

1 **Physical after-effects of colposcopy and related procedures and their inter-relationship with**  
2 **psychological distress: a longitudinal survey**

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18 *Running title:* Physical after-effects of colposcopy and distress

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21

22 **Abstract**

23 **Objectives** To estimate prevalence of post-colposcopy physical after-effects and investigate  
24 associations between these and subsequent psychological distress.

25 **Design** Longitudinal survey.

26 **Setting** Two hospital-based colposcopy clinics.

27 **Population** Women with abnormal cytology who underwent colposcopy (+/- related  
28 procedures).

29 **Methods** Questionnaires were mailed to women 4-, 8- and 12-months post-colposcopy. Details  
30 of physical after-effects (pain, bleeding and discharge) experienced post-colposcopy were  
31 collected at 4-months. Colposcopy-specific distress was measured using the Process Outcome  
32 Specific Measure at all time-points. Linear mixed effects regression was used to identify  
33 associations between physical after-effects and distress over 12-months, adjusting for socio-  
34 demographic and clinical variables.

35 **Main outcome measures** Prevalence of post-colposcopy physical after-effects. Associations  
36 between presence of any physical after-effects, awareness of after-effects and number of after-  
37 effects and distress.

38 **Results** 584 women were recruited (response rate=73%, 59% and 52% at 4, 8 and 12-months,  
39 respectively). 82% of women reported one or more physical after-effect(s). Multiple physical  
40 after-effects were common (two after-effects=25%; three after-effects=25%). Psychological  
41 distress scores declined significantly over time. In adjusted analyses, women who experienced all  
42 three physical after-effects had on average a 4.58 (95% CI 1.10 to 8.05) higher distress scored  
43 than those who experienced no after-effects. Women who were unaware of the possibility of  
44 experiencing after-effects scored significantly higher for distress during follow-up.

45 **Conclusions** Prevalence of physical after-effects of colposcopy and related procedures is high.  
46 The novel findings of inter-relationships between awareness of the possibility of after-effects,  
47 and experiencing multiple after-effects, and post-colposcopy distress may be relevant to the  
48 development of interventions to alleviate post-colposcopy distress.

49  
50 **Keywords** Longitudinal survey, colposcopy, post-colposcopy distress, physical after-effects.

51

52 **Tweetable abstract** Experiencing multiple physical after-effects of colposcopy is associated  
53 with psychological distress.

54

## 55 **Introduction**

56 For cervical screening to be effective, women who have a positive screening test (irrespective of  
57 whether the initial test is cytological- or HPV-based) require follow-up. Hospital-based  
58 colposcopy examinations are a cornerstone of follow-up and likely to remain so under the newer  
59 screening protocols. Colposcopy is a very common procedure; for example, each year almost  
60 200,000 women in England and 16,000 in Ireland are referred for colposcopy.<sup>1,2</sup>

61 Undergoing colposcopy and related treatment procedures (e.g. large loop excision of the  
62 transformation zone (LLETZ)) can be distressing and studies have shown that women may have  
63 raised anxiety levels prior to, during, and after a colposcopy.<sup>3-7</sup> While there is considerable  
64 evidence for psychological morbidity among women undergoing colposcopy, data on post-  
65 colposcopy physical after-effects (e.g. pain or bleeding) reported by women is relatively scarce.  
66 Nonetheless, the data that is available suggests that high proportions of women experience  
67 physical after-effects. For example, in a study of 108 women, 68% reported experiencing pain  
68 after a LLETZ,<sup>8</sup> while in another study of 751 women, 79% of those who had punch biopsies,  
69 and 87% of those who had a LLETZ, reported bleeding afterwards.<sup>9</sup> Emerging findings  
70 tentatively suggest that the physical and psychological consequences of colposcopy and related  
71 procedures may be linked. In recent qualitative work among women who had had colposcopy  
72 and/or related procedures, we found that having had physical after-effects that impacted on their  
73 lives was related to women experiencing long-term psychological distress.<sup>10</sup> Similarly, a  
74 quantitative study found that women who reported pain or bleeding post-colposcopy had  
75 increased risk of psychological distress,<sup>6</sup> but that study was cross-sectional so the direction of the  
76 association was uncertain.

77 In a 12-month longitudinal study of women attending colposcopy, we investigated prevalence of  
78 physical after-effects following colposcopy and related procedures and associations between  
79 experiencing physical after-effects and subsequent psychological distress. We further  
80 investigated whether women's awareness of the possibility of physical after-effects was related  
81 to subsequent distress.

82

## 83 **Methods**

### 84 **Setting**

85 The study was conducted in Ireland, which has a mixed public-private healthcare system.  
86 CervicalCheck, the national cervical screening programme was implemented in 2008, offering  
87 free cervical cytology tests and follow-up, if required, to women aged 25-60 years. Women with  
88 two or more low-grade abnormal cervical cytology test results, or one high-grade result, are  
89 referred for colposcopy in a clinic affiliated with the screening programme located in one of 15  
90 maternity hospitals throughout Ireland.<sup>1</sup>

### 91 **Study participants and recruitment**

92 Women who attended CervicalCheck colposcopy clinics at two large Dublin hospitals were  
93 recruited to the study between September 2010 and July 2011. To be eligible, women had to  
94 have been referred to colposcopy on the basis of an abnormal cervical cytology test result, in the  
95 context of routine screening. They were eligible irrespective of the management they received at  
96 their initial clinic appointment (i.e. colposcopy only, punch biopsies, loop excision, or another  
97 form of intervention or treatment) or subsequent follow-up. Women who had previously had  
98 treatment for cervical abnormalities, or who were pregnant at the time of recruitment (i.e. at the  
99 initial colposcopy clinic appointment) were ineligible. At their clinic appointment, women were  
100 invited to take part in the study by research staff and were given a study information sheet.

101 Women willing to participate in the study signed a consent form and returned it to research staff.  
102 Consenting women were invited to complete a questionnaire which was sent by post at 4, 8 and  
103 12 months following their initial colposcopy appointment.

104 Ethical approval was obtained from the ethics committees of the Coombe Women and Infants  
105 University Hospital and the National Maternity Hospital, Dublin.

106

## 107 **Assessment of physical after-effects of colposcopy and related procedures**

108 Physical after-effects were assessed at 4 month follow-up using a questionnaire designed to  
109 measure three physical after-effects of colposcopy and related procedures - pain, bleeding and  
110 discharge- developed in the UK TOMBOLA trial.<sup>9</sup> Women were also asked whether they had  
111 been aware that they might experience physical after-effects. Table S1 displays the questions  
112 asked and response options.

## 113 114 **Assessment of post-colposcopy psychological distress**

115 Psychological distress was measured at three time points: 4, 8 and 12 months post-colposcopy. It  
116 was assessed using the Process Outcome Specific Measure (POSM), which was developed  
117 specifically to evaluate issues of concern to women being followed-up for abnormal cervical  
118 cytology.<sup>11</sup> The POSM contains 14 items, 7 of which can be combined into a measure of distress  
119 (Table S2;<sup>12</sup>). Six of these seven items have six-level Likert response options ranging from  
120 ‘Strongly agree’ to ‘Strongly disagree’. The remaining item has seven response options ranging  
121 from ‘Strongly for the better’ to ‘Strongly for the worse’. Women were asked to indicate the  
122 extent to which each statement applied ‘in the last month’. The raw score for each of the seven  
123 questions was multiplied by 100 and divided by the maximum possible raw score for that  
124 question. Item responses for each question were thus standardised to be scored out of 100. The  
125 overall distress score was obtained by calculating the arithmetic mean of the seven standardised  
126 item scores. The higher the overall score, the greater the psychological distress/burden.

## 127 **Co-variates**

128 Information on potential confounders of the relationship between physical after-effects and  
129 psychological distress was obtained from the questionnaire administered at the 4 month time-  
130 point and from women’s clinic records. Questions on socio-demographic characteristics, lifestyle  
131 behaviours and attitudes, and healthcare-related history were included in the questionnaire. Data  
132 extracted from clinic records were: colposcopy referral cytology, initial colposcopic impression,  
133 initial management received and initial histology result. Table 1 and Table S3 list the co-variates  
134 available.

135 **Statistical analyses**

136 Stata (version 13) was used for analysis. Characteristics of respondents were summarised using  
137 descriptive statistics. Summary statistics for any, number of, and each type of, physical after-  
138 effect were calculated. T-tests were used to determine if the distress score at each time point  
139 differed between: (i) those with any versus no after-effects; and (ii) those with and without each  
140 type of after-effect. Similarly, summary statistics and t-tests were also computed for awareness  
141 of the possibility of physical after-effects. At each follow-up time point, a test for trend was  
142 calculated to assess if the distress score increased with increasing number of physical after-  
143 effects.

144 Since our primary aim was to determine whether presence of any physical after-effects (and/or  
145 awareness of after-effects) was associated with psychological distress, we created a binary  
146 variable which was 0 if no physical after-effects were experienced and 1 if one or more (of  
147 pain/bleeding/discharge) was experienced. In order to account for the longitudinal nature of the  
148 outcome psychological distress, we employed a linear mixed effects model, with unstructured  
149 covariance. This allowed women who have a distress score at least one follow-up time-point to  
150 be included in the analysis, with any missing data assumed to be missing at random. Initially,  
151 fixed effects for follow-up time and experience of physical after-effect(s) were included in the  
152 model. To investigate whether there were differences in the pattern of distress over time between  
153 those with and without any after-effects, an interaction between follow-up time and the binary  
154 physical after-effects variable was tested. We then included the variable awareness of physical  
155 after-effects and also tested for an interaction between follow-up time and awareness of physical  
156 after-effects.

157 In order to choose the final multivariable model, we started with a saturated model consisting of  
158 the physical after-effect (any/none) variable and all candidate co-variates. Using a stepwise  
159 backward approach we eliminated variables if the p-value for inclusion was greater than 0.1  
160 (Wald test), taking care to avoid multicollinearity between co-variates. The main explanatory  
161 variable – any physical after-effects - was kept in the model regardless of its p-value. As a check  
162 of the model, we fitted models with random intercepts only and random intercepts and slopes; we

163 concluded that these more complex models were not required and have reported the findings  
164 from the final fixed effects multivariable model.

165 To determine whether *number* of physical after-effects predicted distress, we ran a multivariable  
166 model in a similar manner replacing the binary physical after-effects variable with a 4-level  
167 variable representing the number of physical after-effects experienced. As above we checked  
168 whether the variable awareness of after effects should be included in this model.

169 To explore whether the association between physical after-effects and distress varied by *type* of  
170 physical after-effect, we conducted a sensitivity analysis in which we re-ran the final  
171 multivariable model three times, each time replacing the any physical after-effects variable with  
172 a binary variable representing any pain or bleeding or discharge. As above we checked whether  
173 the variable awareness of after effects should be included in this model. We did not fit these  
174 three different after-effects simultaneously as they were highly correlated.

## 175 **Results**

### 176 **Characteristics of respondents**

177 429 of the 584 women recruited to the study completed the 4 month questionnaire (73%), 343  
178 (59%) completed the questionnaire at 8 months; and 303 (52%) completed the questionnaire at  
179 12 months. Table 1 displays selected socio-demographic characteristics and clinical variables  
180 for the 429 who completed the 4-month questionnaire. The additional socio-demographic,  
181 lifestyle behaviours and attitudes, and health-care related history variables are displayed in Table  
182 S3.

183

### 184 **Prevalence of physical after-effects**

185 Overall, 82% of women experienced at least one physical after-effect, with a quarter (25%)  
186 experiencing all three physical after-effects (Figure 1). In terms of individual after-effects, 68%  
187 reported experiencing bleeding, 58% experienced pain, and 39% experienced discharge. The  
188 majority (86%) of respondents were aware of the possibility of having after-effects following  
189 their colposcopy.



190 **Unadjusted associations between physical after-effects and post-colposcopy psychological**  
191 **distress, by follow-up time point**

192 The mean distress score at 4 months was 46.6 (of a possible 100), reducing by approximately 2  
193 points at each subsequent follow-up time point (Table 2). The distress score was significantly  
194 higher for those with at least one physical after effect (v. none) at each time point. This result  
195 was mirrored for each of the individual after-effects, pain, bleeding and discharge (Table 2). At  
196 each time point, there was a statistically significant trend of higher distress with increasing  
197 number of after-effects ( $p \leq 0.001$ ).

198 At all three time points, women who were not aware of the possibility of physical side-effects  
199 had higher distress scores than women aware of this possibility; this difference was statistically  
200 significant at the 4 and 8 month time points.

201 **Regression results**

202 *Any physical after-effects*

203 In the multivariable analysis with any vs. no physical after-effects as the main explanatory  
204 variable of interest, having any physical after-effect was associated with a higher distress score  
205 over the entire follow-up period (2.11; 95% CI -0.76 to 4.97; Table 3; with full multivariable  
206 results shown in Table S4), but this was not statistically significant (Wald test p-value 0.15;  
207 Table 3). In the same model, not being aware of the possibility of physical after-effects was  
208 significantly associated with higher distress score (on average 3.99 points higher) during follow-  
209 up (Wald test p-value 0.02; Table 3).

210 There was no significant interaction between distress score and whether or not a physical after-  
211 effect (any vs. none) was experienced over the follow-up period. In addition, there was no  
212 evidence of an interaction between awareness of physical after-effects and distress score over  
213 time.

214 *Number of physical after-effects*

215 In the multivariable analysis, number of physical after-effects was significantly associated with a  
216 higher distress score during follow-up (Wald test p-value 0.03, Table 3). There was also a

217 significant linear trend ( $p=0.004$ ). In women with two physical after-effects, follow-up related  
218 distress was on average 2.20 (95% CI -0.97 to 5.38) points higher than for women who  
219 experienced none (Table 3); follow-up related distress was on average 4.58 (95% CI 1.10 to  
220 8.05) points higher in women who experienced all three physical after-effects than in women  
221 who experienced none (Table 3). In a linear test for trend, a one unit increase in the number of  
222 physical after effects was associated with a 1.6 increase in psychological distress score,  $p =$   
223 0.004. Not being aware of the possibility of physical after-effects was significantly associated  
224 with on average a 4.25 (95% CI 0.93 to 7.57) higher distress score (Wald test  $p$ -value 0.01).

225 *Sensitivity analysis: type of physical after-effect*

226 In our sensitivity analysis, the effect size for association with (a higher) distress score was  
227 similar for each physical after-effect. In women who experienced pain, follow-up related distress  
228 was on average 2.32 (95% CI 0.01 to 4.62) points higher than for women who experienced none.  
229 Follow-up related distress was on average 2.40 (95% CI -0.06 to 4.86) points higher in women  
230 who experienced bleeding than in women who experienced none and was 2.30 (95% 0.02 to  
231 4.57) points on average higher in women who experienced distress than in women who  
232 experienced no discharge (Table 3).

233

## 234 **Discussion**

### 235 **Main findings**

236 Our study has highlighted the burden of physical after-effects of colposcopy/treatment on  
237 women. The prevalence of physical after-effects following these types of procedures is high; four  
238 in every five women reported experiencing one or more after-effect. We also found, in  
239 longitudinal analyses, associations between physical after-effects and psychological distress  
240 following colposcopy. While there was no statistically significant difference in distress between  
241 women who experienced any physical after-effect and those who experienced none - over the  
242 entire 12 month follow-up period, women who experienced all three physical after-effects had  
243 significantly higher distress levels than women who did not (after adjusting for covariates). In  
244 addition having no awareness of the possibility of physical after-effects was significantly related  
245 to higher distress post-colposcopy in unadjusted and adjusted analyses.

### 246 **Strengths and limitations**

247 The major strengths of this study were the longitudinal design and the fact it was nested in  
248 clinics affiliated with the screening programme, so reflects real-world clinical practice. In terms  
249 of possible limitations, physical after-effects were measured at 4 months post-colposcopy and  
250 there may be some inaccuracy in recall. While we found increased distress in women with  
251 multiple after-effects, we did not have sufficiently large sample size to be able to identify  
252 whether any particular combinations of after-effects were responsible for the association. While  
253 we found statistically significant differences in the average POSM scores at each time point,  
254 further work is needed to determine whether these differences would represent a clinically  
255 meaningful difference in psychosocial wellbeing. We do not know the characteristics of non-  
256 responders (those who consented to taking part but did not respond to questionnaires). Therefore,  
257 we cannot exclude the possibility that responders and non-responders differed in terms of socio-  
258 demographic characteristics, physical after-effects or distress. Among women who responded to  
259 the 4-month questionnaire, those who also responded at 12-months had a lower mean distress  
260 score than women who did not respond at 12-months; this suggests that women who dropped out  
261 of the study were more likely to be distressed and that we may have under-estimated the true  
262 mean distress score Although women in our study would have received information leaflets

263 which contained some (limited) information about possible after-effects, we do not know  
264 anything about the verbal information clinic staff may have given women during their  
265 consultations about the possibility of experiencing physical after-effects, and whether/how this  
266 might have impacted on experiences.

## 267 **Interpretation**

268 The high proportions of women experiencing physical after-effects in our study are a cause for  
269 concern. Other evidence on the burden of physical after-effects of colposcopy and related  
270 procedures is scarce with most studies conducted more than 10 years ago and focused mainly on  
271 after-effects of LLETZ.<sup>13-15</sup> In these studies, LLETZ appears to be strong a predictor a greater  
272 physical after-effect burden. In the current study, only 18% of women underwent LLETZ  
273 treatments, yet the percentages of women overall who reported bleeding and pain was 70% and  
274 60%, respectively. These figures are much higher than those reported (using the same  
275 instrument) in the TOMBOLA trial (pain 37%, bleeding 46%).<sup>9</sup> This may be due to the fact that,  
276 in the current study, approximately 75% of women were managed by colposcopy with punch  
277 biopsies or treatment compared to less than half (46%) of the women in TOMBOLA. In recent  
278 years the proportion of women with an abnormal transformation zone who have undergone  
279 diagnostic biopsies at colposcopy clinics in Ireland has increased steadily from 87.8% in  
280 2010/2011<sup>16</sup> to 95.4% in 2014/2015.<sup>1</sup> The high proportions of physical after-effects observed in  
281 our study suggests that diagnostic biopsies can incur significant physical-after-effects for women  
282 and this needs to be considered when managing women referred to colposcopy.

283 Our study also found, for the first time in a longitudinal analysis, that there is a positive  
284 association between number of physical-after-effects experienced and post-colposcopy distress.  
285 Similar findings have been reported in studies of other health-related conditions. In one follow-  
286 up study among women with recurrent breast cancer, those who experienced multiple symptoms  
287 were at increased risk of distress.<sup>17</sup> In another study among women who had completed breast  
288 cancer treatment, greater physical side-effects predicted greater distress.<sup>18</sup> It may be that having  
289 one side-effect of cancer treatment (or any procedure) is anticipated by individuals and perceived  
290 as normal but worry, and hence distress, intensifies when multiple after-effects are experienced.  
291 Another explanation may relate to the representations women hold of their 'condition' (abnormal

292 cervical cytology) and their management experiences.<sup>19</sup> Women in our study who perceived their  
293 multiple physical after-effects as serious may have been more likely to be worried about them  
294 (and therefore have post-colposcopy distress) than those who did not have multiple physical  
295 after-effects –this is somewhat alluded to in a study of women who were treated for breast  
296 cancer, In that study, patients who viewed their illness as having serious consequences reported  
297 worse physical and mental health than those who did not .<sup>20</sup> Interestingly, the magnitude of the  
298 association between physical after-effects and distress in our study was similar, irrespective of  
299 the type of physical after-effect experienced. Our findings suggest more emphasis on the  
300 possibility of experiencing multiple physical after-effects in pre-colposcopy and post-colposcopy  
301 counselling may be required to minimise distress.

343 We have shown in a recent qualitative study that some women can have negative sensory  
344 experiences of colposcopy and related procedures (which can lead to post-colposcopy distress)  
345 and that factors contributing to women having a negative sensory procedure included sensory  
346 expectations of the procedure(s) and lack of preparatory sensory information (i.e. how the  
347 procedures may feel).<sup>10</sup> Similar to this, in the current study women who were unaware of the  
348 possibility of experiencing physical after-effects had greater post-colposcopy distress during  
349 follow-up than women who were aware they could experience some physical after-effects.  
350 Physical after-effects of procedures such as colposcopy, punch biopsies, and LLETZ are for the  
351 main part unavoidable. However, increasing awareness that such side-effects can occur is in  
352 principle, modifiable and raising women’s awareness that physical after-effects are common and  
353 “normal” may serve to ameliorate post-colposcopy psychological wellbeing.

354 Our findings highlight the importance of preparing women for the possibility of experiencing  
355 (perhaps multiple) physical after-effects through counselling pre-colposcopy and the provision of  
356 appropriate procedure-related information on physical after-effects (e.g. via screening  
357 programme information materials). The novel findings of inter-relationships between awareness  
358 of the possibility of after-effects and experiencing multiple physical after-effects, and post-  
359 colposcopy distress may be relevant to the development of interventions to ease post-colposcopy  
360 distress. In particular, our findings highlight that, among women who experience multiple  
361 physical after-effects, targeted intervention measures to alleviate post-colposcopy distress are  
362 needed.

363 **Conclusion**

364 The prevalence of physical after-effects of colposcopy and related procedures is high. Our  
365 findings of inter-relationships between awareness of the possibility of after-effects, and  
366 experiencing multiple physical after-effects, and post-colposcopy distress may be useful for the  
367 development and targeting of interventions to alleviate post-colposcopy distress.

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369

370 **Disclosure of interests**

371 None declared.

372 **Contribution to authorship**

373 MO’C, JMcR and LS conceived the study. LS, CMM and JOL obtained funding for the study.  
374 MO’C and JMcR was in charge of overall project coordination and data management and  
375 coordination of data collection. CR, CW and LP recruited participants at the colposcopy clinics.  
376 KOB conducted data analysis. MO’C drafted the manuscript. MO’C, KOB, JW, PG and LS  
377 contributed to interpretation of study results. TD, GF and WP provided access to potential study  
378 participants. KOB, JW, PG, TD, GF, CMM, JMcR, WP, CW, CR, LP, JJOL and LS reviewed  
379 the drafts. All authors approved the final version of the article.

380 **Details of ethics approval**

381 This study was approved by the research ethics committee of the Coombe Women and Infants  
382 University Hospital, Dublin (reference number: 21-2006; approved 27 April 2010) and the  
383 research ethics committee of the National Maternity Hospital, Dublin (approved 26 October  
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**Table 1.** Selected socio-demographic characteristics and clinical variables\*

<b>Total</b>	<i>n</i>	%
<b>Age</b>		
< 30 years	153	36.0
30 – 40 years	146	34.4
> 40 years	126	29.6
Not stated	4	
<b>Highest level of education attained</b>		
Third level (e.g. college, university)	286	67.5
Primary/secondary	138	32.5
Not stated	5	
<b>Marital status</b>		
Married/cohabiting	199	46.7
Divorced/separated/widowed	36	8.5
Single	191	44.8
Not stated	3	
<b>Have children</b>		
Yes	215	50.6
No	210	49.4
Not stated	4	
<b>Private health insurance</b>		
Yes	207	48.4
No	221	51.6
Not stated	1	
<b>Referral cytology test result</b>		
Low grade (borderline/mild)	329	76.7
High grade (moderate/severe)	95	22.1
Not available	5	1.2
<b>Colposcopic impression</b>		
Normal	114	26.6
Abnormal	293	68.3
Unsatisfactory	8	1.9
Not available	14	3.3
<b>Initial management received</b>		
Colposcopy only	110	25.8
Colposcopy plus punch biopsies**	241	56.4
Colposcopy plus LLETZ***	76	17.8
Not available	2	
<b>Histology result at/following initial colposcopy</b>		
No CIN	65	15.2
CIN 1	90	21.0
CIN 2+	145	33.8
No result/result unavailable/colposcopy unsatisfactory	129	30.1

\*Measured at 4 months post-colposcopy; \*\*Women had 1 or more biopsies taken with their colposcopy, with further procedures dependant on biopsy findings;\*\*\*Women had colposcopy and were managed by immediate treatment (LLETZ; Large Loop Excision of the Transformation Zone)

**Table 2.** Prevalence of physical after-effects (number (%)), mean distress scores (with standard deviations (SD)) and p values for associations between physical after-effects and distress at 4, 8 and 12 months post-colposcopy

<b>Total</b>	<b>Sample characteristics at 4 months Number (%)</b>	<b>Mean (SD) distress score at 4 months (n =402)</b>	<b>Mean (SD) distress score at 8 months (n = 331)</b>	<b>Mean (SD) distress score at 12 months (n = 294)</b>
<b>Overall distress</b>				
Whole sample	402 (100%)	46.6 (14.7)	44.2 (13.5)	42.2 (13.9)
<b>Any physical after-effect</b>				
Yes	324 (82%)	47.4 (14.7)	44.8 (13.7)	43.2 (13.8)
No	73 (18%)	43.0 (14.1)	39.5 (12.5)	37.6 (12.6)
p value*		0.019	0.005	0.006
<b>Number of physical after-effects</b>				
0	73 (18%)	43.0 (14.1)	39.5 (12.5)	37.6 (12.6)
1	81 (20%)	44.5 (13.6)	41.4 (14.6)	39.7 (13.1)
2	140 (35%)	46.8 (14.4)	44.7 (12.7)	42.7 (12.7)
3	103 (26%)	50.5 (15.4)	47.8 (13.8)	47.3 (15.2)
p-value**		0.001	<0.001	<0.001
<b>Pain</b>				
Yes	248 (59%)	48.1 (15.0)	45.8 (13.4)	44.2 (13.9)
No	173 (41%)	44.4 (13.9)	40.9 (13.5)	39.5 (12.9)
p value*		0.012	0.002	0.004
<b>Bleeding</b>				
Yes	290 (69%)	47.7 (14.4)	45.1 (13.2)	43.6 (13.6)
No	132 (31%)	43.8 (14.8)	40.5 (14.1)	38.8 (13.2)
p value *		0.012	0.006	0.003
<b>Discharge</b>				
Yes	167 (40%)	49.2 (15.6)	46.6 (14.5)	45.5 (15.1)
No	253 (60%)	44.9 (13.8)	42.0 (12.8)	40.3 (12.7)
p value *		0.004	0.004	0.003
<b>Awareness of the possibility of experiencing after-effects</b>				
Yes	370 (86%)	46.0 (14.4)	43.1 (13.1)	41.6 (13.6)
No	55 (13%)	50.8 (16.2)	48.7 (16.4)	45.1 (13.9)
p value *		0.033	0.014	0.173

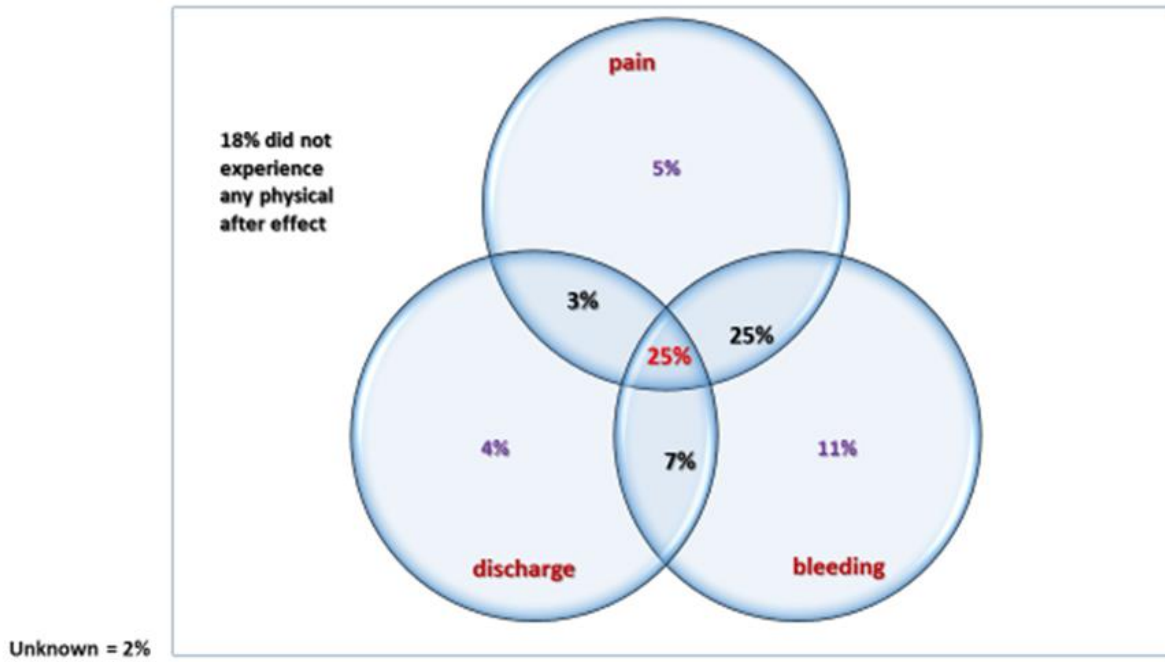
\*t-test, \*\*test for trend.

**Table 3.** Multivariable mixed effects model results for associations between after-effects and distress and sensitivity analysis results (to test whether distress varied by type of physical after-effect –pain, bleeding or discharge)

	Adjusted mean**	Estimate	Distress score* 95% CI	p value***
<b>Any physical after-effects</b>				
None	42.7 (40.2, 45.2)	Ref		
Any (vs none)	44.8 (43.6, 46.0)	2.11	(-0.76, 4.97)	0.149
<b>Number of physical after-effects****</b>				
0	42.5 (40.0, 45.0)	Ref		
1	42.8 (40.5, 45.1)	0.32	(-3.05, 3.68)	
2	44.7 (42.8, 46.5)	2.20	(-0.97, 5.38)	
3	47.0 (44.8, 49.2)	4.58	(1.10, 8.05)	0.030
<b>Pain</b>				
No	43.1 (41.4, 44.8)	Ref		
Yes	45.4 (43.9, 46.8)	2.32	(0.01, 4.62)	0.049
<b>Bleeding</b>				
No	42.8 (40.8, 44.7)	Ref		
Yes	45.2 (43.8, 46.4)	2.40	(-0.06, 4.86)	0.056
<b>Discharge</b>				
No	43.5 (42.2, 44.9)	Ref		
Yes	45.8 (44.0, 47.6)	2.30	(0.02, 4.57)	0.048
<b>Awareness of the possibility of experiencing after-effects*****</b>				
Yes	43.9 (42.8, 45.0)	Ref		
No	47.9 (44.8, 51.0)	4.00	(0.66, 7.32)	0.019

\* All models adjusted for timepoint, awareness of possibility of physical after-effects, initial colposcopy histology result, age, smoking status, perceived severity of colposcopy exam, satisfaction with healthcare and whether or not the woman had colposcopy prior to taking part in the current study. \*\*Predicted margins with 95% confidence interval, from multivariable models. \*\*\*Wald test p-values. \*\*\*\*The test for linear trend was significant (p=0.004). \*\*\*\*\*Estimate from the primary model, with main variable of interest physical after effects (any v. none).

**Figure 1.** Percentages of women with none, one, two or three after-effects\*



\*Of 429 women, physical after-effects assessed in the 4-month questionnaire only.

**Table S1.** Questions (and response options) on physical after-effects of colposcopy and related procedures measured 4 months following women’s initial colposcopy

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**1a. Did you have any discomfort/pain following your appointment?**  
 Yes 1 No 2  
**If No, please go to question 2a**

**(1b) If Yes, How long did the discomfort/pain last?**  
 DAYS

**(1c) If Yes, At its worst, was your discomfort/pain?**  
 Very mild Mild Moderate Severe Very severe  
 1 2 3 4 5

**2a. Did you have any bleeding following your appointment?**  
 Yes 1 No 2  
**If No, please go to question 3a**

**(2b) If Yes, How long did the bleeding last?**  
 DAYS

**(2c) If Yes, At its worst, was your bleeding?**  
 Very light (spotting) Light Moderate Heavy Very heavy  
 1 2 3 4 5

**3a. Did you have any unpleasant discharge following your appointment?**  
 Yes 1 No 2  
**If No, please go to question 4**

**(3b) If Yes, How long did the discharge last?**  
 DAYS

**(3c) If Yes, At its worst, was your discharge?**  
 Very light Light Moderate Heavy Very heavy  
 1 2 3 4 5

**4. Were you aware that you might have some after-effects following your appointment?**  
 Yes 1 No 2

**5. Overall were your after-effects?**  
 I didn't have any after-effects Same as I expected Worse than I expected Not as bad as I expected  
 1 2 3 4

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**Table S2.** POSM items used to develop an overall POSM score

<b>POSM item* (abbreviated)</b>	<b>Response options</b>						
<b>Feel well enough informed about my follow-up</b>	Strongly agree	Moderately agree	Slightly agree	Slightly disagree	Moderately disagree	Strongly disagree	
<b>Worried about my general health</b>	Strongly agree	Moderately agree	Slightly agree	Slightly disagree	Moderately disagree	Strongly disagree	
<b>Way I feel about myself has changed</b>	Strongly for the better	Moderately for the better	Slightly for the better	Neither for the better nor worse	Slightly for the worse	Moderately for the worse	Strongly for the worse
<b>Worried that my next smear will show changes to the cells</b>	Strongly agree	Moderately agree	Slightly agree	Slightly disagree	Moderately disagree	Strongly disagree	
<b>Worried that I may have cervical cancer</b>	Strongly agree	Moderately agree	Slightly agree	Slightly disagree	Moderately disagree	Strongly disagree	
<b>Worried about having sex</b>	Strongly agree	Moderately agree	Slightly agree	Slightly disagree	Moderately disagree	Strongly disagree	
<b>Satisfied with support I have had from other people</b>	Strongly agree	Moderately agree	Slightly agree	Slightly disagree	Moderately disagree	Strongly disagree	

POSM, Process Outcome Specific Measure



**Table S3.** Socio-demographic characteristics (continued), lifestyle behaviours and attitudes, and health-care related history\*

<b>Total</b>	<i>n</i>	%
<b>Employment status</b>		
In work (working for an employer or self-employed)	306	71.7
Other**	121	28.3
Not stated	2	
<b>Nationality</b>		
Irish	386	90.8
Other	39	9.2
Not stated	4	
<b>Currently pregnant</b>		
Yes***	17	4.0
No	410	96.0
Not stated	2	
<b>Smoking status</b>		
Current smoker	140	32.8
Never smoked	153	35.8
Past smoker	134	31.4
Not stated	2	
<b>History of depression****</b>		
Yes	123	28.9
No	303	71.1
Not stated	3	
<b>Social support: No. of close friends and relatives</b>		
Mean	7.4 (5.7)	-
<b>Satisfaction with life</b>		
Mean (SD) satisfaction with life	7.3 (1.8)*****	-
<b>Satisfaction with healthcare</b>		
Mean (SD) satisfaction with healthcare	5.0 (1.1) <sup>1</sup>	-
<b>Ever had an abnormal cervical cytology test result<sup>2</sup></b>		
Yes	247	58.3
No	177	41.7
Not stated	5	
<b>Ever had a colposcopy examination<sup>3</sup></b>		
Yes	89	20.8
No	339	79.2
Not stated	1	
<b>Perceived severity of a colposcopy exam</b>		
Not at all serious	25	5.9
Slightly serious	210	49.2
Serious	149	34.9
Very serious	43	10.1
Not stated	2	

\*Measured at 4 months post-colposcopy; \*\*Unemployed, retired from employment, unable to work, looking after family/home or student; \*\*\* women who were pregnant at the time of the 4-month questionnaire but not pregnant at recruitment (the initial colposcopy appointment); \*\*\*\*Self-reported depression; \*\*\*\*\*mean is from possible Likert score of 1-10; <sup>1</sup>mean is from possible Likert score of 1-7; <sup>2</sup>Prior to the one the woman had at study recruitment; <sup>3</sup>Prior to taking part in the study

**Table S4.** Multivariable mixed effects model for association between distress score and experiencing none v any physical after-effects

	Adjusted mean*	Estimate	Distress score 95% CI	p value**
<b>Any physical after-effects</b>				
None	42.7 (40.2, 45.2)	Ref		
Any (v none)	44.8 (43.6, 46.0)	2.11	(-0.76, 4.97)	0.149
<b>Awareness of physical after-effects</b>				
Yes	43.9 (42.8, 45.0)	Ref		
No	47.9 (44.7, 51.0)	3.99	(0.66, 7.32)	0.019
<b>Timepoint</b>	45.8 (44.5, 47.0)	-1.60	(-2.34, -0.85)	<0.001
<b>Initial Colposcopy Histology result</b>				
No CIN	41.9 (39.1, 44.6)	Ref		
CIN 1	44.7 (42.4, 47.1)	2.89	(-0.69, 6.48)	
CIN 2+	47.5 (45.5, 49.5)	5.65	( 2.26, 9.04)	
No result/result unavailable/colposcopy unsatisfactory	42.0 (40.0, 44.1)	0.17	(-3.23, 3.58)	<0.001
<b>Perceived severity of colposcopy exam</b>				
Not serious	35.6 (31.1, 40.2)	Ref		
Slightly serious	42.5 (41.0, 44.0)	6.89	(2.08, 11.69)	
Serious	46.7 (44.9, 48.5)	11.10	(6.17, 16.02)	
Very serious	50.8 (47.3, 54.2)	15.16	(9.37, 20.95)	<0.001
<b>Ever had a colposcopy***</b>				
Yes	43.5 (42.3, 44.7)	Ref		
No	47.9 (45.6, 50.3)	-4.45	(-7.13, -1.76)	0.001
<b>Satisfaction with healthcare</b>				
Per unit increase****	44.4 (43.4, 45.5)	-2.46	(-3.49, -1.44)	<0.001
<b>Smoking status</b>				
Current smoker	46.5 (44.5, 48.4)	Ref		
Never smoked	44.9 (43.1, 46.7)	-1.51	(-4.21, 1.19)	
Past smoker	41.8 (39.9, 43.7)	-4.70	(-7.46, -1.95)	0.003
<b>Age</b>				
< 30 years	47.1 (45.3, 48.9)	Ref		
30 - 40 years	44.1 (42.3, 45.9)	-3.01	(-5.58, -0.45)	
≥ 40 years	41.8 (39.8, 43.7)	-5.35	(-8.03, -2.67)	<0.001

\*predicted margins with 95% confidence intervals, from multivariable models;\*\*Wald test p value; \*\*\*Prior to the one the woman had at study recruitment; \*\*\*\*Likert scale range 1-7; Completely satisfied = 7.