Postpartum anal incontinence in a resource-constrained setting: Prevalence and obstetric risk factors

T D Naidoo,[1] FCOG; **J Moodley**,[2] FCOG, FRCOG, MD

[1] *Department of Obstetrics and Gynaecology, Grey's Hospital, Pietermaritzburg and Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban, South Africa*
[2] *Department of Obstetrics and Gynaecology/Women's Health and HIV Research Group, Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban, South Africa*

Corresponding author: *T D Naidoo (thinagrin.naidoo@kznhealth.gov.za)*

Background. Postpartum anal incontinence (AI) is a common and debilitating condition, but data from resource-constrained settings are scarce.
Objective. To show that AI is common in a resource-constrained setting and that obstetric factors contribute to its development.
Methods. This prospective questionnaire-based study performed in the Durban metropolitan area of South Africa involved black Africans and Indians. Patients were recruited antenatally and followed up for 6 months after delivery. Data collected antenatally and 6 weeks and 6 months after delivery included demographics, obstetric factors and symptoms of AI. The association between these variables and AI were explored using bivariate and multivariate analysis.
Results. The median age of the 1 248 participants was 24 years (range 13 - 45 years). The majority were black Africans (*n*=1 004, 80.4%), 86 (6.7%) underwent induction of labour, 95 (7.6%) required augmentation, 186 (14.9%) had epidural analgesia, 418 had mediolateral episiotomies (33.5%), and 51 (4.1%) had third- or fourth-degree tears. The antenatal prevalence of AI was 57.9% (*n*=722). Six weeks after delivery, 23.1% more women had symptoms of AI compared with the antenatal prevalence. At 6 months, only 0.7% of women reported symptoms. Being black African was significantly associated with AI (odds ratio (OR) 1.7, 95% confidence interval (CI) 1.2 - 2.7) and having had epidural analgesia was significantly associated with faecal incontinence (OR 1.7, 95% CI 1.1 - 2.9) at 6 weeks after delivery. At 6 months most women reported no symptoms of AI.
Conclusion. Postpartum AI is common in our resource-constrained setting and appears to be transient, with most cases resolving by 6 months.

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Anal incontinence (AI) is defined as involuntary loss of faeces or flatus. Faecal incontinence is defined as a complaint of involuntary loss of solid or liquid faeces, while flatal incontinence is defined as a complaint of involuntary loss of flatus.[1] AI results in emotional, psychological and social problems.[2-4] Mechanical sphincter disruption and nerve damage occurring as a complication of childbirth contribute to the development of AI.[2-7] Studies suggest that obstetric factors increase the risk of damage to the anal sphincter and subsequent development of AI.[4-6] These include a prolonged second stage of labour, fetal macrosomia, posterior positions of the fetal skull, instrumental delivery, epidural analgesia, episiotomy and, most significantly, rupture of the anal sphincter.[2,4,7]

Determining the true incidence of AI is often difficult, because women rarely volunteer information about symptoms unless specifically asked.[3-5] Variations in definitions, underlying causes and subjectivity of symptoms also impact on the incidence.[3,4] Furthermore many women only present with symptoms after the puerperium, or later.

Prevalence rates vary from 13% to 44% between 6 weeks and 10 months after delivery in primiparous and multiparous women.[3-5] Up to 25% of primigravidas experience altered continence postnatally, with one-third having evidence of anal sphincter injury.[4,5]

Most of the published data on AI involve studies performed on white women in high-income countries. There are minimal data from low- and middle-income countries (LMICs) like ours, where socioeconomic, demographic, racial, anatomical and histological variations may impact on obstetric risk factors and AI prevalence. We therefore performed a study in our population, which consists mainly of Zulu-speaking black Africans and Indians.

The aim was to describe the prevalence of AI in our population antenatally and 6 weeks and 6 months after vaginal delivery or emergency caesarean section (CS) in late labour, and to explore the association between demographic and obstetric risk factors and AI.

Methods

This prospective observational study was conducted at two regional hospitals (King Edward VIII Hospital and R K Khan Hospital) servicing the lower socioeconomic groups of the Durban metropolitan area in KwaZulu-Natal Province, South Africa.

Women delivering vaginally or by emergency CS late in labour (*N*=1 254) were recruited over a 3-month period and followed up for 6 months. Participants completed a standardised AI symptom questionnaire on 3 occasions: antenatally or within 24 hours of delivery (information on the antenatal period), and 6 weeks and 6 months after delivery. The antenatal questionnaire was administered in person, while the post-delivery questionnaires were administered telephonically or through the mail. The questionnaire, which was administered in either English or Zulu (depending on the patient's preference), was validated for use in our population in a separate study (unpublished data). A single researcher (TDN) administered the questionnaire, collected antenatal and intrapartum obstetric data, and captured all data.

Six cases with missing information pertaining to the continuous and categorical variables under study were excluded from further analysis. The remaining 1 248 patients comprised a representative sample of Indian and black African primigravidas and multigravidas utilising the hospital's obstetric services in terms of age, weight and height.

There were three questions on symptoms of AI, viz. 'Do you have difficulty controlling wind?', 'Do your bowels leak liquid stool?' and 'Do your bowels leak solid stool?'. Anticipated responses to the questions were on a 5-point scale: never, occasionally, sometimes, most of the time, and all of the time. Women who answered 'never' were classified as non-cases, while those answering 'occasionally', 'sometimes', 'most of the time' or 'all of the time' were classified as cases of AI.

Obstetric data were captured on a structured data form. Continuous independent variables included age, weight, height, parity, duration of labour and birth weight of the baby. Categorical independent variables included race, social status, induction and augmentation of labour, epidural use, instrumental delivery, episiotomy use, perineal tears and birth weight.

All labours were managed using a partogram, and at the time of the study there was an active policy in our units of providing epidural analgesia for pain relief. Duration of labour was determined from a reported history of the onset of regular, frequent, painful contractions to delivery of the fetus.

Professional midwives conducted the vaginal deliveries, while obstetric trainees and specialists performed instrumental or operative deliveries. Perineal tears were diagnosed clinically and classified as first-, second-, third- or fourth-degree tears. Women with muscular and neurological disorders and obstetric complications such as severe pre-eclampsia, eclampsia and antepartum haemorrhage, as well as bowel disorders (irritable bowel syndrome or Crohn's disease) and ano-rectal pathology (ulcerative colitis or fistulas), were excluded from the study.

Data analysis

Data captured in Microsoft Excel were analysed in SPSS version 15 (SPSS Inc., Chicago, Ill., USA). Medians and frequencies were used to describe continuous and categorical variables, respectively. The dependent variables studied were flatal incontinence, faecal incontinence and AI. Women reporting at least one symptom of incontinence of liquid or solid stools were classified as having faecal incontinence. Women reporting incontinence symptoms for flatus and faeces were classified as having AI.

At 6 weeks after delivery, only women who reported a worsening of their incontinence symptoms compared with symptoms reported during pregnancy were classified as being incontinent for all dependent outcomes under study. Women who had no symptoms of incontinence or whose symptoms remained the same as had been reported during the pregnancy were classified as having no incontinence at 6 weeks after delivery. A similar approach was taken for determining incontinence for all dependent outcomes at 6 months after delivery.

The χ^2 test was used for significant associations between categorical independent variables and dependent outcomes on bivariate analysis. Continuous independent variables (maternal age, weight and height, parity, duration of labour, and birth weight of the baby) were categorised around the median for use in bivariate and multivariate analyses. Information on socioeconomic status was collected on a 4-point scale (1 - 4) on which 1 and 2 were categorised as low and 3 and 4 as high socioeconomic status.

Binary logistic regression analysis was used to test for associations between independent variables and dependent variables at 6 weeks after delivery on multivariate analysis. Owing to the small number of participants reporting incontinence 6 months after delivery, no multivariate analysis was possible for this time period. Participants with missing data on dependent outcomes at 6 weeks (n=112) were excluded from the bivariate and multivariate analyses.

Race and socioeconomic status were highly correlated, so social status was not included in the multivariate models. Induction of labour, augmentation and having had an epidural were highly correlated. These variables were considered in separate models during multivariate analysis. All significant independent variables ($p<0.05$) and independent variables that were reported as being significant in the literature[3-7] were considered in the multivariate models. During model building the 'type of tear' and 'type of episiotomy' were redundant, and these were excluded from the final multivariate models. The level of significance was 0.05 (α=0.05).

Regulatory approvals

Institutional and hospital ethical approval were obtained from the relevant authorities and all study participants provided written informed consent before entry into the study.

Results

Baseline characteristics

The median age of study participants was 24 years (range 13 - 45 years), and the majority were black African (n=1 004, 80.4%), of low socioeconomic status (n=1 105, 88.5%) and multiparous (n=714, 57.2%), with a median parity of 2 (range 1 - 11). The median birth weight of the babies was 3 000 g (range 600 - 5 200 g).

A limited number of women underwent induction of labour (n=86, 6.7%) and required augmentation (n=95, 7.6%). Overall 186 women (14.9%) had epidural analgesia. Most of the episiotomies (n=444, 35.6%) were mediolateral (n=418, 33.5%). Nine (0.7%) and 6 (0.5%) women had forceps and ventouse-assisted deliveries, respectively. Among the women who sustained perineal tears (n=202, 16.2%), 51 (4.1%) had third- or fourth-degree tears (Table 1).

Main outcomes

At 6 weeks after delivery, there was a worsening of symptoms of incontinence for all three outcomes under study. There was a 19.5% increase in the prevalence of flatal incontinence and a 29.3% incidence in the prevalence of faecal incontinence compared with the baseline antenatal assessment. The overall increase in the prevalence of AI at 6 weeks after delivery was 23.1%. At 6 months after delivery the majority of women reported having no symptoms of flatal or faecal incontinence (Table 2).

Bivariate analysis was performed on 1 136 study participants for whom complete data on incontinence outcomes were available. Being black African was significantly associated with reporting all three outcomes of incontinence, flatal (odds ratio (OR) 1.7, 95%

confidence interval (CI) 1.3 - 2.3), faecal (OR 1.7, 95% CI 1.2 - 2.4) and AI (OR 1.8, 95% CI 1.2 - 2.7), at 6 weeks after delivery. Having had an epidural was significantly associated with reporting faecal incontinence (OR 1.7, 95% CI 1.1 - 2.9) at 6 weeks after delivery.

Induction of labour (flatal incontinence OR 1.4, 95% CI 0.9 - 2.2, faecal incontinence OR 0.9, 95% CI 0.5 - 1.7, AI OR 1.0, 95% CI 0.5 - 2.1) and duration of labour of ≥6.3 hours (flatal incontinence OR 1.1, 95% CI 0.9 - 1.4, faecal incontinence OR 1.0, 95% CI 0.7 - 1.3, AI OR 1.2, 95% CI 0.9 - 1.7) approached significance with the outcomes of incontinence under study at 6 weeks after delivery on bivariate analysis. Perineal tear approached a significant association with faecal incontinence (OR 1.4, 95% CI 0.9 - 2.2) and AI (OR 1.5, 95% CI 0.9 - 2.7) on bivariate analysis. There was no significant association with having a third- or fourth-degree perineal tear and these symptoms of incontinence at 6 weeks after delivery on bivariate analysis (flatal incontinence OR 1.3, 95% CI 0.7 - 2.5, faecal incontinence OR 0.7, 95% CI 0.3 - 1.9, AI OR 1.1, 95% CI 0.3 - 3.6) (Table 3).

On multivariate model building, race remained significantly associated with all three dependent outcomes in the three different statistical models. Having an epidural was significantly associated with reporting symptoms of faecal incontinence (OR 1.7, 95% CI 1.1 - 3.0) and approached significance with reported symptoms of AI (OR 1.7, 95% CI 0.9 - 3.1).

Induction of labour (OR 1.1, 95% CI 0.9 - 2.2), duration of labour of ≥6.3 hours (OR 1.1, 95% CI 0.9 - 1.4) and having had an episiotomy (OR 1.1, 95% CI 0.9 - 1.5) all approached significance with reported symptoms of flatal incontinence. Similarly, maternal weight of ≥69 kg (OR 1.3, 95% CI 0.9 - 1.9) and having had an episiotomy (OR 1.5, 95% CI 0.9 - 2.2) approached significance with reported symptoms of AI. On multivariate analysis the presence of perineal tears was not significantly associated with any of the dependent outcomes under study (Table 4).

Parity was not significantly associated with AI on bivariate (OR 1.0, 95% CI 0.7 - 1.5) or multivariate analysis (model 1: OR 1.1, 95% CI 0.7 - 1.6; model 2: OR 1.0, 95% CI 0.7 - 1.6; model 3: OR 1.1, 95% CI 0.7 - 1.7).

Table 1. Maternal demographics and obstetric characteristics at baseline (*N*=1 248)

Demographic and obstetric variables	
Demographics	
Age (years), median (range)	24 (13 - 45)
Weight (kg), median (range)	69 (45 - 161)
Height (cm), median (range)	160 (140 - 180)
Race, *n* (%)	
Black	1 004 (80.4)
Indian	244 (19.6)
Socioeconomic status (high), *n* (%)	143 (11.5)
Obstetric characteristics	
Parity, median (range)	2 (1 - 11)
Induction of labour (yes), *n* (%)	84 (6.7)
Duration of labour (hours), median (range)	6.3 (1 - 70)
Augmentation (yes), *n* (%)	95 (7.6)
Episiotomy (yes), *n* (%)	444 (35.6)
Mediolateral	418 (33.5)
Medial	26 (2.1)
Perineal tears (yes), *n* (%)	202 (16.2)
First and second degree	151 (12.1)
Third and fourth degree	51 (4.1)
Instrumentation (yes), *n* (%)	15 (1.2)
Forceps	9 (0.7)
Vacuum	6 (0.5)
Epidural (yes), *n* (%)	186 (14.9)
Baby birth weight (g), median (range)	3 000 (600 - 5 200)

Discussion

This study conducted among black African and Indian women in KwaZulu-Natal highlights a high prevalence of AI in the antenatal period. Chaliha *et al.*,[8] in their UK-based study, showed that pregnancy itself may be a risk factor for AI, with an increase in prevalence from 1.4% before pregnancy to 7% in pregnancy. Our findings highlight an increase in the prevalence of AI at 6 weeks followed by a marked decline in persistence at 6 months. This is in keeping with other studies, which show that 13 - 25% of women report faecal incontinence at 3 - 6 months after delivery[4,6,9] with a decline in prevalence over time.[4,5,10] Zetterstrom *et al.*,[5] in their Swedish study, showed similar findings to ours for flatal incontinence, with a higher prevalence in women with clinically detectable perineal injuries than in those without. Our findings differ from those of O'Boyle *et al.*,[10] who showed a combined antenatal prevalence for flatal and faecal incontinence of 18 - 29%, which fell to 15% after delivery, in a group of pregnant nulliparous American women.

The reduction in persistence of AI over time is encouraging and suggests that symptoms may be transient in most women.

A significant variation in the incidence of AI between races was evident in the present study. It is possible that these differences could be attributed to variations in perineal anatomy and differing body type. Hoyte *et al.*[11] highlighted anatomical differences involving the levator ani and puborectalis muscles between African-American and white American women, while Huang *et al.*[12] showed a lower AI incidence among Asian-American women compared with white Americans (21% v. 29%; p=0.007). This suggests that while the underlying anatomical and physiological causes for the pathogenesis of AI may be the same, there may well be ethnic or interracial variations in AI incidence and associated risk factors. There was a significant association between epidural analgesia and AI in our study, which is in keeping with previous studies.[5,6]

Table 2. Prevalence of flatal, faecal and anal incontinence at baseline and 6 weeks and 6 months after delivery (*N*=1 248)

	Baseline prevalence, *n* (%)	Prevalence 6 weeks after delivery, *n* (%)	Prevalence 6 months after delivery, *n* (%)
Flatal incontinence	330 (26.4)	573 (45.9)	7 (0.6)
Faecal incontinence	669 (53.6)	942 (82.9)	2 (0.2)
Anal incontinence	722 (57.9)	1 004 (81.0)	9 (0.7)

Table 3. Bivariate analysis of demographics, obstetric characteristics and flatal, faecal and anal incontinence at 6 weeks after delivery (*N*=1 136*)

	Flatal incontinence		Faecal incontinence		Anal incontinence	
	N=573	OR (95% CI)	*N*=942	OR (95% CI)	*N*=1 004	OR (95% CI)
Demographics						
Age (≥24 years)	318	0.9 (0.7 - 1.2)	530	1.0 (0.7 - 1.3)	567	1.1 (0.7 - 1.5)
Weight (≥69 kg)	288	1.0 (0.8 - 1.3)	475	1.1 (0.8 - 1.5)	509	1.3 (0.9 - 1.8)
Height (≥160 cm)	486	1.2 (0.9. - 1.6)	787	0.9 (0.6 - 1.4)	836	0.7 (0.4 - 1.3)
Race (black)	479	1.7 (1.3 - 2.3)‡	760	1.7 (1.2 - 2.4)†	807	1.8 (1.2 - 2.7)†
Socioeconomic status (high)	56	0.7 (0.5 - 1.0)	112	1.2 (0.7 - 2.1)	117	1.1 (0.6 - 2.0)
Obstetric characteristics						
Parity (≥2)	325	1.0 (0.8 - 1.2)	542	1.2 (0.8 - 1.6)	573	1.0 (0.7 - 1.5)
Induction of labour (yes)	45	1.4 (0.9 - 2.2)	64	0.9 (0.5 - 1.7)	69	1.0 (0.5 - 2.1)
Duration of labour (≥6.3 hours)	295	1.1 (0.9 - 1.4)	470	1.0 (0.7 - 1.3)	508	1.2 (0.9 - 1.7)
Augmentation (yes)	49	1.2 (0.8 - 1.8)	77	1.2 (0.6 - 2.1)	80	1.0 (0.5 - 1.8)
Episiotomy (yes)	206	1.0 (0.8 - 1.2)	341	0.9 (0.7 - 1.3)	367	1.0 (0.7 - 1.5)
Episiotomy type (mediolateral)	195	1.3 (0.6 - 3.0)	321	1.0 (0.3 - 2.8)	346	1.1 (0.3 - 4.0)
Tear (yes)	90	1.0 (0.7 - 1.4)	155	1.4 (0.9 - 2.2)	164	1.5 (0.9 - 2.7)
Third- or fourth-degree tear	28	1.3 (0.7 - 2.5)	43	0.7 (0.3 - 1.9)	47	1.1 (0.3 - 3.6)
Instrumentation (yes)	8	1.1 (0.4 - 3.1)	12	0.8 (0.2 - 2.9)	14	1.9 (0.2 - 14.2)
Instrumentation (forceps)	5	1.3 (0.2 - 9.9)	7	0.7 (0.1 - 10.0)	9	-
Epidural (yes)	84	1.0 (0.7 - 1.3)	150	1.7 (1.1 - 2.9)†	156	1.7 (0.9 - 3.1)
Baby birth weight (≥3 000 g)	286	0.9 (0.7 - 1.2)	481	1.1 (0.8 - 1.5)	509	1.0 (0.7 - 1.4)

OR = odds ratio; CI = confidence interval.

*Participants for whom complete data on incontinence outcomes were available.

χ^2, α=0.05: †$p<0.05$; ‡$p<0.001$.

Epidural use is known to prolong the second stage of labour, hence preventing the bearing down reflex and thereby increasing the risk of pudendal nerve injury and AI. Our policy is one of promoting prolongation of the passive second stage, facilitating descent of the fetal head and reducing the need for instrumental delivery.

No significant association between episiotomy and AI was found on bivariate analysis, but on multivariate analysis having had an episiotomy approached significance with symptoms of AI at 6 weeks. The evidence relating to episiotomy and AI varies. Dannecker *et al.*[13] also described episiotomy as a risk factor for AI, but Chiarelli *et al.*[14] and Handa *et al.*[15] found no association between episiotomy and AI in a 5 - 10-year cohort study.

Having a perineal tear approached significance with AI at 6 weeks after delivery on bivariate analysis, but not on multivariate analysis. The study did not highlight a significant association between third- or fourth-degree tears and AI. This can be attributed to the low prevalence (4.1%) of third- and fourth-degree tears.

Zetterstrom *et al.*[5] found a significant association between sphincter tears and AI, 42% for incontinence of flatus and 1% for incontinence of faeces at 9 months. A systematic review by Bols *et al.*[4] concluded that having a third- or fourth-degree tear was the only factor strongly associated with AI. More recently, Handa *et al.*[15] showed that women who sustain perineal lacerations are at increased risk of developing pelvic floor disorders 5 - 10 years after their first delivery.

Our finding of a non-significant association between AI and instrumental delivery at 6 weeks after delivery differs from that of Donnelly *et al.*,[6] who showed that instrumentation, mainly forceps delivery, carried the greatest risk for sphincter disruption and AI at 6 weeks. Because of the small numbers of patients who underwent instrumental delivery, our study could not show any significant association between forceps and AI after delivery. Similarly, Handa *et al.*[15] could not demonstrate an association between forceps delivery and AI. However all the women (1.4%) in our study who had instrumental delivery and reported symptoms of AI at 6 weeks after delivery reported a resolution of symptoms at 6 months.

Zetterstrom *et al.*[5] identified instrumental delivery as a significant risk factor at 5 months after delivery but not at 9 months, with 97% of patients having ventouse-assisted deliveries. Chiarelli *et al.*[14] showed no association between instrumental delivery and AI over a 1-year follow up period, with their study making no distinction between forceps and ventouse deliveries. These findings suggest that in cases of altered anal continence related to instrumental delivery, there may be an improvement in symptoms over time with a return to normal. Combined analysis of ventouse and forceps deliveries may in fact result in the effects of the forceps being masked. Instrumental delivery may also be associated with a higher incidence of neurological injury rather than direct sphincter injury, with resultant improvement over shorter periods.[14]

Unlike Zetterstrom *et al.*,[5] we were unable to demonstrate a significant association between augmentation or induction of labour and the development of AI after delivery (although induction of labour approached significance). Similarly, Donnelly *et al.*[6] demonstrated that neither induction nor augmentation of labour was associated with the development of AI. Reasons for our

Table 4. Multivariate analysis of demographics, obstetric characteristics and flatal, faecal and anal incontinence at 6 weeks after delivery (*N*=1 136*)

	Flatal incontinence† OR (95% CI)			Faecal incontinence† OR (95% CI)			Anal incontinence† OR (95% CI)		
	Model 1‡	Model 2§	Model 3¶	Model 1‡	Model 2§	Model 3¶	Model 1‡	Model 2§	Model 3¶
Demographics									
Age (≥24 years)	1.0 (0.7 - 1.3)	1.0 (0.7 - 1.3)	1.0 (0.7 - 1.3)	0.9 (0.6 - 1.3)	1.0 (0.7 - 1.4)	1.0 (0.7 - 1.4)	1.1 (0.7 - 1.8)	1.1 (0.7 - 1.7)	1.1 (0.7 - 1.8)
Weight (≥69 kg)	1.0 (0.8 - 1.3)	1.0 (0.8 - 1.3)	1.0 (0.8 - 1.3)	1.1 (0.8 - 1.5)	1.0 (0.8 - 1.5)	1.1 (0.7 - 1.5)	1.3 (0.9 - 1.9)	1.3 (0.9 - 1.9)	1.3 (0.9 - 1.9)
Height (≥160 cm)	1.2 (0.9 - 1.7)	1.2 (0.9 - 1.7)	1.2 (0.9 - 1.7)	0.9 (0.6 - 1.4)	0.9 (0.6 - 1.4)	0.9 (0.6 - 1.4)	0.7 (0.4 - 1.3)	0.7 (0.4 - 1.3)	0.7 (0.4 - 1.3)
Race (black)	1.8 (1.3 - 2.5)	1.8 (1.3 - 2.5)	1.8 (1.3 - 2.5)	1.7 (1.1 - 2.5)	1.7 (1.1 - 2.5)	1.7 (1.2 - 2.5)	1.9 (1.2 - 2.9)	1.9 (1.2 - 2.9)	1.9 (1.2 - 3.0)
Obstetric characteristics									
Parity (≥2)	1.0 (0.8 - 1.3)	1.0 (0.9 - 1.3)	1.0 (0.7 - 1.3)	1.2 (0.8 - 1.7)	1.2 (0.8 - 1.7)	1.2 (0.8 - 1.7)	1.1 (0.7 - 1.6)	1.0 (0.7 - 1.6)	1.1 (0.7 - 1.7)
Induction of labour (yes)	1.4 (0.9 - 2.2)	-	-	0.9 (0.5 - 1.7)	-	-	1.0 (0.5 - 2.0)	-	-
Duration of labour (≥6.3 hours)	1.1 (0.9 - 1.4)	1.1 (0.9 - 1.4)	1.1 (0.9 - 1.4)	0.9 (0.7 - 1.3)	0.9 (0.7 - 1.3)	0.9 (0.7 - 1.3)	1.1 (0.8 - 1.7)	1.1 (0.8 - 1.7)	1.3 (0.8 - 1.6)
Augmentation (yes)	-	1.1 (0.7 - 1.8)	-	-	1.2 (0.6 - 2.1)	-	-	1.0 (0.5 - 1.9)	-
Episiotomy (yes)	1.1 (0.9 - 1.5)	1.1 (0.8 - 1.5)	1.1 (0.8 - 1.5)	1.2 (0.8 - 1.8)	1.2 (0.8 - 1.8)	1.1 (0.8 - 1.7)	1.5 (0.9 - 2.3)	1.4 (0.9 - 2.2)	1.4 (0.9 - 2.1)
Tear (yes)	0.9 (0.8 - 1.3)	0.9 (0.7 - 1.3)	0.9 (0.7 - 1.3)	1.4 (0.8 - 2.2)	1.4 (0.8 - 2.2)	1.3 (0.8 - 2.1)	1.5 (0.8 - 2.7)	1.5 (0.8 - 2.7)	1.4 (0.8 - 2.6)
Instrumentation (yes)	1.2 (0.4 - 3.3)	1.2 (0.4 - 3.4)	1.2 (0.4 - 3.5)	0.9 (0.2 - 3.1)	0.8 (0.2 - 3.1)	0.8 (0.2 - 2.8)	1.8 (0.2 - 14.1)	1.8 (0.2 - 14.1)	1.6 (0.2 - 12.9)
Epidural (yes)	-	-	1.0 (0.7 - 1.4)	-	-	1.7 (1.1 - 3.0)	-	-	1.7 (0.9 - 3.1)
Baby birth weight (≥3 000 g)	0.9 (0.7 - 1.2)	0.9 (0.7 - 1.2)	0.9 (0.7 - 1.2)	1.0 (0.7 - 1.4)	1.0 (0.7 - 1.4)	1.0 (0.7 - 1.4)	0.9 (0.6 - 1.3)	0.9 (0.6 - 1.3)	0.9 (0.6 - 1.3)

OR = odds ratio; CI = confidence interval.
*Participants for whom complete data on incontinence outcomes were available.
†Model included age (≥24 years), weight (≥69 kg), height (≥160 cm), race (black), parity (≥2), duration of labour (≥6.3 hours), episiotomy (yes), tear (yes), instrumentation (yes), baby birth weight (≥3 000 g).
‡Model included induction of labour.
§Model included augmentation.
¶Model included epidural.

study not showing a significant association could include the small number of patients undergoing induction and augmentation of labour.

In our study, a duration of labour of ≥6.3 hours was significantly associated with AI on bivariate analysis and approached significance on multivariate analysis. Zetterstrom *et al.*[5] showed that a duration of labour >12 hours was significantly associated with postpartum AI. Although we did not record the duration of second stage of labour, studies show a significant association between a prolonged second stage and AI.[5,6]

On multivariate analysis, a maternal weight of ≥69 kg approached significance with AI at 6 weeks, suggesting that if the numbers had been greater there may well have been a significant association. This differs from the findings of Bols *et al.*[4] and Handa *et al.*,[15] who showed no association between maternal body mass index and postpartum AI.

Study limitations

Limitations of our study included the absence of a non-pregnant cohort to compare with antenatal AI, preventing us from reporting a true overall prevalence of AI in women. We could only report a postpartum prevalence of AI in pregnant women. We relied on self-reporting of incontinence symptoms, introducing recall bias into our study. Women who had symptoms of incontinence at baseline may have exaggerated their symptoms at 6 weeks after delivery. However, the consistent trend of symptoms at baseline and 6 weeks with resolution of symptoms at 6 months is in keeping with the findings of others, suggesting that if over-reporting occurred it was not excessive. The use of a validated questionnaire in our study ensures a genuine assessment of AI. Despite the above limitations, we believe that our findings highlight the prevalence of AI and associated obstetric factors, as well as an interracial variation in AI incidence, among pregnant women in this LMIC setting.

Conclusion

The findings of this study highlight the difficulties in determining the influence of the various aetiological factors for AI. Many previous postpartum prevalence studies have described AI at a single point in time, whereas our study reports time trends showing marked resolution of symptoms with prolonged follow-up. The study also highlights the need for further evaluation of differing AI incidences based on race, which may be useful in guiding future practice with regard to prevention and management of this distressing problem.

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Author contributions. TDN: project development, data collection, manuscript writing; JM: project development, manuscript writing/editing.

1. Haylen BT, de Ridder D, Freeman RM, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. Int Urogynecol J 2010;21(1):5-26. [http://dx.doi.org/10.1007/s00192-009-0976-9]
2. Pretlove SJ, Thompson PJ, Toozs-Hobson PM, Radley S, Khan KS. Does the mode of delivery predispose women to anal incontinence in the first year postpartum? A comparative systemic review. BJOG 2008;115(4):421-434. [http://dx.doi.org/10.1111/j.1471-0528.2007.01553.x]
3. Sharma A, Marshall RJ, Macmillan AK, Merrie AEH, Reid P, Bisset IP. Determining levels of fecal incontinence in the community: A New Zealand cross-sectional study. Dis Colon Rectum 2011;54(11):1381-1387. [http://dx.doi.org/10.1097/DCR.0b013e31822dd0f0]
4. Bols EMJ, Hendriks EJM, Berghmans BCM, Beaten CGMI, Nijhuis JG, de Bie RA. A systematic review of etiological factors for postpartum fecal incontinence. Acta Obstet Gynecol Scand 2010;89(3):302-314. [http://dx.doi.org/10.3109/00016340903576004]
5. Zetterstrom J, Lopez A, Anzen B, Dolk A, Norman M, Mellgren A. Anal incontinence after vaginal delivery: A prospective study in primiparous women. BJOG 1999;106(4):324-330. [http://dx.doi.org/10.1111/j.1471-0528.1999.tb08269.x]
6. Donnelly VS, Fynes M, Campbell D,Johnson H, O'Connell R, O'Herlihy C. Obstetric events leading to anal sphincter damage. Obstet Gynaecol 1998;92(6):955-961. [http://dx.doi.org/10.1016/S0029-7844(98)00255-5]
7. Guise JM, Boyles SH, Osterweil P, et al. Does cesarean protect against fecal incontinence in primiparous women? Int Urogynecol J Pelvic Floor Dysfunct 2009;20(1):61-67. [http://dx.doi.org/10.1007/s00192-008-0729-1]
8. Chaliha C, Sultan AH, Bland JM, Monga AK, Stanton SL. Anal function: Effect of pregnancy and delivery. Am J Obstet Gynecol 2001;185(2):427-432. [http://dx.doi.org/10.1067/mob.2001.115997]
9. Guise JM, Morris C, Osterweil P, Li H, Rosenberg D, Greenlick M. Incidence of fecal incontinence after childbirth. Obstet Gynecol 2006;109(2):281-288. [http://dx.doi.org/10.1097/01.AOG.0000254164.67182.78]
10. O'Boyle AL, O'Boyle JD, Magann EF, Rieg TS, Morrison JC, Davis GD. Anorectal symptoms in pregnancy and the postpartum period. J Reprod Med 2008;53(3):151-154.
11. Hoyte L, Thomas J, Foster RT, Shott S, Jakab M, Weidner AC. Racial differences in pelvic floor morphology among asymptomatictic nulliparous women as seen on three-dimensional magnetic resonance images. Am J Obstet Gynecol 2005;193(6):235-240. [http://dx.doi.org/10.1016/j.ajog.2005.06.060]
12. Huang AJ, Thom DH, Kanaya AM, et al. Urinary incontinence and pelvic floor dysfunction in Asian-American women. Am J Obstet Gynecol 2006;195(5):1331-1337. [http://dx.doi.org/10.1016/j.ajog.2006.03.052]
13. Dannecker C, Hillemanns P, Strauss A, Hasbargen U, Hepp H, Anthuber C. Episiotomy and perineal tears presumed to be imminent: The influence on the urethral pressure profile, anal manometric and other pelvic floor findings – follow-up study of a randomized controlled trial. Acta Obstet Gynecol Scand 2005;84(1):65-71. [http://dx.doi.org/10.1111/j.0001-6349.2005.00585.x]
14. Chiarelli P, Murphy B, Cockburn J. Fecal incontinence after high-risk delivery. Obstet Gynaecol 2003;102(6):1299-1305. [http://dx.doi.org/10.1016/j.obstetgynecol.2003.08.021]
15. Handa VL, Blomquist JL, McDermott KC, Friedman S, Munoz A. Pelvic floor disorders after vaginal birth: Effects of episiotomy, perineal laceration, and operative birth. Obstet Gynecol 2012;119(2):233-239. [http://dx.doi.org/10.1097/AOG.0b013e318240df4f]