when you cough or sneeze*' **AND** '*Leaks when you are physically active/exercising*' **AND** '*Leaks before you can get to the toilet'* **AND** '*Leaks when you have finished urinating and are dressed*' **AND** '*Leaks when you are asleep*'
Anal incontinence (AI)	Complaint of involuntary loss of feces or flatus	Positive response to screening question: *'Yes, I leaked stool or passed gas by accident'*, **AND** positive response to **EITHER**: '*How often do you have accidents to well-formed stool?',* **OR** *'How often do you have accidents to liquid stool/diarrhea?',* **OR** *'How often does the gas escape without your knowledge or control?'* ie Excludes *'never'* to all three questions.
Fecal incontinence	Complaint of involuntary loss of solid or liquid feces	Positive response to **EITHER** '*How often do you have accidents to well-formed stool?*', **OR** '*How often do you have accidents to liquid stool/diarrhea?*',
Flatus incontinence	Complaint of involuntary loss of flatus	Positive response to: '*How often does the gas escape without your knowledge or control?*'
Fecal (rectal) urgency	Sudden, compelling desire to defecate that is difficult to defer	Not defined[±]
Fecal (flatal) urgency incontinence	Involuntary loss of feces (flatus) associated with urgency	Not defined[±]

Classification and symptoms defined using terminology and definitions offered by Haylen et al (2010) and Abrams et al (2002).
Case definition defined using responses from ICIQ-UI SF (urinary incontinence) and Wexner Scale (anal incontinence).
[#]subcategory not defined by Haylen et al (2010) or Abrams et al (2002).
[±]Not defined by responses on the ICIQ-UI SF or Wexner Scale.
[a]Included in urgency urinary incontinence; [b]Included in the category 'Other'.

Figure 2

Framework for standardised outcome measurement and reporting of perinatal incontinence.

	Urinary incontinence	*Anal incontinence*
Instrument(s)	ICIQ-UI SF[a]	Wexner Scale[b]
Classification	Outlined in Figure 1	Outlined in Figure 1
Symptoms	Outlined in Figure 1	Outlined in Figure 1
Case definitions	Outlined in Figure 1	Outlined in Figure 1
Casemix variables	Outlined in ICHOM reference guide[c]	Outlined in ICHOM reference guide[c]
Data collection time-points	Outlined in ICHOM reference guide[c]	Outlined in ICHOM reference guide[c]

[a]Avery et al., 2004; [b]Jorge and Wexner., 1993; [c]ICHOM, 2016.

Procedures

Online surveys were administered at four time-points during pregnancy (≤27 weeks, 36-weeks) and postpartum (6- and 26-weeks). Each survey posed an incontinence screen question, '*In the last month, have you leaked urine, leaked stool or passed gas by accident?*' Three responses included (1) Yes, I leaked urine, (2) Yes, I leaked stool or passed gas by accident, (3) No, I do not leak urine, leak stool or pass gas by accident. Women who responded positively to any urine leakage were classified as having broad category urinary incontinence and were asked to complete the ICIQ-UI SF. Women who responded positively to any stool or gas leakage were classified as having broad category anal incontinence. Data collection took place between August 2017 and January 2019.

Approach to analysis

Our analysis is designed to evaluate a framework for standardised reporting. Participant responses were classified as either stress, urgency, mixed or 'other' urinary incontinence as defined by the case definitions outlined in *Figure 1*. For all analysis purposes, women were only classified as '*other*' if they never met any other criteria for stress, urgency or mixed urinary incontinence. For example, if a woman responded positively to both '*Leaks when you cough or sneeze*' (stress UI) and '*Leaks for no obvious reason'* (Other), she would be classified *only* as stress incontinent. For all analyses, women were allocated to one category only, thus if they were allocated to the mixed incontinence category they were not also allocated in the stress and urgency category.

Firstly, we report the incidence of urinary incontinence subcategories (stress, urgency, mixed, other) at four time-points as frequencies and percentages with 95 percent confidence intervals (95% CIs) using Clopper Pearson Exact Test for binary probability. The dependent variables relating to urinary incontinence subcategories, as outlined in *Figure 1*, were transformed into binary dummy variables. Participants who reported no urinary incontinence on the screening question were recorded as no incontinence. We hypothesised that stress urinary incontinence would be the most prevalent type of incontinence during pregnancy followed by mixed and then urgency urinary incontinence. Change in proportion of participants who reported urinary incontinence on the ICIQ-UI SF across the four time-points were assessed using Cochran's Q Test. Significance values were adjusted by the Bonferroni correction for multiple tests. Significance was $p < .05$. We hypothesised that each category of incontinence would remain stable during pregnancy but expected stress incontinence to reduce early postpartum with a concomitant rise in urge and mixed UI. We expected all incontinence subcategories to be stable postpartum (Thom and Rortveit., 2010).

Group differences in terms of incontinence subcategories were explored using chi squared test. Yates continuity correction is reported for 2x2 table and Fisher's Exact Test is reported when >20% of cells have expected counts less than 5. Effect size is presented as relative risk (RR) with 95% confidence interval (CI). Evidence regarding factors associated with urinary incontinence subcategories is limited. Where evidence is unavailable, we compare group differences on the evidence for broad category urinary incontinence. Multiparity was hypothesised to be the most important risk factor for urinary incontinence during pregnancy and mode of birth as the greatest risk factor following birth (vaginal birth higher than caesarean section) (Chang et al., 2014; Rortveit et al., 2003; Salvatore et al., 2017; Wesnes et al., 2009). Urinary incontinence during pregnancy was expected to be strongly associated with postpartum UI (Solans-Domènech et al., 2010; Wesnes et al., 2009). Consistent with Sangsawang (2014) we also expected that during pregnancy stress urinary incontinence would be associated with increased age, obesity and pre-pregnancy urinary incontinence.

Due to small numbers of women who reported fecal incontinence, hypothesis testing was not possible for anal incontinence. Broad category anal incontinence is however included to evaluate the relationship with urinary incontinence.

All statistical analyses were conducted using SPSS for Windows version 25 (IBM Corp, 2017). For brevity we use the abbreviated terms SUI (stress urinary incontinence), UUI (urgency urinary incontinence, and MUI (mixed urinary incontinence) throughout.

Ethics approval

Ethical approval to conduct this study was obtained from the Human Research Ethics Committees of the participating health service and university. Written informed consent was obtained from all participating women. National Health and Medical Research Council (NHMRC, 2007) protocols were followed to protect the privacy and confidentiality of participants.

Findings

Sample characteristics

The sample consisted of 309 women, 306 (99%) of whom completed the incontinence screen at baseline, 276 (89.3%) at 36-weeks, 260 (84.1%) at 6-weeks postpartum and 238 (77.0%) at 26-weeks postpartum. Details relating to participant recruitment, retention and characteristics are fully reported elsewhere (Slavin et al., 2019). Response frequencies to the question '*When does urine leak?*' are presented in *Table 1*.

Table 1

Responses to the question '*When does urine leak?*' at four time-points during pregnancy and postpartum.

	Pregnancy		Postpartum	
	Baseline	36-weeks	6-weeks	26-weeks
	n (%)	*n* (%)	*n* (%)	*n* (%)
Never – urine does not leak	0	0	0	0
Leaks before you can get to the toilet	16 (15.1)	27 (19.6)	32 (54.2)	16 (31.4)
Leaks when you cough or sneeze	89 (84.0)	108 (78.3)	29 (49.2)	33 (64.7)
Leaks when you are asleep	1 (0.3)	10 (7.2)	3 (5.1)	0
Leaks when you are physically active/exercising	17 (16.0)	19 (13.8)	17 (28.8)	19 (38.0)
Leaks when you have finished urinating and are dressing	8 (7.5)	21 (15.2)	10 (16.9)	9 (17.6)
Leaks for no obvious reason	8 (7.5)	18 (13.0)	5 (8.5)	4 (7.8)
Leaks all the time	0 (0)	2 (1.4)	0	0

n and % for women with broad category urinary incontinence (Baseline n=106, 36-weeks n=138, 6-weeks n=59, 26-weeks n=51)
Note: Cumulative % may be more than 100% due to multiple responses at each time point

Urinary incontinence subcategories: incidence and trajectory

Incidence and trajectory of urinary incontinence subcategories experienced by participants during pregnancy and postpartum are presented in *Table 2*. *Figure 3* is a pictorial representation of proportion change over time.

Stress Urinary Incontinence

During pregnancy 121 (39.2%) women reported SUI at *any* point during their pregnancy and 45 (14.6%) reported SUI at *any* point following birth. When stratified by time-point, the incidence was highest during pregnancy (baseline: 26.5%; 36-weeks: 30.8%) and lowest postpartum (6-weeks: 7.3%; 26-weeks: 12.6%) (*Table 2*). The change in proportion was significant, Q (3, n = 221) = 64.58, p<.001. Pairwise comparisons revealed significant differences between all-time points except two. No significant difference was seen during pregnancy (baseline to 36-weeks) or postpartum (6- to 26-weeks postpartum).

Urgency Urinary Incontinence

During pregnancy 23 women (7.4%) reported UUI at *any* point and 30 women (9.7%) reported UUI at *any* point following birth. When stratified by time, the incidence of UUI was lowest during pregnancy (baseline: 2.9%; 36-weeks: 6.2%), and highest at 6-weeks postpartum (9.2%), before returning to values seen in pregnancy at 26-weeks (3.8%). The change in proportion was significant, Q (3, n = 221) = 15.80, p =.001). Pairwise comparisons revealed significant differences from baseline to 26-weeks postpartum (p = .001) and from 6-weeks to 26-weeks postpartum (p = .022).

Mixed Urinary Incontinence

Mixed urinary incontinence (MUI) was reported by 35 (11.3%) women at *any* point during pregnancy and 24 (7.8%) at *any* point postpartum. Incidence of MUI was both lowest and highest during pregnant (4.2 - 10.1%). Change in proportion over four time-points was not significant, Q (3, n = 221) = 7.29, p =.063).

Other Urinary Incontinence

At baseline, of the 8 women who responded to either '*Leaks for no obvious reason*' OR *'Leaks all the time',* two also recorded mixed UI, and three also recorded stress UI. Similarly, at 36-weeks, of the 18 women who responded positively to either question, six also recorded mixed UI, three recorded stress UI and one recorded urgency UI. At 6-weeks postpartum, of the five women who responded positively three also recorded mixed UI and one recorded stress UI. Similarly, at 26-weeks postpartum of the four women who responded positively, two also recorded mixed UI, one recorded urgency UI and one recorded stress UI. The number of women meeting the criteria for 'Other' was therefore low (1 – 2.9%).

Table 2

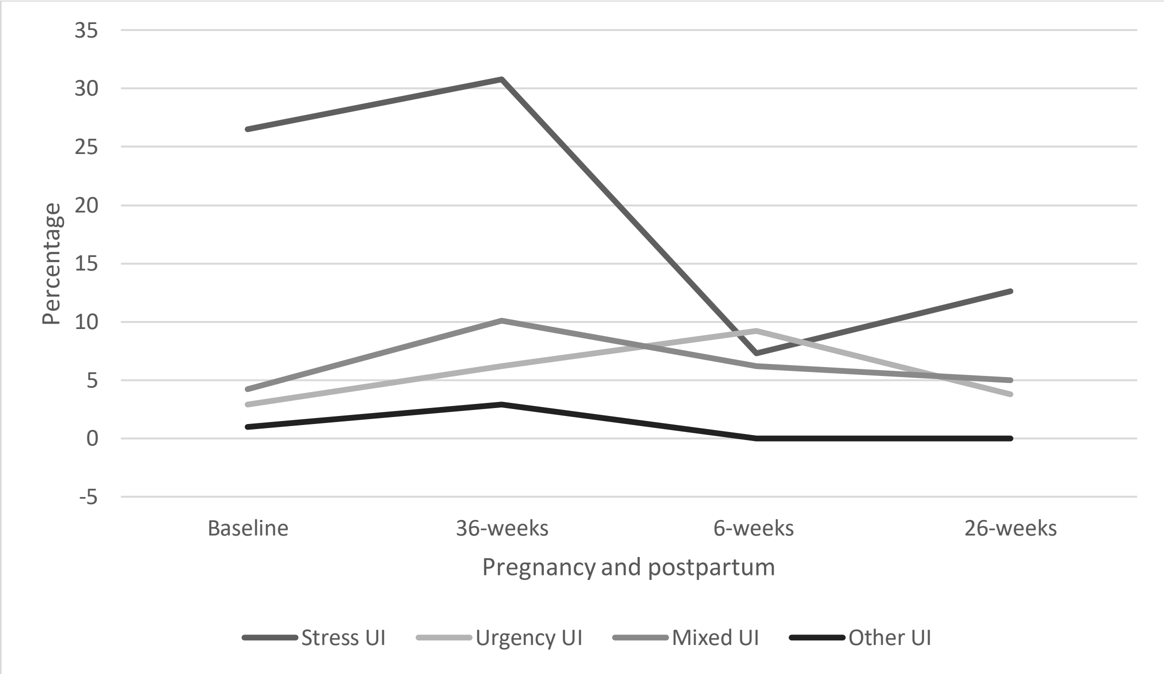
Incidence and proportion change in urinary incontinence subcategories during pregnancy (baseline, 36 weeks) and postpartum (6-weeks and 26 weeks).

	Baseline (Time 1)		36-weeks (Time 2)		6-weeks (Time 3)		26-weeks (Time 4)							
	n	% (95% CI)	*n*	% (95% CI)	*n*	% (95% CI)	*n*	% (95% CI)	p^a	p^b	p^c	p^d	p^e	p^f
SUI	81	26.5 (21.6 - 31.8)	85	30.8 (25.4 – 36.6)	19	7.3 (4.5 – 11.2)	30	12.6 (8.7 - 17.5)	.519	**<.001**	**<.001**	**<.001**	**<.001**	1
UUI	9	2.9 (1.4 – 5.5)	17	6.2 (3.6 – 9.7)	24	9.2 (6.0 – 13.4)	9	3.8 (1.7 – 7.1)	.705	1	.152	1	**.001**	**.022**
MUI	13	4.2 (2.3 – 7.2)	28	10.1 (6.8 – 14.3)	16	6.2 (3.6 – 9.8)	12	5.0 (2.6 – 8.6)	-	-	-	-	-	-
Other	3	1.0 (0.9 – 4.7)	8	2.9 (1.3 – 5.6)	0	0 (0 – 0)	0	0 (0 – 0)	-	-	-	-	-	-

% for incontinent women at: T1: n = 306; T2: n = 276; T3: n = 260; T4: n = 238
SUI = Stress urinary incontinence; UUI = Urgency urinary incontinence; MUI = Mixed urinary incontinence.
p = Cochran's Q Test: [a]respondents at T1 versus T2; [b]respondents at T2 versus T4; [c]respondents at T2 versus T3; [d]respondents at T1 versus T4; [e]Respondents at T1 versus T3; [f]Respondents at T3 versus T4

Figure 3

Trajectory of urinary incontinence subcategories during pregnancy (baseline and 36-weeks) and postpartum (6-weeks and 26-weeks)



Group differences during late pregnancy

Table 3 presents group differences for incontinence subcategories during pregnancy and postpartum. In late pregnancy the relative risk for stress UI was higher in multiparous women compared to nulliparous women (37.5% vs 21.6%, χ^2 [1, n = 276] = 7.29, *p* = .007, RR 1.74) and in those women who reported any urinary incontinence at baseline (52.1% vs 18.6%, χ^2 [1, 273] = 31.33, *p* <.001, RR 2.79). Similarly, the relative risk for mixed UI was higher for pregnant women who reported any early pregnancy urinary incontinence (17.7% vs 6.2%, χ^2 [1, 273] = 7.73, *p* = .005, RR 2.85) or co-existing anal incontinence (25.6% vs 7.3%, χ^2 [1, 276] = 11.38, *p* = .001, RR 3.51). At 36-weeks of pregnancy, no significant differences were seen for urgency incontinence or for age or obesity.

Group differences following birth

At 6-weeks postpartum, in contrast to pregnancy, no significant difference was seen in terms of parity for stress UI. The relative risk of urgency UI was now lower for multiparous women compared to primiparous women (5.8% vs 14.2%, χ^2 [1, 260] = 4.23, *p* = .04, RR 0.41). Women who birthed vaginally recorded much higher rates of stress UI compared to women who birthed by caesarean (9.6% vs 0%, χ^2 [1, 257] (Fisher's Exact Test), *p* = .009, but no significant different in terms of urgency or mixed UI was observed. While women who experienced induced labour were 3 times more likely to report stress UI compared to all other birthing women (13.6% vs 4.5%, χ^2 [1, 257] = 5.36, *p* = .021, RR 2.99) they were less likely to record urgency UI (2.5% vs 12.5%, χ^2 [1, 257] = 5.46, *p* = .019, RR 0.2). The relative risk of urgency UI was also higher for women who birthed in water compared to non-waterbirth (19.1% vs 7.2%, χ^2 [1, 255] = 5.08, *p* = .024, RR 2.66). Relative risk for urgency UI was highest for those women who reported co-existing anal incontinence (25.9% vs 7.3%, χ^2 [1, 260] (Fisher's Exact Test), *p* = .006, RR 3.55) and for women who reported any urinary incontinence in late pregnancy (36-weeks), but only in terms of mixed UI (9.5% vs 2.4%, χ^2

[1, 251] (Fisher's Exact Test, p = .034, RR 3.97). No significant differences were seen for age, obesity, epidural, episiotomy or infant birth weight.

Table 3

Group difference for women with stress, mixed and urgency urinary incontinence during pregnancy (36-weeks) and postpartum (6-weeks).

	SUI	No SUI	*p*	RR (95% CI)	MUI	No MUI	*p*	RR (95% CI)	UUI	No UUI	*p*	RR (95% CI)
Pregnancy (36-weeks)												
Age (years)			.614	0.85 (0.52 – 1.38)			.909	1.18 (0.50 – 2.75)			.748±	0.57 (0.14 – 2.43)
35 or more	14 (26.9)	38 (73.1)			6 (11.5)	46 (88.5)			2 (3.8)	50 (96.2)		
Less than 35	71 (31.7)	153 (68.3)			22 (9.8)	202 (90.2)			15 (6.7)	209 (93.3)		
Body mass index			.720	0.89 (0.56 – 1.41)			.209	1.77 (0.84 – 3.73)			.106±	2.36 (0.88 – 6.36)
Obese (≥30)	16 (28.1)	41 (71.9)			9 (15.8)	48 (84.2)			6 (10.5)	51 (89.5)		
Non-obese (<30)	64 (31.7)	138 (68.3)			18 (8.9)	184 (91.1)			9 (4.5)	193 (95.5)		
Parity			**.007**	1.74 (1.17 – 2.60)			.914	1.12 (0.55 – 2.30)			.857	0.82 (0.32 – 2.05)
Nulliparous	25 (21.6)	91 (78.4)			11 (9.5)	105 (90.5)			8 (6.9)	108 (93.1)		
Multiparous	60 (37.5)	100 (62.5)			17 (10.6)	143 (89.4)			9 (5.6)	151 (94.4)		
UI at baseline			**<.001**	2.79 (1.94 – 4.02)			**.005**	2.85 (1.39 – 5.83)			.802	0.77 (0.28 – 2.12)
Incontinent	50 (52.1)	46 (47.9)			17 (17.7)	79 (82.3)			5 (5.2)	91 (94.8)		
Continent	33 (18.6)	144 (81.4)			11 (6.2)	166 (93.8)			12 (6.8)	165 (93.2)		
Anal incont (36-wks)			.651	1.16 (0.74 – 1.83)			**.001**	3.51 (1.77 – 6.96)			.156±	2.26 (0.84 – 6.08)
Incontinent	15 (34.9)	28 (65.1)			11 (25.6)	32 (74.4)			5 (11.6)	38 (88.4)		
Continent	70 (30.0)	163 (70.0)			17 (7.3)	216 (92.7)			12 (5.2)	221 (94.8)		
Postpartum (6-weeks)												

	SUI	No SUI	*p*	RR (95% CI)	MUI	No MUI	*p*	RR (95% CI)	UUI	No UUI	*p*	RR (95% CI)
Age (years)			.311	1.85 (0.74 – 4.63)			1	0.92 (0.27 – 3.12)			.794±	0.80 (0.29 – 2.24)
35 or more	6 (11.5)	46 (88.5)			3 (5.8)	49 (94.2)			4 (7.7)	48 (92.3)		
Less than 35	13 (6.3)	195 (93.8)			13 (6.3)	195 (93.8)			20 (9.6)	188 (90.4)		
Body mass index			1±	0.95 (0.33 – 2.78)			.323±	1.86 (0.65 – 5.31)			.405±	0.53 (0.16 – 1.72)
Obese (≥30)	4 (7.1)	52 (92.9)			5 (8.9)	51 (91.1)			3 (5.4)	53 (94.6)		
Non-obese (<30)	14 (7.5)	173 (92.5)			9 (4.8)	178 (95.2)			19 (10.2)	168 (89.8)		
Parity			.715	0.77 (0.32 – 1.82)			.299	0.54 (0.21 – 1.39)			**.040**	0.41 (0.19 – 0.91)
Primiparous	9 (8.5)	97 (91.5)			9 (8.5)	97 (91.5)			15 (14.2)	91 (85.8)		
Multiparous	10 (6.5)	144 (93.5)			7 (4.5)	147 (95.5)			9 (5.8)	145 (94.2)		
Onset of labour			**.021**	2.99 (1.25 – 7.15)			.391	0.50 (0.15 – 1.71)			**.019±**	0.20 (0.05 – 0.82)
Induction	11 (13.6)	70 (86.4)			3 (3.7)	78 (96.3)			2 (2.5)	79 (97.5)		
No induction	8 (4.5)	168 (95.5)			13 (7.4)	163 (92.6)			22 (12.5)	154 (87.5)		
Epidural			1±	0.85 (0.29 – 2.47)			.769±	0.74 (0.22 – 2.50)			.461±	0.64 (0.23 – 1.78)
Yes	4 (6.6)	57 (93.4)			3 (4.9)	58 (95.1)			4 (6.6)	57 (93.4)		
No	15 (7.7)	180 (92.3)			13 (6.7)	182 (93.3)			20 (10.3)	175 (89.7)		
Waterbirth			.360±	1.58 (0.60 – 4.17)			1±	1.02 (0.30 – 3.44)			**.023**	2.66 (1.24 – 5.70)
Yes	5 (10.6)	42 (89.4)			3 (6.4)	44 (93.6)			9 (19.1)	38 (80.9)		
No	14 (6.7)	194 (93.3)			13 (6.3)	195 (93.8)			15 (7.2)	193 (92.8)		

	SUI	No SUI	*p*	RR (95% CI)	MUI	No MUI	*p*	RR (95% CI)	UUI	No UUI	*p*	RR (95% CI)
Mode of birth			**.009**±	-			.129±	0.22 (0.03 – 1.62)			.078±	0.30 (0.07 – 1.23)
Vaginal	19 (9.6)	178 (90.4)			15 (7.6)	182 (92.4)			22 (11.2)	175 (88.8)		
Caesarean section	0 (0)	60 (100)			1 (1.7)	59 (98.3)			2 (3.3)	58 (96.7)		
Episiotomy			.166±	2.11 (0.81 – 5.52)			1±	0.85 (0.20 – 3.57)			.215±	1.97 (0.84 – 4.64)
No	14 (6.4)	205 (93.6)			14 (6.4)	205 (93.6)			18 (8.2)	201 (91.8)		
Yes	5 (13.5)	32 (86.5)			2 (5.4)	35 (94.6)			6 (16.2)	31 (83.8)		
Infant birth weight (g)			.247±	2.09 (0.74 – 5.86)			.70±	1.12 (0.27 – 4.67)			.742±	1.12 (0.36 – 3.52)
Less than 4000	15 (6.6)	212 (93.4)			14 (6.2)	213 (93.8)			21 (9.3)	206 (90.7)		
4000 or more	4 (13.8)	25 (86.2)			2 (6.9)	27 (93.1)			3 (10.3)	26 (89.7)		
Pregnancy UI (36-weeks)			.474	1.56 (0.63 – 3.89)			**.03**±	3.97 (1.15 – 13.72)			.506±	0.71 (0.33 – 1.54)
Incontinent	11 (8.7)	115 (91.3)			12 (9.5)	114 (90.5)			10 (7.9)	116 (92.1)		
Continent	7 (5.6)	118 (94.4)			3 (2.4)	122 (97.6)			14 (11.2)	111 (88.8)		
Anal incont (6-weeks)			1.0±	1.02 (0.25 – 4.16)			.07±	2.88 (0.98 – 8.30)			**.006**±	3.55 (1.62 – 7.79)
Incontinent	2 (7.4)	25 (92.6)			4 (14.8)	23 (85.2)			7 (25.9)	20 (74.1)		
Continent	17 (7.3)	216 (92.7)			12 (5.2)	221 (94.8)			17 (7.3)	216 (92.7)		

UI = urinary incontinence; ES = Effect size; p = probability (p = <.05 is significant; Significant results are shown in bold).
Yates continuity correction reported for 2X2; ± Fishers exact test reported for ≥25% of cell counts less than 5. Effect size: Phi reported for 2 X 2 table
RR = Relative risk when the outcome is incontinence

Discussion

This study developed and evaluated a framework to facilitate the future consistent reporting of urinary and anal incontinence in childbearing women according to the ICIQ-UI SF and Wexner Scale. Using hypothesis testing, the framework, was found to be effective in identifying expected incidence and trajectory of urinary incontinence subcategories. As hypothesised, group differences were observed in late pregnancy for parity, and early pregnancy urinary incontinence, and at 6-weeks postpartum in terms of mode of birth and pregnancy urinary incontinence. Due to small numbers, it was not possible to conduct hypothesis testing on anal incontinence subcategories.

The ability to compare our findings with those of systematic reviews were challenged due to limitations in reporting. Most reviews report outcomes specific to pregnancy (Barbosa et al., 2018; Davidson and Kruger, 2018; Sangsawang and Sangsawang, 2013; Sangsawang, 2014), or postpartum (Press et al., 2007; Thom and Rortveit, 2010; Van der Woude et al, 2014). We therefore compare our findings to individual studies where evidence from reviews are not available.

Incidence and trajectory

Consistent with Davidson and Kruger, (2018) and Sansawang and Sangsawang, (2014), stress incontinence (39.2%) was the largest type of urinary incontinence during pregnancy, followed by mixed (11.3%) and urgency incontinence (7.4%), regardless of parity or gestation. In terms of trajectory, Solans-Domènech et al., (2010) offers comparable methodology, using the ICIQ-UI SF to evaluate urinary incontinence over three trimesters of pregnancy and once postpartum (around 7-weeks) in 1128 continent nulliparous women. Consistent with Solans-Domènech et al, stress incontinence was stable from the second to third trimesters (25.0 - 27.6%) with a significant reduction in the early weeks postpartum to 8.9%. Our findings further show all but one urinary incontinence subcategory remained stable to 26-weeks postpartum which is somewhat consistent with the findings of Thom and Rortveit (2010). While the evolution of urgency, and mixed incontinence followed the expected trajectory in terms of increasing following birth, our incidence at each time point is higher than that of Solans-Domènech et al, likely reflecting differences in definitions used to classify incontinence. They classified leakage during sleep, just urinated and dressed, unexpected and continuous as 'other', whereas we categorise leakage during sleep and just urinated and dressed as urge incontinence which is consistent with others (Chang et al, 2014; Rotar et al., 2009). The issue of heterogeneity between studies is widespread. Authors of two systematic reviews report inconsistencies between studies in terms of measurement instrument, terminology, definitions and data collection time-points (Davidson and Kruger, 2018; Thom & Rortveit, 2010). Our finding suggests variations exist even when using the same instrument, confirming the need for a standardised approach to reporting.

Group differences for urinary incontinence subcategories during pregnancy

As expected, we found multiparous women were 1.7 times more likely to experience stress incontinence compared to nulliparous women during pregnancy. While this is slightly lower than that of Barbosa et al., (2018) who reported a RR 2.09 (95% CI 1.07 – 4.08), this might be explained by the difference in classification, Barbosa reports broad category urinary incontinence. Similarly, as expected we found a report of urinary incontinence in early pregnancy to be associated with both stress (RR 2.79) and mixed (RR 2.85) urinary incontinence in late pregnancy. This is consistent with Daly et al., (2018) who reported an OR 2.8 (95% CI 1.8 – 4.2), but for broad category, pre-pregnancy incontinence. A significant finding not generally reported by others, was the strong effect found with co-existing anal incontinence at 36-weeks of pregnancy. Women with anal incontinence were 3.5 times more likely to also report mixed urinary incontinence. Although little evidence can be found regarding this relationship in childbearing women, a relationship has been shown in non-peripartum women (Bezerra et al., 2014) and warrants further exploration.

Group differences for urinary incontinence subcategories postpartum

A strong association exists between vaginal birth and broad category urinary incontinence (Barbosa et al., 2018), but less is documented for incontinence subcategories. Consistent with the findings of two systematic reviews, vaginal birth was strongly associated with stress incontinence – all 18 women with stress incontinence birthed this way - Tähtinen et al., (2016) reported an adjusted OR of 1.85 (95% CI 1.56, 2.19), and Press et al., (2007) reported reduced risk of stress UI in favour of caesarean section, OR 0.56 (95% CI 0.45, 0.68). We also found a strong association between any urinary incontinence reported in late pregnancy and mixed urinary incontinence at 6-weeks postpartum (RR 3.9). We were unable to find a comparable study, but Wesnes et al., (2009) reported an increased risk of broad category urinary incontinence at six months postpartum for women who experienced incontinence during pregnancy, AOR 2.3 (95% CI 2.2 – 2.4). Our findings are consistent with long term follow up studies which show urinary incontinence in the first pregnancy to be a significant factor associated with urinary incontinence four (Gartland et al, 2016) and twelve years later (OR 3.77; 95% CI 1.83 – 7.76) (Pizzoferrato et al., 2014). In contrast to the findings of Wesnes and Lose (2013) and Sangsawang (2014), who reported rates of urinary incontinence in terms of increased maternal age, and obesity we found no significant difference. The relationship was however seen when we evaluated broad category incontinence in the same sample (see Slavin et al., 2019). The trend seen towards significance for some subcategories indicates a possible lack of power.

Framework for Standardised Reporting of Incontinence – Pregnancy and Childbirth

We have presented a framework for the standardised measurement and reporting of urinary and anal incontinence in the context of the clinical application of the ICHOM core outcome set for pregnancy and childbirth (ICHOM, 2016; Nijagal et al., 2018). The framework includes the ICIQ-UI SF, as endorsed by the International Consultation on Incontinence Committee (Grade A evidence: valid, reliable and responsive to change) (Diaz et al., 2017), and validated for use during pregnancy and postpartum (Slavin et al., 2019). Standardised reporting is enhanced by female-specific consensus-based definitions and terminology for broad and urinary and anal incontinence subcategories. The female-specific approach of Haylen et al., (2010) was chosen over that of the traditional International Continence Society (ICS) (Abrams et al., 2002) due to its comprehensive and clinically relevant content. Further Haylen utilised the traditional terminology outlined by Abrams (2002). Standardised casemix variables and data collection time-points as recommended by ICHOM (2016) are clinically relevant reflecting common time-points at which women generally engage with maternity care (Nijagal et al., 2018). The ICHOM working party acknowledges the 6-month point is outside of normal maternity care scheduling and would require additional planning (Nijagal et al., 2018).

Strengths and limitations

Our findings are strengthened by several methodological applications. Firstly, we measure incontinence in a mixed-parity sample over multiple timepoints, twice during pregnancy and twice postpartum using a validated measure of urinary incontinence. Further we evaluated urinary incontinence subcategories which moves beyond broad category incontinence to offer a nuanced understanding of the condition for perinatal women. Finally, we utilised a framework for consistent reporting of urinary incontinence in childbearing women which aims to address current issues in terms of heterogeneity. The development and application of a standardised framework goes some way to support the inclusion of two incontinence scales in the ICHOM standard set of outcome measures for use during pregnancy and childbirth (ICHOM, 2016). The wide variation in research methodologies, terminologies and case definitions between studies of incontinence prevents meaningful data synthesis and contributes to research wastage (Ionnnidis et al., 2014). Standardisation will help to address these issues (Chalmers and Glasziou, 2009; Ioannidis et al., 2014). The evaluation of both anal *and* urinary incontinence provided a unique opportunity to explore the important association between the two types of incontinence and addresses the limitations of findings where only urinary (Wesnes et al., 2007; Martínez Franco et al., 2014; Dinç, 2018) or anal incontinence (Johannessen et al., 2014; Svare et al., 2016; Larsson et al., 2019) is reported.

We acknowledge our work has some limitations. Most importantly, our sample size was not calculated to evaluate incontinence. The subsequent small numbers of women with anal incontinence prevented the evaluation of this aspect of our framework and precision of our effect sizes may be impacted. While our mixed-parity sample was drawn from one maternity facility in Australia possibly limiting the generalisability, our comparable findings to other international studies and those of nulliparous women only, indicate some confidence in our findings. While several known risk factors for postpartum incontinence are acknowledged (such as severe perineal trauma, episiotomy, instrumental birth) low incidence rates prevented meaningful analysis. We also acknowledge symptoms of incontinence preceding the index pregnancy were not measured but are an important consideration for both the trajectory and etiology of incontinence (Daly et al., 2018; Gartland et al., 2016). While our findings support the current evaluation of our framework for standardised reporting, larger studies with diverse maternity populations are recommended.

Recommendations for clinical application and future research

The framework presented offers preliminary findings regarding effectiveness in terms of urinary incontinence. We were unable to evaluate effectiveness in terms of anal incontinence. Findings from our phase one study however, (Slavin et al., 2019) found six women reported some form of fecal incontinence during pregnancy or following birth. The impact on women's quality of life is likely significant but was not evaluated. Evaluating anal incontinence is therefore important to ensure appropriate care and referral is provided. Our findings also suggest nuanced differences in terms of parity, stage of perinatal period and type of incontinence experienced warranting further investigation. Knowledge of the evolution of urinary incontinence subcategories would inform targeted primary prevention interventions specific to nulliparous and multiparous women. Further, our framework includes timepoints to 26-weeks postpartum which is in line with the ICHOM core outcome set. Considering our findings which indicate one in five women experience persistent urinary incontinence, and one in 14 experience persistent anal incontinence at 26-weeks postpartum, data collection beyond this time point is recommended. Universal clinical application of the ICHOM core outcome set in routine maternity care would aid the ongoing evaluation of incontinence beyond the index pregnancy. Universal application would also serve to open opportunities for discussion, education, prevention and would facilitate ongoing greater understanding of the evolution of the condition.

Impact of micro-level birthing practices on incontinence

Incontinence literature generally presents the association of broad macro-level birth outcomes, such as mode of birth, on incontinence. Consistent with the literature, vaginal birth was a strong predictor of postpartum urinary incontinence. This is significant as concerns regarding incontinence informs women's request for elective caesarean section (Jenabi et al., 2019). Macro-level reporting on mode of birth however fails to evaluate the potential influence of micro-level birth practices on the incidence, severity and impact on incontinence. Practices and interventions such as back-laying, lithotomy position, oxytocin augmentation, induction of labour, epidural, directed pushing and episiotomy are common practices during labour and birth (Chalmers et al., 2009; Nyman et al., 2017; Wesnes and Lose, 2013), but the full impact in terms of incontinence is not fully understood. For example, several birth factors are associated with severe perineal lacerations (Pergialiotis et al., 2014), which is a risk factor for postpartum fecal incontinence (Bols et al., 2010). Further, we found higher rates of incontinence related to both induction of labour and waterbirth, but we did not account for any other confounding factors. It is likely that a complex interplay of practices and interventions effect incontinence outcomes. Further research, sufficiently powered to facilitate comprehensive multivariate analysis, is needed to fully inform evidence-based clinical practice guidelines, primary prevention interventions, as well as women's decision-making regarding labour and mode of birth.

Conclusions

This study addressed a need for a standardised approach to outcome reporting regarding incontinence. The framework presented here has been shown to be effective in relation to the measurement and reporting of perinatal urinary incontinence but requires further evaluation. Universal application of a standardised approach will facilitate ongoing benchmarking, comparison and shared learning in this important area of women's health to better inform evidence-based clinical practice and decision-making.

Research data for this article

The de-identified dataset used and analysed for this study is available from the corresponding author upon reasonable request so that appropriate data transfer agreements can be established.

Author contributions

JG and DKC conceived the primary project aims and objectives. JG was responsible for the overall study implementation. JG, DKC and VS developed the data collection plan with equal contribution. Survey development, online electronic survey collection tool and piloting of surveys were conducted by VS. Ethics submission was attended by JG, DKC and VS. VS

collected all outcome data. VS analysed and interpreted the data. All authors contributed to manuscript editing and read and approved the final manuscript.

CRediT Roles:

Valerie Slavin: Data curation; Formal analysis; Investigation; Methodology; Project administration: Software; Validation; Visualization; Roles/Writing – original draft; Writing – review & editing

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Debra K Creedy: Conceptualization; Funding acquisition; Investigation; Methodology; Resources; Supervision; Validation; Visualization; Writing – review & editing.

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