

Healthcare utilisation, induced labour and caesarean section in the pregnancy after stillbirth: a prospective study

Ida Kathrine Gravensteen^{1,2}, Eva-Marie Jacobsen², Per Morten Sandset², Linda Björk Helgadóttir³, Ingela Rådestad⁴, Leiv Sandvik⁵ and Øivind Ekeberg^{1,6}

¹Department of Behavioural Sciences in Medicine, Institute of Basic Medical Sciences, University of Oslo, Oslo, Norway

²Department of Haematology, Oslo University Hospital and University of Oslo, Oslo, Norway

³Department of Obstetrics and Gynaecology, Oslo University Hospital, Oslo, Norway

⁴Sophiahemmet University, Stockholm, Sweden

⁵Oslo Centre for Biostatistics and Epidemiology, Research support services, Oslo University Hospital and University of Oslo, Oslo, Norway

⁶Division of Mental Health and Addiction, Oslo University Hospital, Oslo, Norway.

Running title: Care and delivery in the pregnancy after stillbirth

1 **Corresponding author**

2 Ida Kathrine Gravensteen

3 Institute of Clinical Medicine, University of Oslo

4 P.O box 1171 Blindern

5 0318 Oslo, Norway

6 Tel. +4790732593

7 E-mail: ida.gravensteen@gmail.com

8 **Abstract**

9 **Objective:** To investigate healthcare utilisation, induced labour and caesarean section
10 (CS) in the pregnancy after stillbirth and assess anxiety and dread of childbirth as
11 mediators for these outcomes.

12 **Design:** Population-based pregnancy cohort study.

13 **Setting:** The Norwegian Mother and Child Cohort Study.

14 **Sample:** 901 pregnant women; 174 pregnant after stillbirth, 362 pregnant after live
15 birth and 365 previously nulliparous.

16 **Methods:** Data from questionnaires answered in the second and third trimesters of
17 pregnancy and information from the Medical Birth Registry of Norway.

18 **Main outcome measures:** Self-reported assessment of antenatal care, register-based
19 assessment of onset and mode of delivery.

20 **Results:** Women with a previous stillbirth had more frequent antenatal visits (mean
21 10.0; 95% confidence interval [CI] 9.4 - 10.7) compared with women with a previous
22 live birth (6.0; 5.8 - 6.2) and previously nulliparous women (6.3; 6.1 - 6.6). Induced
23 labour and CS, elective and emergency, were also more prevalent in the stillbirth group.
24 The adjusted odds ratio for elective CS was 2.5 (95% CI 1.3 – 5.0) compared with
25 women with previous live birth and 3.7 (1.8 - 7.6) compared with previously
26 nulliparous women. Anxiety was a minor mediator for the association between stillbirth
27 and frequency of antenatal visits, while dread of childbirth was not a significant
28 mediator for elective CS.

29 **Conclusions:** Women pregnant after stillbirth were more ample users of healthcare
30 services and had more often induced labour and CS. The higher frequency of antenatal
31 visits and elective CS could not be accounted for by anxiety or dread of childbirth.

32 **Funding:** This substudy was funded by the Norwegian SIDS and Stillbirth Society,
33 the South-Eastern Norway Regional Health Authority Trust, the University of Oslo
34 and Oslo University Hospital.

35 **Keywords:** Stillbirth; prenatal care; induced labour; caesarean section; anxiety; The
36 Norwegian Mother and Child Cohort study; MoBa

37

38 **Tweetable abstract:** Women pregnant after stillbirth are ample users of healthcare
39 services and interventions during childbirth.

40 **Introduction**

41 Most couples embark on another pregnancy after a stillbirth, as many as 50% within a
42 year (1). In pregnancies subsequent to a miscarriage or stillbirth, many women sense a
43 threat of an additional loss (2) and increased generalised and pregnancy specific anxiety
44 (2-7). Attempts to cope may involve asking more questions, requesting additional tests
45 and telephoning healthcare professionals between visits (4).

46

47 In Norway, antenatal care is free of charge and mainly carried out by midwives and
48 general practitioners. Until gestational week 32 it routinely includes five appointments
49 including one second trimester ultrasound scan (8). Additional care and referrals to the
50 specialist services is provided when needed, but national guidelines on antenatal care
51 for women with previous stillbirths are non-existent.

52

53 It remains uncertain whether anxiety accounts for higher healthcare utilisation in
54 women pregnant after stillbirth and if the type of support given is helpful. In a recent
55 international survey on care for parents in pregnancies subsequent to stillbirth, the
56 majority was provided with additional visits and ultrasound scans (9). Care addressing
57 psychosocial needs was less frequently reported. In another study including 36 women
58 pregnant after pregnancy loss, increased healthcare utilisation was associated with
59 maternal intrusion symptoms and state anxiety (5).

60

61 The rate of caesarean section (CS) in Norway has increased from 4% in 1975 to 17%
62 in 2012 (10). Worldwide, the increasing rate of CS and interventions during childbirth
63 is of concern (11, 12) and cannot be fully explained by maternal medical factors or
64 obstetrical complications (13). Some research indicate that the increased rate of CS is

65 partly a result of maternal requests, in turn related to fear of childbirth (11, 14). Previous
66 studies have demonstrated that previous miscarriages and a variety of delivery
67 experiences are associated with fear of childbirth (15, 16).

68

69 A retrospective Australian study on 316 subsequent deliveries after unexplained
70 stillbirth reported increased rates of preterm birth, induced labour, forceps delivery and
71 CS, both elective and emergency (17). Studies from Finland and Scotland reported
72 similar findings (18, 19). Whether anxiety, fear or dread of childbirth partially accounts
73 for more frequent use of interventions in pregnancies subsequent to stillbirth, however,
74 remains unknown.

75

76 The objectives of this study were to investigate healthcare utilisation, induced labour
77 and caesarean section in the pregnancy after stillbirth and to assess anxiety and dread
78 of childbirth as possible mediators for the frequency of antenatal visits and elective
79 CS.

80

81 **Methods**

82 This paper is based on data from the Norwegian Mother and Child Cohort Study
83 (MoBa) and the Medical Birth Registry of Norway (MBRN). MoBa is a population-
84 based pregnancy cohort study conducted by the Norwegian Institute of Public Health
85 (20) that recruited participants from all over Norway from 1999 to 2008. The
86 participation rate was 41% and the cohort includes more than 95 000 women (21). The
87 current substudy is based on version VIII of the quality-assured data files released on
88 14th of February 2014. The participants answered extensive questionnaires regarding
89 demographic factors, reproductive history and maternal health during pregnancy. Data
90 from the MoBa study were linked with data from MBRN (22).

91 This substudy included women who were pregnant after a stillbirth and two reference
92 groups; 1) women with at least one live birth and no previous stillbirth and 2)
93 nulliparous women. Only women with singleton or twin pregnancies, and with the
94 MoBa pregnancy resulting in a live birth were included. Women not responding to the
95 first MoBa questionnaire, with missing MBRN data or participating more than once
96 were excluded. Results of previous pregnancies were identified using data from the
97 MoBa questionnaires and the MBRN. We defined stillbirth defined according to the
98 World Health Organizations International Statistical Classification of Diseases 10th
99 revision, ie, fetal death ≥ 22 completed gestational weeks or birthweight > 500 grams
100 (23). Aside from the selection criteria, the reference women were randomly selected
101 from the entire MoBa cohort. We identified 197 women in the MoBa cohort who had
102 experienced stillbirth in their previous pregnancy (stillbirth group). The reference
103 groups included 394 women with a live birth in their previous pregnancy (live birth
104 group) and 394 nulliparous women (nulliparous group). We used data from

105 questionnaires completed at approximately 17 gestational weeks (Q1) and
106 approximately 30 gestational weeks (Q2) and data from the MBRN.

107 At the second assessment (30 gestational weeks) 174 women with a previous stillbirth,
108 362 with a previous live birth and 365 nulliparous women completed the questionnaire.

109

110 **Outcome variables**

111 Information about healthcare utilisation was collected at gestational week 30 (Q2). The
112 women were asked how many and where they had their antenatal visits, categorised as
113 family healthcare centre, physicians office or hospital outpatient clinic, unscheduled
114 contacts, number of ultrasound scans (transabdominal/transvaginal) and whether or not
115 they had been admitted to hospital during the pregnancy.

116

117 Outcome variables regarding onset of labour and mode of delivery were obtained from
118 the MBRN. Onset of labour was classified as spontaneous, induced or CS. Mode of
119 delivery was classified as vaginal birth; spontaneous or instrumental (vacuum-assisted
120 or forceps-assisted) or CS; elective or emergency. Elective CS included those planned
121 >8 hours before the delivery, while emergency CS included all other CS.

122

123 **Covariates**

124 Sociodemographic, health-related and obstetrical factors that could plausibly influence
125 the association between previous stillbirth and the outcomes were identified based on
126 the literature and pre-analytical assumptions. Maternal age at the time of delivery was
127 retrieved from the MBRN. The following sociodemographic variables were obtained
128 from Q1: marital status, categorised as married/cohabiting or living alone; pre-
129 pregnancy daily smoking; pre-pregnancy body mass index ≥ 30 kg/m² and higher

130 education (>12 years of school). High parity was defined as two or more previous live
131 births or stillbirths and verified with information from the MBRN. Previous
132 miscarriage(s) was categorised as “yes” or “no”. Pre-pregnancy comorbidity was
133 defined as having at least one of the following previous medical problems reported in
134 the MBRN: Asthma, hypertension, recurrent urinary tract infections, kidney disease,
135 rheumatoid arthritis, heart disease, epilepsy, pre-pregnancy diabetes mellitus, and/or
136 thyroid disease. For women with a previous stillbirth and women with a previous live
137 birth, MBRN-data regarding the previous pregnancy were retrieved and included
138 information on hypertensive disorders, instrumental vaginal delivery and CS (all
139 pregnancies).

140

141 MBRN-data regarding the MoBa pregnancy were obtained for all three groups and
142 included bleeding in pregnancy; hypertensive disorders, diabetes (all types), small for
143 gestational age (birthweight <10th percentile according to gestational age and gender),
144 macrosomia (birthweight >4.5 kg), preterm birth (delivery before week 37 gestational
145 weeks) and delivery after 41 gestational weeks. Complications of labour such as
146 dystocia, feto-pelvic disproportion, abnormal labour and augmentation of labour were
147 recorded in the MBRN as the variable dystocia. The inter-pregnancy interval was
148 defined as the number of months between the previous delivery (stillbirth or live birth)
149 and the next conception (estimated by ultrasound measurements).

150

151

152 **Potential mediators**

153 Anxiety was measured using a short version of the Hopkins Symptom Checklist (SCL).
154 The SCL-25 is widely used as a screening tool for anxiety and depression and shows a
155 high concordance with clinical assessments (24). We used a four-items subscale (SCL-
156 4a) that correlates 0.90 with the original anxiety subscale of the SCL-25 (25). In the
157 third trimester of pregnancy (Q2) the women were asked if they had been bothered by
158 any of the following during the previous two weeks: 1) “feeling fearful,” 2)
159 “nervousness or shakiness inside,” 3) “feeling tense or keyed up” and 4) “suddenly
160 scared for no reason”. Items are scored on a Likert scale ranging from one (not at all
161 bothered) to four (very much bothered). We defined a mean score ≥ 2.0 on SCL-4a as
162 presence of anxiety (25, 26). Cronbach’s alpha of internal consistency was 0.79.

163

164 The variable “dread of childbirth” was derived from the MoBa questionnaire at
165 gestational week 30 (Q2). Women responded to the statement “I am really dreading
166 giving birth” with one of six response alternatives: 1) agree completely, 2) agree, 3)
167 agree somewhat, 4) disagree somewhat, 5) disagree and 6) disagree completely. The
168 variable was dichotomised, defining responses 1-2 as dread of childbirth. Since the item
169 has not been tested for its validity in reflecting fear of childbirth, we named it “dread
170 of childbirth” reflecting the wording in the questionnaire.

171

172 A variable can be considered a mediator if it accounts for the relationship between the
173 predictor and the outcome (27). Thus, when a mediator is present, the association
174 between the predictor and the outcome variable is reduced, either to zero (full mediator)
175 or not to zero (partial mediator).

176 **Statistical analyses**

177 Categorical variables were reported as proportions and compared between groups using
178 chi-square tests. Continuous variables were reported as means with confidence interval
179 (CI) or standard deviation (SD) and compared between groups using independent
180 samples t-test. To reduce potential sample distortion caused by missing values, the
181 Estimation-Maximation procedure in SPSS was used to impute missing values on SCL-
182 4a if at least 50% of items were present. This resulted in 0.4% missing on the SCL4a.
183 The proportion of missing values were <5% on all other variables.

184 Bivariate and multivariate linear regression models were used to estimate beta
185 coefficients (B) and adjusted beta coefficients (aB) for the frequency of antenatal visits
186 among women with a previous stillbirth compared with the two reference groups.
187 Logistic regression models were used to estimate odds ratios (ORs) and adjusted odds
188 ratios (aORs) for induced labour and CS among women with a previous stillbirth
189 compared with the two reference groups. Covariates that were unevenly distributed
190 between the groups ($p < 0.1$) and associated with the outcome variable in a bivariate
191 model ($p < 0.1$) were included in the multivariate analyses. Age was included as a
192 covariate in every multivariate model.

193 Testing for mediators was restricted to regression models comparing women with a
194 previous stillbirth to women with a previous live birth. Anxiety (SCL-4a) was
195 considered a potential mediator for the association between stillbirth and frequency of
196 antenatal visits and for the association between stillbirth and elective CS. Dread of
197 childbirth was considered a potential mediator for the association between stillbirth and
198 elective CS. The potential mediators were included in the multivariate regression
199 models if they were significantly associated with the predictor and the outcome
200 variable. Mediation analyses were conducted by using the procedure described by

201 Baron and Kenny (27). Since the mediator variables (anxiety and dread of childbirth)
202 and one of the outcome variables (elective CS) were dichotomous, the regression
203 coefficients were standardized to make them comparable before testing the significance
204 of the mediating effect using the Sobel test (28, 29). If the potential mediators remained
205 significant in the multivariate regression models, they were also tested for interaction
206 with previous stillbirth.

207 All data were analysed using the Statistical Package for Social Science version 23.0
208 (SPSS Inc., Chicago, IL, United States). Two-sided p-values <0.05 were regarded as
209 statistically significant.

210

211 **Results**

212 The mean gestational age at the time of stillbirth was 33.5 weeks (95% CI 32.5 - 34.6,
213 range 20.4 - 42.6). Table 1 displays characteristics and covariates categorised by group.
214 Women with a previous stillbirth and women with a previous live birth did not differ
215 according to age, but were significantly older than the previously nulliparous women.
216 A high BMI was more prevalent in the stillbirth group compared with both reference
217 groups, whilst higher education was less prevalent. In addition, more women in the
218 stillbirth group had two or more previous births compared with the live birth group,
219 while the proportion with previous CS did not differ. In the stillbirth group the average
220 inter-pregnancy interval was shorter compared with the live birth group. Anxiety and
221 dread of childbirth was more prevalent in the stillbirth group (22.5% and 30.2%)
222 compared with both reference groups (4.4% / 5.5% and 21.7% / 16.9%, respectively).

223

224 **Healthcare utilisation**

225 Table 2 displays healthcare utilisation in pregnancy and mode of delivery categorised
226 by group. The great majority (91.3%) of women with a previous stillbirth had antenatal
227 visits at the hospital outpatient clinic. Women with a previous stillbirth had significantly
228 more antenatal visits (mean 10.0) compared with women with a previous live birth
229 (mean 6.0, $p < 0.001$) and previously nulliparous women (mean 6.3, $p < 0.001$). Women
230 with a previous stillbirth had performed more ultrasound scans, had more frequently
231 unscheduled contacts with midwife (but not physician) and were more often admitted
232 to the hospital compared with both reference groups (Table 2).

233 In the multivariate linear regression models, previous stillbirth was significantly
234 associated with more antenatal visits in the subsequent pregnancy compared with both
235 reference groups (Table 3).

236 **Anxiety as a possible mediator for frequency of antenatal visits in the pregnancy**
237 **after stillbirth**

238 Anxiety was bivariately associated with frequency of antenatal visits (B 2.6, 95% CI
239 1.7-3.6, $p < 0.001$). When included in the multivariate model, the association between
240 anxiety and frequency of antenatal visits remained significant (aB 1.0, 95% CI 0.1-1.8).
241 As did the association between previous stillbirth and frequency of antenatal visits (aB
242 reduced from 3.9 to 3.7, 95% CI 3.1-4.2). The mediating effect of anxiety accounted
243 for 7.1% of the total effect of stillbirth on frequency of antenatal care visits (Sobel $Z =$
244 2.078, $p = 0.037$). Figure 1 displays a model illustrating the mediation design.

245

246 There was a significant interaction between anxiety and previous stillbirth (aB 2.2, $p =$
247 0.020). Among women with a previous stillbirth, anxiety was associated with more
248 frequent antenatal visits (aB 1.7, 95% CI 0.3-3.2, $p = 0.021$), but not among women
249 with a previous live birth (aB -0.4, 95% CI -1.6-0.7, $p = 0.472$).

250 **Induced labour and mode of delivery**

251 Induced labour and CS, both elective and emergency, were more prevalent among
252 women with a previous stillbirth compared with both reference groups (Table 2). In
253 the multivariate logistic regression models, previous stillbirth was significantly
254 associated with higher frequencies of induced labour (aOR 9.5 and 4.3), CS (all) (aOR
255 4.8 and 2.5) and elective CS (aOR 2.5 and 3.7) compared with both reference groups
256 (Table 3).

257

258 **Anxiety and dread of childbirth as potential mediators for elective caesarean**
259 **section in the pregnancy after stillbirth**

260 Anxiety was not bivariately associated with elective CS (OR 1.5, 95% CI 0.6-3.7), but
261 dread of childbirth was (OR 3.3, 95% CI 1.8-6.3). When included in the multivariate
262 model, the association between dread of childbirth and elective CS remained significant
263 (aOR 3.1, 95% CI 1.6-5.9). The association between previous stillbirth and elective CS
264 also remained significant (aOR reduced from 2.5 to 2.1, 95% CI 1.1-4.3). The
265 mediating effect of dread of childbirth accounted for 11.0% of the total effect of
266 stillbirth on elective CS, but was not significant (Sobel $Z = 1.704$, $p = 0.088$). There was
267 no interaction between dread of childbirth and previous stillbirth ($p = 0.340$).
268

269 **Discussion**

270 **Main findings**

271 In this study, we found that women with a previous stillbirth had higher healthcare
272 utilisation and more frequently induced labour or CS in the subsequent pregnancy
273 compared with women with previous live births and previously nulliparous women.
274 Anxiety was identified as a minor mediator for the relationship between previous
275 stillbirth and frequency of antenatal visits, and was associated with slightly more
276 antenatal visits among women with a previous stillbirth, but not among women with a
277 previous live birth. Dread of childbirth was not a significant mediator for the association
278 between previous stillbirth and elective CS in the subsequent pregnancy.

279

280 **Strengths and limitations**

281 Healthcare utilisation in pregnancy has been investigated in smaller studies including
282 women with early pregnancy loss and neonatal loss, but with few stillbirths (5). To our
283 knowledge, this is the first study that has exclusively assessed healthcare utilisation in
284 the pregnancy following stillbirth compared with other pregnant women. So far, there
285 have been few large-scale studies on mode of delivery in pregnancies following
286 stillbirth (17, 18), particularly stillbirths of all causes (19). Thus, this study adds to a
287 limited body of evidence. We are also the first to assess anxiety and dread of childbirth
288 as possible mediators for increased healthcare utilisation and elective CS in this group.
289 The data is derived from a large national cohort and our sample size is larger than most
290 previous studies in this field. The prospective design minimised reporting bias, and
291 applying two reference groups to further explore the impact of stillbirth is also a
292 strength.

293 However, the study has a number of limitations. The participation rate of 40.6% is a
294 weakness, but as expected for population-based studies (30). A study investigating
295 selection bias in the MoBa study found that there was an under-representation of
296 participants with a number of exposure variables, including previous stillbirths (31),
297 but that self-selection was not a problem in studies of exposure-outcome associations.
298 We therefore argue that our main findings with some caution can be generalised to other
299 women pregnant after stillbirth.

300

301 Unfortunately, we did not have information on the causes of stillbirth, the level of fear
302 and anxiety among caregivers or the indications for conduction of elective CS. This
303 information could provide opportunities for meaningful stratifications of the outcomes.
304 Another limitation to this study is the lack of validated instruments for measuring
305 healthcare utilisation and fear or dread of childbirth. Since we did not have access to
306 medical records, we cannot exclude the risk of recall bias when measuring health care
307 utilisation. The estimates of anxiety in our study relied on self-reporting using a pre-
308 validated screening tool and such questionnaires are not diagnostic. Optimally, we
309 would also have included an instrument measuring pregnancy specific anxiety. Further,
310 anxiety and healthcare utilisation after 30 gestational weeks was not measured. We
311 cannot rule out that potentially increased anxiety closer to term could be a stronger
312 mediator for health care utilisation or mode of delivery in pregnancies following
313 stillbirth. Regarding the mediation analyses, definite conclusions about the causal
314 relationship between anxiety and frequency of antenatal visits cannot be drawn since
315 the variables were obtained simultaneously.

316

317 **Interpretation**

318 Higher healthcare utilisation in the pregnancy after stillbirth is consistent with previous
319 findings from Hutti et al. in a smaller study on women pregnant after miscarriage,
320 stillbirth or neonatal death (5). The higher frequency of induced labour and CS in our
321 study is consistent with findings in previous studies (17, 19), but with somewhat higher
322 odds ratios in our study, particularly for induced labour. Reasons for this may be that
323 our study includes women with stillbirths regardless of cause and regardless of parity
324 for the parous women. Further, when estimating aORs for induced labour, deliveries
325 starting with CS were excluded. Differing practices in obstetrical management between
326 countries could also be an explanatory factor.

327

328 General anxiety was a statistically significant mediator for the association between
329 previous stillbirth and frequency of antenatal visits, but the effect was minor. This may
330 indicate that women with a previous stillbirth are offered more antenatal visits than
331 other women, but this is mainly regardless of general anxiety. Alternatively, pregnancy
332 specific anxiety could be a stronger mediator for this relationship.

333

334 Fear of childbirth has previously been demonstrated to be associated with maternal
335 requests for CS (11, 12). While dread of childbirth was associated with elective CS in
336 our study, it did not account for the higher frequency in women with a previous
337 stillbirth. However, as the p-value of the mediation effect was just above the
338 significance level, larger studies are needed to conclude as to what degree feelings of
339 anxiety, fear or dread related to the ongoing pregnancy are mediators for labour and
340 delivery interventions in this group. Several mechanisms are likely to explain the
341 associations between previous stillbirth and increased healthcare utilisation, induced

342 labour and CS in the subsequent pregnancy, particularly the higher rate of
343 complications (19, 32) and increased risk of recurrent stillbirth (33-35). These factors
344 depend partly on the aetiology of the previous stillbirth (35). Thus, anxiety and dread
345 of childbirth could potentially be mediators for elective caesarean section in
346 pregnancies with particularly high recurrence risks. Anxiety among obstetricians may
347 also lead to more frequent antenatal visits and affect decisions regarding induction of
348 labour or CS. According to a postal survey regarding obstetrical management in the
349 pregnancy after unexplained stillbirth, Robson et al. found that the tendency for early
350 delivery, and in particular by CS, may be due in part to altered management strategies,
351 and not solely as a consequence of complications in the pregnancy (36). Studies
352 consistently report that the risk of stillbirth in ongoing pregnancies increases gradually
353 from 36 gestational weeks and particularly post term (37-42), and obstetricians may
354 decide on an early delivery for preventive reasons, even though the cost-benefit effect
355 is uncertain (43, 44).

356

357 **Conclusion**

358 Women pregnant after stillbirth were more ample users of healthcare services, and
359 induced labour and caesaren section were more prevalent in this group compared with
360 other multi- and nulliparous women. Anxiety was a minor mediator for the association
361 between previous stillbirth and frequency of antenatal visits in the the subsequent
362 pregnancy. Dread of childbirth was not a significant mediator for the relationship
363 between previous stillbirth and elective caesarean section, but larger studies are needed
364 to conclude on this issue. Future research should include information on cause of the
365 prior stillbirth, indications for CS in the subsequent pregnancy and caregivers levels of
366 fear and anxiety. The quality of care provided in pregnancies following stillbirth should
367 also be evaluated.

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371

372 **Disclosure of interest**

373 None declared. Full disclosure of interests is available to view online as supporting
374 information.

375

376 **Contribution to authorship**

377 IKG, ØE, PMS, EMJ, LBH and IR participated in the conception and design of this
378 substudy. IKG conducted the analyses and drafted the article. LS and ØE participated
379 in the statistical analyses. All authors contributed to interpretation of the data, critically
380 revised the article for important intellectual content and approved the final manuscript.

381

382 **Details of ethics approval**

383 Informed written consent was obtained for all participants upon recruitment. MoBa has
384 obtained a license from the Norwegian Data Protection Authority. This substudy was
385 approved by The Regional Committee for Medical Research Ethics in South-Eastern
386 Norway (date of approval 28.10.13, reference no 1525).

387

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397

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