

1 Author Posting. © The Authors 2006. This is the author's version of the work. It is  
2 posted here for personal use, not for redistribution. The definitive version was  
3 published in BJOG, 113(2):218-24. doi:10.1111/j.1471-0528.2005.00818.x  
4

5

6 **Persistent urinary incontinence and delivery mode history: a 6 year**  
7 **longitudinal study**

8

9 **Christine MacArthur<sup>a\*</sup>, Cathryn M A Glazener<sup>b</sup>, P Don Wilson<sup>c</sup>, Robert J**  
10 **Lancashire<sup>a</sup>, G Peter Herbison<sup>c</sup>, Adrian M Grant<sup>b</sup>**

11

12 <sup>a</sup>*University of Birmingham, UK*

13 <sup>b</sup>*University of Aberdeen, UK*

14 <sup>c</sup>*University of Otago, New Zealand*

15

16 \*Professor Christine MacArthur  
17 Department of Public Health and Epidemiology  
18 University of Birmingham  
19 Birmingham B15 2TT, UK  
20 Tel: +44 (0)121 414 6770  
21 Fax: +44 (0)121 414 7878  
22 Email: C.MacArthur@bham.ac.uk  
23

24 **Short headline:** Longitudinal study of urinary incontinence and delivery modes

25 **ABSTRACT**

26 **Objective:** To investigate the prevalence of persistent and long term postpartum  
27 urinary incontinence and associations with mode of first and subsequent delivery.

28 **Setting:** Maternity units in Aberdeen (Scotland), Birmingham (England) and Dunedin  
29 (New Zealand).

30 **Design:** Longitudinal study

31 **Population:** 4214 women who returned postal questionnaires 3 months and 6 years  
32 after the index birth.

33 **Methods:** Symptom data were obtained from both questionnaires and obstetric data  
34 from case-notes for the index birth and the second questionnaire for subsequent  
35 births. Logistic regression investigated the independent effects of mode of first  
36 delivery and delivery mode history.

37 **Main outcome measures:** Urinary incontinence – persistent (at 3 months and 6  
38 years after index birth) and long-term (at 6 years after index birth).

39 **Results:** The prevalence of persistent urinary incontinence was 24%. Delivering  
40 exclusively by Caesarean section was associated with both less persistent (OR=  
41 0.46, 95% CI 0.32 to 0.68) and long term urinary incontinence (OR=0.50, 95% CI  
42 0.40 to 0.63). Caesarean section birth in addition to vaginal delivery however was  
43 not associated with significantly less persistent incontinence (OR 0.93, 95%CI 0.67 to  
44 1.29). There were no significant associations between persistent or long-term urinary  
45 incontinence and forceps or vacuum extraction delivery. Other significantly  
46 associated factors were increasing number of births and older maternal age.

47 **Conclusions:** The risk of persistent and long term urinary incontinence is  
48 significantly lower following Caesarean section deliveries but not if there is another  
49 vaginal birth. Even when delivering exclusively by Caesarean section, the  
50 prevalence of persistent symptoms (14%) is still high.

51 **INTRODUCTION**

52

53 Childbirth is well documented as a major risk factor for urinary incontinence. It has  
54 generally been considered that delivery by Caesarean section provides protection.

55 Cross-sectional studies, based on both general population and postpartum  
56 samples,<sup>1-6</sup> as well as pathophysiological studies<sup>7-10</sup> have produced data to support  
57 this. However, there is little information on the prevalence of *persistent* postpartum  
58 urinary incontinence and the relationship between this and delivery history.

59 Longitudinal studies of incontinence in postpartum populations have had only short  
60 follow up<sup>11;12</sup> or were not large enough to examine the effects of delivery mode  
61 history.<sup>13;14</sup>

62

63 We have recently shown that whilst forceps delivery was predictive of persistent  
64 symptoms of faecal incontinence, neither a first birth Caesarean section nor  
65 delivering exclusively by Caesarean section were associated with a reduction in  
66 these symptoms.<sup>15</sup> The aim of this longitudinal study, which is based on the same  
67 population, was to examine the prevalence of persistent and long term urinary  
68 incontinence six years after birth and to consider the effect of mode of first and  
69 subsequent deliveries.

70

71 **METHODS**

72 All women who delivered during one year (1993/1994) in three maternity units, in  
73 Aberdeen (Scotland), Birmingham (England) and Dunedin (New Zealand), were sent  
74 a postal questionnaire at three months postpartum to assess prevalence of  
75 incontinence. These deliveries are referred to throughout as the 'index births'. Those  
76 with urinary incontinence were invited to take part in a randomised controlled trial  
77 (RCT) of the effects of an intensive pelvic floor exercise programme (see later) and  
78 28% agreed.<sup>16</sup>

79 The questions to ascertain presence, effects and type of urinary incontinence are  
80 given in the appendix to the related paper published in this issue<sup>17</sup> The Hospital  
81 Anxiety and Depression (HAD) scale<sup>18</sup> and a general health question, 'how are you  
82 feeling generally' were also included. The questionnaire was designed by the study  
83 team with the questions on incontinence in accordance with the International  
84 Continence Society definitions.

85

86 Six years after the index birth a second postal questionnaire ascertained later  
87 symptoms, using the same questioning. This questionnaire also obtained date and  
88 mode of all deliveries, which enabled mode and age of first birth to be determined for  
89 the women who had been multiparous at the index birth. Obstetric and maternal data  
90 relevant to the index birth was obtained from the hospital case-notes. Ethnic origin  
91 data was only available from Birmingham: since it is known that Dunedin and  
92 Aberdeen had almost no local south Asian population, women in these centres were  
93 classed as non-Asian. The initial study and follow-up were approved by ethics  
94 committees in all centres.

95

#### 96 **Outcome measures**

97 The *primary outcome* of the study was persistent urinary incontinence, defined as  
98 any involuntary loss of urine at both three months and 6 years.

99 *Secondary outcomes* were:

- 100 • long-term incontinence, defined as occurrence at 6 years irrespective of three  
101 month occurrence
- 102 • persistent stress incontinence, defined as stress incontinence occurring both  
103 at three months and 6 years.

104

105 Research questions

106 The research questions were whether *mode of first delivery* predicts persistent  
107 urinary incontinence and whether *delivery mode history* predicts both persistent and  
108 long-term urinary incontinence. The questions relating to delivery mode history were  
109 pre-specified based on the 3 month findings and asked about the effect of: delivering  
110 exclusively by Caesarean section; having Caesarean section and vaginal deliveries;  
111 and ever having any forceps delivery.

112

### 113 **Statistical analysis**

114 Multiple logistic regression was the main statistical analysis tool in assessing the  
115 independent effects of delivery mode on symptom outcomes. To investigate the  
116 effect of *mode of first delivery* the variables entered into the model were: mode of first  
117 delivery (spontaneous vaginal delivery(SVD)/forceps/ vacuum /Caesarean section);  
118 maternal age at first birth (<25/25-29/30-34/35+); total number of births at follow-up  
119 (one/two/three/four or more); and south Asian ethnic origin (non-Asian/Asian).

120 Detailed obstetric data were only available for the index births, and a second model  
121 restricted to primiparae at index birth examined additional obstetric variables as  
122 potential independent variables: onset of labour (not induced/induced); perineal  
123 trauma (intact/episiotomy/laceration); second stage labour duration (under  
124 1hour/1hour or more); birthweight (quartiles); and pre-pregnancy body mass index  
125 (quartiles and no response category).

126

127 To examine *delivery mode history* a variable created from the reported birth histories  
128 categorised women based on all her deliveries into: Caesarean section birth(s) only;  
129 any forceps delivery; all other delivery histories. To further explore Caesarean  
130 section history another variable categorised all deliveries into Caesarean section  
131 birth(s) only; Caesarean section and vaginal deliveries; no Caesarean section  
132 deliveries (ie vaginal deliveries only).

133

## 134 RESULTS

135 10989 women had been sent a questionnaire at three months postpartum and 7879  
136 had replied. Excluding subsequent known deaths, 7872 questionnaires were sent at  
137 6 years with 847 returned as undelivered by the Post Office. 4214 were returned  
138 completed, a response rate of 54%. Mean duration since index birth was 5.97 years  
139 (SD=0.32) and for women who had been multiparous at index birth, mean duration  
140 from their first birth to follow-up was 10.9 years (SD 3.8).

141

142 Comparisons of the index birth case-note data for the respondents and non-  
143 respondents at 6 years showed that more non-respondents had been under 25 years  
144 (32% vs 18% ,  $p<0.001$ ) and more were Asian (10% vs 4.7% ,  $p<0.001$ ). Mode of  
145 index delivery of non-respondents was similar to respondents (SVD 70% vs 69%;  
146 Caesarean section 16 % vs 16%; forceps 10% vs 10%; vacuum 3.8% vs 5.3%). The  
147 rate of urinary incontinence at three months was similar for respondents (33%) and  
148 non-respondents (34%).

149

### 150 Prevalence of persistent urinary incontinence

151 The prevalence of persistent urinary incontinence (at both 3 months and 6 years)  
152 was 24% (1010/4211 - 3 women did not answer). Table 1 shows the prevalence and  
153 'severity' of urinary incontinence at each time and separately for primiparae at index  
154 birth. Point prevalence had increased from 33% (1390) at 3 months to 45% (1904) at  
155 6 years. 9% (380) of the sample had symptoms at 3 months which had resolved by 6  
156 years, whilst 21% (894) were non-symptomatic at 3 months but had become  
157 symptomatic at 6 years (Table 1). Among symptomatic women at 3 months, the  
158 proportion who still had symptoms at 6 years was 73% (1010/1390): this rate was  
159 similar among the index primiparae (71%,400/566). Among the women without  
160 symptoms at 3 months, symptoms at 6 years were reported by 33% (463/1396) of

161 those who had a subsequent birth(s) and 30% (431/1425) of those who did not. We  
162 had information on the onset of urinary incontinence prior to first pregnancy only in  
163 relation to the index pregnancy and 3.2% (63/1941) of these women reported pre-  
164 pregnancy symptoms.

165

### 166 **Severity and effects of persistent urinary incontinence**

167 Persistent urinary incontinence at 6 years was reported daily or more often by 12%  
168 (120/1010) of women, and a few time a week by a further 21% (208). 23% (231)  
169 sometimes used a pad to protect against leakage and 11% (111) used one all day  
170 and/or all night. 47% (477) reported an effect on hygiene, 16% (166) on home life,  
171 35% (356) on social life, 21% (162/783 who worked) on work life, and 13% (120/915  
172 with a partner) on sex life. Median VAS, assessing the overall extent of the problem  
173 (higher=worse), was 25.0 with 22% (226) scoring 50 or more.

174

175 Persistent urinary incontinence was associated with more adverse general health:  
176 7.1% (72/1010) with persistent symptoms said generally they were “not very well” or  
177 “not at all well”, compared with only 3.8% (121/3201) of those without persistent  
178 symptoms (  $p < 0.001$ ). Mean HAD scores at 6 years were also significantly greater:  
179 mean anxiety score was 6.6 in women with persistent urinary incontinence compared  
180 with 5.5 (diff=1.1 95% CI 0.9 to 1.3,  $p < 0.001$ ); and mean depression scores were 6.3  
181 and 5.3 respectively (diff=1.0, 95% CI 0.8 to 1.3,  $p < 0.001$ ).

182

### 183 **Reported delivery histories**

184 Data on the mode and dates of deliveries other than the index births were reported in  
185 the follow-up questionnaires. The accuracy of these was examined by comparing  
186 case-note data for the index birth and reported data for the same birth. This showed  
187 98% of reported Caesarean sections and 98% of Spontaneous vaginal deliveries to  
188 be consistent with case-notes, and 87% of forceps and 88% of vacuum extraction

189 births. The largest inaccuracies (though still small) were 17/220 vacuum extraction  
190 deliveries reported by women as forceps, and 17/445 forceps deliveries reported as  
191 SVD. Delivery dates showed similar high levels of consistency.

192

### 193 **Mode of first delivery and persistent urinary incontinence**

194 The logistic regression model of the effects of first delivery mode on persistent  
195 urinary incontinence showed this to be significantly less common in women who had  
196 a first Caesarean section delivery and no association for forceps or vacuum  
197 extraction delivery (Table 2). Older maternal age at first birth and increasing number  
198 of births both showed independent associations and there was no association for  
199 ethnic group. The subsequent histories and symptoms of the 671 women (see Table  
200 2) whose first birth was by Caesarean section were further examined: 12/121 (9.9%)  
201 who had no further births experienced persistent urinary incontinence, as did 44/314  
202 (14%) who only had further Caesarean section(s) ( $p=0.33$ ) compared with 52/235  
203 (22%) of those who had at least one subsequent vaginal delivery ( $p=0.007$  and  
204  $p=0.018$  respectively).

205 The second logistic regression model restricted to primiparae at index birth showed  
206 that inclusion of the additional obstetric variables did not alter the associations with  
207 mode of first delivery, maternal age, number of births or ethnic group. Symptoms  
208 were less likely with a first delivery by Caesarean section (OR 0.36, 95% CI 0.25 to  
209 0.53) and there were no associations with forceps (OR 1.00, 95% CI 0.75 to 1.35) or  
210 vacuum extraction (OR 1.11, 95% CI 0.77 to 1.61). None of the additional obstetric  
211 variables showed associations with persistent urinary incontinence. Only pre-  
212 pregnancy Body Mass Index was associated, with women in the heaviest quartile  
213 (BMI 25+) reporting more symptoms (OR 1.55, 95% CI 1.08 to 2.22).

214

215 **Delivery mode history and persistent and long term urinary incontinence**

216 Delivery mode history may be more important in affecting urinary incontinence risk  
217 than first delivery mode. By 6 year follow-up mean total births was 2.4, and mean  
218 time since last birth was 4.4 years. The association between *persistent* urinary  
219 incontinence and delivery mode history could only be examined in the sub-group of  
220 2146 women (51%) who had had no further births since the index birth, showing that  
221 delivering exclusively by Caesarean section was associated with a reduced likelihood  
222 of persistent urinary incontinence and there was no association for any forceps  
223 deliveries. (Table 3). The model to further examine *Caesarean section history* (Table  
224 4) found that relative to women who had only vaginal deliveries, a delivery history  
225 that included abdominal and vaginal deliveries was not associated with any less  
226 persistent urinary incontinence. Numbers were too small to separately specify the  
227 combinations of type of Caesarean section in the model. Among the 252 women  
228 who delivered exclusively by Caesarean section, 57 had only pre-labour Caesarean  
229 section(s), 7 (12%) of whom had persistent incontinence, compared with 10/105  
230 (10%) who had only Caesarean section(s) during labour and 19/90 (21%) who had  
231 both types.

232

233 Since the three month symptoms could not relate to deliveries occurring after this, in  
234 investigating delivery mode history in the whole sample the outcome examined was  
235 'long-term' (at 6 years irrespective of 3 month occurrence) rather than persistent  
236 urinary incontinence. This showed the same pattern of associations (Table 5).

237

238 **Stress incontinence**

239 72% (726/1010) of the women with persistent incontinence reported stress  
240 incontinence at both 3 months and 6 years. Incontinence with urgency was reported  
241 by 39% (391). The logistic regression analysis to examine the effects of first delivery

242 mode on persistent stress incontinence (comparable with Table 2) showed the same  
243 pattern of associations as for any incontinence: fewer symptoms with first delivery by  
244 Caesarean section (OR 0.53, 95% CI 0.41 to 0.70) and no associations for forceps  
245 (OR 0.99, 95%CI 0.81 to 1.21) or vacuum extraction (OR 1.02, 95% CI 0.72 to 1.43).  
246 The same delivery mode history associations (comparable with Table 5) were also  
247 shown as for any incontinence: less long-term stress incontinence with exclusive  
248 Caesarean section deliveries (OR 0.51, 95% CI 0.40 to 0.64) and no association for  
249 any forceps delivery (OR 0.90, 95% CI 0.77 to 1.05).

250

### 251 **Randomised controlled trial participants**

252 516 women had been participants in our RCT of conservative treatment of urinary  
253 incontinence (263 in treatment arm), which found less urinary incontinence at 12  
254 months postpartum relative to controls<sup>16</sup> but no association at 6 years.<sup>19</sup> All analyses  
255 in the present report were repeated excluding trial participants (not shown) and did  
256 not show any differences in any of the delivery or maternal associations found for  
257 persistent or long term urinary incontinence.

258

### 259 **DISCUSSION**

260 This longitudinal study has shown that delivering exclusively by Caesarean section  
261 was associated with less persistent urinary incontinence, with about half the  
262 likelihood of symptoms. The association was not altered when those women who  
263 took part in the related treatment RCT<sup>16;19</sup> were excluded and was consistent for  
264 'stress incontinence' and for 'severe' symptoms (data not shown). We found no  
265 evidence of any association between persistent or long-term urinary incontinence  
266 and forceps or vacuum extraction delivery, but older maternal age and greater total  
267 number of births were associated with increased symptoms.

268 Our investigation of faecal incontinence in the same sample<sup>15</sup> showed a completely  
269 different delivery mode history pattern: significantly more faecal incontinence with

270 any forceps delivery but no association for exclusive Caesarean section deliveries.  
271 Maternal age and total births however, showed the same associations for faecal as  
272 for urinary incontinence.<sup>15</sup>

273 It has generally been assumed that Caesarean section delivery protects against  
274 urinary incontinence and several studies, based on postpartum<sup>1;5;11;12;20</sup> and general  
275 populations<sup>2-4</sup> have found this association. Pathophysiological studies have also  
276 demonstrated less damage, although neurological function may be affected by  
277 Caesarean section during labour.<sup>7-10</sup> Our study comprised a longitudinal cohort  
278 investigation of urinary incontinence in a postpartum population large enough to  
279 examine the effect of delivery mode history. Viktrup et al<sup>13</sup> followed 278 primiparae  
280 to 5 years postpartum and found no statistically significant association between first  
281 birth by Caesarean section and stress urinary incontinence at follow up, but noted  
282 few Caesarean deliveries (18%) in their sample. The large Norwegian community  
283 study of urinary incontinence (EPINCONT) separately identified women who had  
284 delivered exclusively by Caesarean section and found the (age-adjusted) point  
285 prevalence of 16% in this group (n=669) to be significantly lower than the 21%  
286 prevalence in the group (n= 11299) who only had vaginal deliveries.<sup>3</sup>

287

288 We found no evidence of less urinary incontinence where the delivery history  
289 included both Caesarean section and vaginal deliveries, consistent with two much  
290 smaller studies.<sup>21;22</sup> Among the women who delivered exclusively by Caesarean  
291 section, our comparison of types of Caesarean section was based on smaller  
292 numbers, but this did not seem to provide any indication of fewer symptoms from  
293 exclusively delivering by *pre-labour* Caesarean section.

294 Most investigations have studied either any urinary incontinence or only stress  
295 incontinence. Those that have separated type have generally found no association  
296 between childbirth factors and urge incontinence.<sup>3;22</sup> Our main analyses were any  
297 incontinence, but the separate investigation of stress incontinence showed the same

298 pattern of associations as for any incontinence. Numbers with urge incontinence  
299 were too small to separately examine this group.

300 An independent association was found between persistent incontinence and  
301 increasing number of births. Other studies have found higher point prevalence  
302 associated with greater parity.<sup>2;6;23</sup> We found older maternal age at first birth was  
303 also an independent predictor of persistent urinary incontinence, even after taking  
304 account of delivery mode history. An age association is consistent with other  
305 studies.<sup>22;24-27</sup> We found no association between persistent incontinence and  
306 forceps, either for first or any delivery. This is consistent with most other studies,  
307 although two smaller studies did find a significant increase after forceps.<sup>11;12</sup> Most  
308 other studies have examined point prevalence of incontinence rather than persistent  
309 symptoms based on longitudinal data.

310 Asian ethnic group was a predictor of faecal incontinence in this sample<sup>15;28</sup> but there  
311 was no association for urinary incontinence. We found no other studies of  
312 postpartum incontinence in Asian women.

313 An important strength of this study was that it was a large longitudinal investigation.  
314 Nevertheless there was loss to follow-up over time: of the 10989 women who  
315 delivered and 7879 followed at 3 months, only 4214 were followed to 6 years. From  
316 the first questionnaire data however we know that the 6 year respondents had had a  
317 similar rate of urinary incontinence at 3 months to non-respondents. We had  
318 obstetric and maternal data on all index deliveries and the obstetric characteristics of  
319 respondents at 6 years were similar to non-respondents. More older women, more  
320 primiparae and more Caucasian women responded on both occasions. These  
321 differences might affect symptom prevalence but it is more difficult to see how  
322 differences between responders and non-responders might affect obstetric  
323 associations.

324 The delivery history data relied on reports from the women, since hospital records  
325 were only available for the index births. Error in women's recall of all their delivery

326 modes is possible, but for deliveries where we had data from both sources  
327 discrepancies were small.

328

## 329 CONCLUSIONS

330 This study has shown that just under three-quarters of cases of urinary incontinence  
331 occurring soon after a first birth persist to 6 years later. Delivery exclusively by  
332 Caesarean section incurs about a halving in the odds of persistent urinary  
333 incontinence but even among this group the prevalence of persistent incontinence,  
334 was still relatively high, at 14%. A Caesarean delivery with other vaginal birth(s) was  
335 not associated with fewer symptoms.

336

## 337 **Acknowledgements**

338 We thank the women who took part in the study and Alison McDonald, Anne-Marie  
339 Rennie, Jane Cook and Jane Harvey who provided nursing and administrative  
340 support. The original study was supported by Wellbeing and the Health Research  
341 Council of New Zealand and the follow-up by the Health Services Research Unit  
342 which is core-funded by a grant from the Chief Scientist Office of the Scottish  
343 Executive Health Department. The views expressed are those of the authors.

344  
345  
346

## Reference List

347

348

349

#### Reference List

350

351

352

353

1. Wilson P, Herbison R, Herbison G. Obstetric practice and the prevalence of urinary incontinence three months after delivery. *British Journal of Obstetrics and Gynaecology* 1996;**103**:154-61.

354

355

356

2. Assassa R, Dallosso H, Perry S, Shaw C, Williams K, Azam U *et al.* The association between obstetric factors and incontinence: a community survey. *British Journal of Obstetrics and Gynaecology* 2000;**107**:822.

357

358

3. Rortveit G, Daltveit A, Hannestad Y, Hunskaar S. Urinary incontinence after vaginal delivery or cesarean section. *New England Journal of Medicine* 2003;**348**:900-7.

359

360

361

4. Foldspang A, Hvidman L, Mommsen S, Nielsen B. Risk of postpartum urinary incontinence associated with pregnancy and mode of delivery. *Acta Obstetrica et Gynecologica Scandinavica* 2004;**83**:923-7.

362

363

364

5. MacArthur C, Lewis M, Bick D. Stress incontinence after childbirth: prediction, persistence, impact and medical consultation. *British Journal of Midwifery* 1993;**1** :207-15.

365

366

367

6. Goldberg R, Kwon C, Gandhi S, Atkuru L, Sornsen M, Sand P. Urinary incontinence among mothers of multiples: the protective effect of cesarean delivery. *American Journal of Obstetrics and Gynecology* 2003;**188**:1447-50.

368

369

7. Snooks S, Setchell M, Swash M, Henry M. Injury to innervation of pelvic floor sphincter musculature in childbirth. *The Lancet* 1984;546-50.

370

371

8. Snooks S, Swash M, Mathers S, Henry M. Effect of vaginal delivery on the pelvic floor: a 5-year follow-up. *British Journal of Surgery* 1990;**77**:1358-60.

372

373

9. Allen R, Hosker G, Smith A, Warrell D. Pelvic floor damage and childbirth: a neurophysiological study. *British Journal of Obstetrics and Gynaecology* 1990;**97**:770-9.

374

375

376

10. Sultan A, Kamm M, Hudson C. Pudendal nerve damage during labour: prospective study before and after childbirth. *British Journal of Obstetrics and Gynaecology* 1994;**101**:22-8.

377

378

379

11. Burgio K, Zyczynski H, Locher J, Richter H, Redden D, Clark Wright K. Urinary incontinence in the 12-month postpartum period. *Obstetrics & Gynecology* 2003;**102**:1291-8.

380

381

12. Farrell S, Alen V, Baskett T. Parturition and urinary incontinence in primiparas. *Obstetrics & Gynecology* 2001;**97**:350-6.

382

383

13. Viktrup L. The risk of lower urinary tract symptoms five years after the first delivery. *Neurourology and Urodynamics* 2002;**21**:29.

384

385

386

14. Yip S-K, Sahota D, Chang A, Chung T. Effect of one interval vaginal delivery on the prevalence of stress urinary incontinence: a prospective cohort study. *Neurourology and Urodynamics* 2003;**22**:558-62.

387

388

389

15. MacArthur C, Glazener C, Lancashire RJ, Herbison G, Wilson D, Grant A. Faecal incontinence and mode of first and subsequent delivery: a 6 year longitudinal study. *British Journal of Obstetrics and Gynaecology* 2005;**112**:1075-82.

- 390 16. Glazener C, Herbison G, Wilson P, MacArthur C, Lang G, Gee H *et al.* Conservative  
391 management of persistent perinatal urinary and faecal incontinence: randomised  
392 controlled trial. *BMJ* 2001;**323**:593-6.
- 393 17. Glazener C, Herbison G, MacArthur C, Lancashire RJ, McGee M, Grant A *et al.* New  
394 postnatal urinary incontinence: obstetric and other risk factors in primiparae. *BJOG*  
395 2005;**current issue**.
- 396 18. Zigmond A, Snaith R. The Hospital Anxiety and Depression Scale. *Acta Psychiatrica*  
397 *Scandinavica* 1983;**67**:361-70.
- 398 19. Glazener C, Herbison G, MacArthur C, Grant A, Wilson D. Randomised controlled trial  
399 of conservative management of postnatal urinary and faecal incontinence: six year  
400 follow-up. *BMJ* 2005;**330**:337-40.
- 401 20. Viktrup L, Lose G, Rolff M, Barfoed K. The symptom of stress incontinence caused by  
402 pregnancy or delivery in primiparas. *Obstetrics & Gynecology* 1992;**79**:945-9.
- 403 21. Handa V, Harvey L, Fox H, Kjerulff K. Parity and route of delivery: does cesarean  
404 delivery reduce bladder symptoms in later life? *American Journal of Obstetrics and*  
405 *Gynecology* 2004;**191**:463-9.
- 406 22. Kuh D, Cardozo L, Hardy R. Urinary incontinence in middle aged women: childhood  
407 enuresis and other lifetime risk factors in a British prospective cohort. *Journal of*  
408 *Epidemiology and Community Health* 1999;**53**:453-8.
- 409 23. Wilson P, Herbison G. A randomized controlled trial of pelvic floor muscle exercises to  
410 treat postnatal urinary incontinence. *International Urogynecology Journal and Pelvic*  
411 *Floor Dysfunction* 2003;**9**:257-64.
- 412 24. MacArthur C, Bick D, Keighley M. Faecal incontinence after childbirth. *British Journal of*  
413 *Obstetrics and Gynaecology* 1997;**104**:46-50.
- 414 25. Foldspang A, Mommsen S, Kjurhuus J. Prevalent urinary incontinence as a correlate of  
415 pregnancy, vaginal childbirth, and obstetric techniques. *American Journal of Public*  
416 *Health* 1999;**89**:209-12.
- 417 26. Fritel X, Fauconnier A, Levet C, Bénifla J-L. Stress urinary incontinence 4 years after  
418 the first delivery: a retrospective cohort survey. *Acta Obstetrica et Gynecologica*  
419 *Scandinavica* 2004;**83**:945.
- 420 27. Groutz A, Rimon E, Peled S, Gold R, Pauzner D, Lessing J *et al.* Cesarean section:  
421 does it really prevent the development of postpartum stress urinary incontinence? A  
422 prospective study of 363 women one year after their first delivery. *Neurourology and*  
423 *Urodynamics* 2004;**23**:6.
- 424 28. MacArthur C, Glazener C, Wilson P, Herbison G, Gee H, Lang G *et al.* Obstetric  
425 practice and faecal incontinence three months after delivery. *British Journal of*  
426 *Obstetrics and Gynaecology* 2001;**108**:678-83.

427