

1 **Abstract**

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3 **Introduction:** Limited research has explored the influence of commuting on expectant
4 mother's health and well-being and how expectant mothers can be supported during their
5 commute. The present study aimed to identify the impact of commuting during pregnancy on
6 women's physical and mental health. Further, the effectiveness of Transport for London's
7 baby-on-board badge was explored.

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9 **Method:** This was a mixed-method study. An online survey of 295 participants over the age
10 of 18 years was conducted to explore their views on commuting and the effectiveness of the
11 baby-on-board badge. A subsample of female participants completed the General Health
12 Questionnaire to assess the impact of commuting while pregnant on women's health. This
13 was followed by a qualitative study in which 15 women who currently or previously
14 commuted to work while pregnant participated in a semi-structured interview about their
15 experience.

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17 **Results:** Commuting was found to represent a major challenge for some women during
18 pregnancy. It was often a source of stress and anxiety and had detrimental effects on
19 women's health and well-being, especially when they had pre-existing medical conditions.
20 Pregnant women often made adjustments to their commute, such as travelling outside peak
21 times. Although the majority of women commuting into London wore the Baby-on-Board
22 badge during pregnancy, its effectiveness at encouraging commuters to offer their seat or give
23 more space to expectant mothers was mixed. Many women felt the badges were ignored or
24 difficult to see during crowded commutes.

25 **Conclusions:** There is limited support for pregnant commuters. The main approach to
26 supporting pregnant commuters is the TfL baby-on-board badge, but the effectiveness of this
27 badge is mixed. A multi-agency approach involving transport agencies, employers, midwives
28 and expectant mothers supporting pregnant commuters may result in a less stressful commute
29 experience and improve women's well-being and productivity at work.

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50 **Pregnancy and Commuting on Public Transport**

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Introduction

53 The impact of commuting to work on pregnant women has been neglected both nationally
54 and internationally. Pregnancy is associated with hormonal changes, physical changes (e.g.
55 weight gain), physical symptoms (e.g. nausea, fainting, tiredness), as well as psychological
56 symptoms (e.g. anxiety). Stress can impact the health of expectant mothers and their
57 developing foetuses (Hobel, Goldstein, & Barrett, 2008). A negative commuting experience
58 may induce stress and impact on pregnancy and its associated changes, which may have
59 wellbeing and health implications for expectant mothers.

60 There are gender differences in perceptions of public transport, especially in relation to
61 perceptions of safety. A study of 28 cities, for example, found that women were 10% more
62 likely than men to feel unsafe in metros (Ait Bihi Ouali, Graham, Barron & Trompet, 2019).
63 These gender differences may become more apparent during certain contexts, such as
64 pregnancy. Pregnancy (especially during the first and third trimester) can lead to tiredness
65 and this may be exacerbated in women with long commutes. A study of expectant mothers in
66 the United States by MacLeod et al. (2018) found longer commutes were associated with
67 poorer mental health during pregnancy, even after taking into account physical inactivity and
68 other stressors (e.g. number of stressful events). However, this was found only for expectant
69 mothers from socioeconomically deprived backgrounds and focused on commuting in general
70 (not just via public transport). Emerging evidence therefore indicates that commuting may
71 lead to stress and poorer wellbeing during pregnancy, but further research attention needs to
72 unpack this relationship, especially in relation to public transport.

73 Commuting via public transport may be especially challenging for expectant mothers as it
74 can be unpredictable (e.g., delays, cancellations), can involve multiple changes of transport
75 methods, and involve negative conditions (e.g. overcrowding, lack of seating, high
76 temperatures). All of which may exacerbate pregnancy symptoms and impact the wellbeing
77 of expectant mothers. In 2005, Transport for London (TfL) introduced the Baby-on-Board
78 badge for commuters in London; a badge that can be worn by expectant mothers to indicate
79 that they may need a seat while traveling. The effectiveness of the Baby-on-Board badge and
80 its impact on expectant mothers' health and wellbeing has yet to be investigated.

81 A report by TfL (2019) referred to raising awareness of the need for priority seating,
82 including for pregnant women. The report highlights that being able to have a seat when you
83 need it can make the difference between a safe and unsafe journey. Encouraging passengers
84 to offer priority seats to those in greater need prevents incidents of passengers becoming
85 unwell and reduces the number of passenger emergency alarms activated. TfL's (2016) action
86 on equality report also highlighted priority seating. The report stated that although awareness
87 of priority seating is high among customers across transport modes, 30% of passengers who
88 need a seat have experienced a situation when another passenger does not voluntarily vacate a
89 priority seat. However, it is not clear from the report what percentage of these passengers
90 were expectant mothers. There has yet to be a research study evaluating the effectiveness of
91 the baby-on-board badge for expectant mothers. This may reflect the limited attention paid to
92 the role of commuting in pregnancy in the literature.

93 The present study aimed to address current gaps in the literature relating to understanding the
94 impact of commuting on pregnant women and their wellbeing as well as exploring the
95 effectiveness of the TfL baby-on-board badge. This is an important area of research as there
96 is an extensive literature indicating that stress during pregnancy can have health and

97 wellbeing consequences for women and their unborn children (Hobel et al., 2008).
98 Identifying potential day-to-day stressors and effective methods of managing these stressors
99 may therefore improve health and wellbeing of pregnant women commuting to work as well
100 as their unborn children and reduce the need for healthcare interventions. A mixed-method
101 study was conducted. A quantitative survey aimed to identify how male and female (non-
102 pregnant) commuters reacted to pregnant commuters and to evaluate the effectiveness of the
103 TfL baby-on-board badge. The survey further explored the impact of commuting on well-
104 being during pregnancy. Qualitative interviews provided an in-depth exploration of women's
105 experiences.

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107 **Study 1**

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Method

109 **Participants**

110 A sample of 295 participants completed the online survey. The survey was advertised via
111 several routes, including: university mailing lists, transport groups, and social media. The
112 sample included 104 males and 186 females over the age of 18 years-old (five participants
113 did not specify their gender). Both male and female commuters were included in the survey
114 in order to explore attitudes towards pregnant commuters and whether these compared or
115 contrasted with pregnant commuters experiences. Most participants commuted to work via
116 public transport (78%). Participants were classed as commuting via public transport if any of
117 their journey was made by train, tube, docklands light railway, or bus. A number of
118 participants travelled by car, van, or motorbike (15%). A small number of participants
119 travelled by bike (4%) or walking (2%). Over half of participants (58%) commuted to
120 London and 42% participants commuted to work outside of London. Further, of the 186

121 female participants, 62 (33%) participants were currently pregnant and 55 (30%) had
122 previously commuted to work while pregnant.

123 **Measures**

124 An online survey asked about participant's commute to work, including method and length of
125 commute, as well as participant's experience of commuting. The survey was anonymous and
126 no incentive was offered for participating. For males and participants not currently pregnant
127 the commuting to London the questionnaire also assessed whether they would offer a seat to
128 a pregnant commuter in order to evaluate the effectiveness of the TfL baby-on-board badge.
129 For females who were currently pregnant or had previously commuted to work while
130 pregnant, the survey asked them about their experience of commuting to work while
131 pregnant. This included whether they wore the TfL baby-on-board badge and their reasons
132 for this decision, issues with wearing the badge, and whether they were offered a seat.

133 A subsample of female commuters (n = 69) also completed the General Health Questionnaire
134 (GHQ).. Participants rated the extent to which each of the 12 statements relating to their
135 health were true for the four weeks preceding the completion of the survey. Likert scoring
136 ranging from 0-3 was used, where 0 represents healthiest and 3 represents poor health. Scores
137 for each item were summed providing an overall score between 0 and 36.

138 **Procedure**

139 The University Research Ethics Committee approved this project. A link to the online survey
140 was distributed to participants to complete. The survey took around 15 minutes to complete.

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Findings

Analysis was conducted in SPSS. The majority of participants (80%) stated that they would offer their seat to a pregnant commuter (Table 1). This was the case across genders and age groups. The main reasons participants gave for offering a seat was that “a pregnant commuter is in greater need of a seat” (47%) or “it is polite” (7%). This was the case across genders and age groups.

162 **Table 1. Number of participants who would offer a pregnant commuter a seat**

Age (years)	All													
	Participants				Males						Females			
			18-35		36-55		56+		18-35		36-55		56+	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Yes	137	80.1	15	65.2	44	86.3	12	46.2	25	83.3	27	90.0	7	87.5
Yes, if she was heavily pregnant	12	7.0	1	4.3	2	3.9	11	42.3	1	3.3	1	3.3	-	-
Yes, if she was wearing the B-o-B badge	20	11.7	6	26.1	5	9.8	2	7.7	4	13.3	2	6.7	1	12.5
No	2	1.2	1	4.3	-	-	1	3.8	-	-	-	-	-	-

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165 Around half of women (51%) said they had to make adjustments to their commute due to
 166 pregnancy. The most common adjustment reported was travelling at off-peak times when
 167 public transport was quieter. The second most common adjustment was changing method of
 168 transport. This was followed by allowing more time for the commute. Most women reported
 169 that they were offered a seat most of the time or occasionally (Table 2). Of the women who
 170 currently or previously commuted to work while pregnant, 54 wore the TfL baby-on-board

171 badge, 22 did not wear the badge, and 39 commuted outside of London. The majority of
 172 women ($n = 39$) who wore the badge reported that they had not experienced any issues with
 173 using it.

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175 **Table 2. Number of pregnant commuters who were offered a seat**

	Pregnant commuters		Wore B-o-B badge		Did not wear B-o-B badge	
	N	%	N	%	N	%
Never	11	9.7	3	5.7	3	13.6
Rarely	14	12.4	6	11.3	3	13.6
Occasionally	33	29.2	17	32.1	9	40.9
Most of the time	34	30.1	25	47.2	5	22.7
Always	2	1.8	2	3.7	2	9.1
Do not use public transport	19	16.8	-	-	-	-

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177 Pregnant women found their commute to work significantly less enjoyable ($M = 2.15$, SD
 178 0.96) compared to women not currently pregnant ($M = 2.48$, $SD = 1.01$, $t(167) = -1.96$, $p =$
 179 $.05$). However, there was no significant difference in mean general health score for female
 180 commuters who were currently pregnant ($M = 14.55$, $SD = 5.35$) compared to female
 181 commuters who were not currently pregnant ($M = 13.03$, $SD = 4.27$, $t(58) = 1.22$, $p = .23$).

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185 Study 2**186 Method**

187 A self-selecting sample was used. The online survey invited women who were currently or
188 had previously commuted to work while pregnant to participate in a phone interview
189 regarding their experience of commuting to work while pregnant. Pregnant women interested
190 in participating provided contact details and a researcher followed up with them. In total 15
191 pregnant women were interviewed. Guest et al. (2006) suggest that a sample size of six is
192 sufficient to reach theme saturation. The sample included five women who were currently
193 commuting while pregnant and 10 women who had previously commuted to work while
194 pregnant. There were eight women between 26 and 35 years-old and seven women between
195 36 and 45 years-old. The commute length was 30 – 60 minutes for seven women, 1 – 2 hours
196 for six women and over 2 hours for two women. Interviews were conducted over the phone
197 and lasted approximately 30 minutes. The interviews were semi-structured and asked
198 questions about the impact of pregnancy on their commute, the TfL baby-on-board badge,
199 and the impact of commuting on work and wellbeing. Interviews were audio recorded and
200 transcribed.

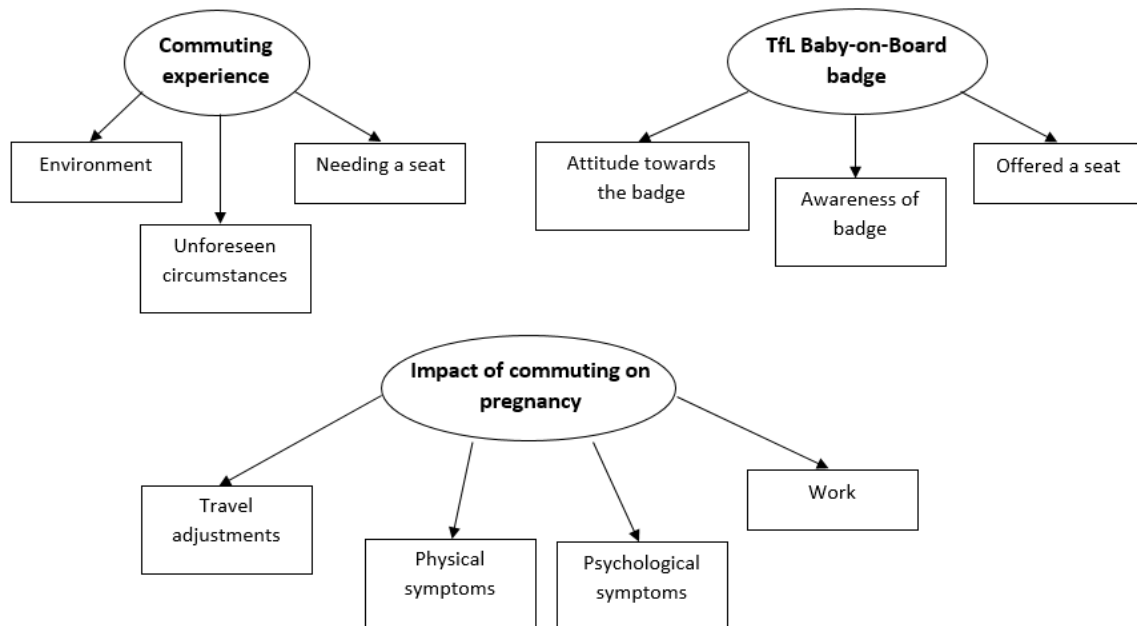
201 Template analysis was used to identify themes within the data (King, 1998). Template
202 analysis involves the development of a thematic template as common codes emerge with the
203 analysis of the first few transcripts. This template is then applied to the whole dataset and
204 modified with insights gained from the analysis of further transcripts. The template formed
205 the basis of the thematic map that was developed. Codes were grouped into larger themes.
206 The data analysis was completed by a researcher using NVivo 11 and reviewed by a second
207 researcher.

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Findings

210 Template analysis identified three main themes: commuting experience, impact of
 211 commuting on pregnancy, and TfL Baby-on-Board badge (Figure 1).



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213 *Figure 1. Thematic diagram. Main themes are in circles and subthemes are in boxes.*

214 Commuting Experience

215 *Environment*

216 The general commuting environment provided by public transport was felt to exacerbate
 217 pregnancy symptoms and cause challenges for pregnant women in using public transport. The
 218 main issues included, overheating and overcrowding both on trains, platforms and in stations.
 219 This led to women feeling sick and claustrophobic:

220 ‘...you feel uncomfortable...like sometimes if it’s really crowded and body heat is just
 221 going to rise in the carriage and you’re waiting for a next train station to come along so
 222 you can get a bit of fresh air through the doors...’ (P15)

223 The difference between transport methods was also discussed by participants. Participants
224 generally felt that the train or bus resulted in a more comfortable commute compared to the
225 tube. This was due to the tube being more crowded and you being less likely to get a seat:

226 '...It's much worse on the Tube, just because, I think, there's less standing space. For
227 example, if you take Central Line, there's that space where the doors open; that's quite a
228 large area where people can stand. But, in between where the seats are, the aisle is very
229 narrow, so only one person's feet can stand, and then be in a single row, rather than the
230 trains – there are sometimes more spacing in between for people to stand.' (P14)

231 Pregnant women may therefore feel excluded from some forms of public transport.

232 *Unforeseen circumstances*

233 Commuting was a source of anxiety and stress for some pregnant women and their commute
234 required more forethought and planning than before their pregnancy. Further, unforeseen
235 circumstances could impact pregnant women's well-being. For example, one participant
236 discussed how being stuck on the train led to panic attacks:

237 '...it was about three months in, actually, I got stuck on the Tube. And it was a really hot
238 day – it was in July – and just had this horrendous panic attack. And I was pregnant – I
239 think I was quite protective of the baby, so I got all panicked. And, literally, from then
240 on, I was just completely claustrophobic getting the Tube at all, so I found it really, really
241 difficult, to be honest.' (P10)

242 *Needing a seat*

243 Participants felt that being able to sit during their commute was beneficial for their health,
244 especially during early pregnancy when symptoms of pregnancy, such as tiredness and
245 morning sickness, can be more severe and later pregnancy when they are carrying more
246 weight.

247 Being able to sit during their commute also prevented more serious incidents such as
248 women falling or fainting during their commute:

249 'Because of when I passed out, I just thought that's not a very sensible thing to do – you
250 could bang your head if you pass out when you're standing up. And I just thought you need
251 to keep yourself and your baby safe, not just you.' (P12)

252 Although some women reported that they were generally offered a seat when commuting,
253 participants responses suggested there was an underlying culture of pregnant women not
254 being entitled to a seat more so than other commuters (also highlighted in survey findings
255 (p.7). Pregnant women reported that often they were only offered a seat if someone noticed
256 they were pregnant, but often commuters were too distracted by phones, tablets, kindles etc.
257 This resulted in situations such as one pregnant women reporting she had to sit on the floor
258 because there were no seats. Some of the participants felt that people assessed whether they
259 were 'pregnant enough' for them to offer their seat:

260 'But early on it genuinely made no difference, people would look at the badge and then
261 try and decide whether you were pregnant enough to deserve a seat...probably a lot of
262 people...have never experienced either a bad pregnancy or pregnancy at all because I
263 probably needed a seat earlier...Now I can barely stand up but there was a period where
264 I looked quite heavily pregnant but I was actually not so bad but I would get offered the
265 seat more than when I was first pregnant when I was actually really, really sick.' (P13)

266 Even though only one participant reported being refused a seat, asking for a seat was
267 uncomfortable for pregnant women as they were anxious about confrontation. Participants
268 reported needing to prepare themselves mentally to ask for a seat:

269 'I actually said, "Excuse me, can I have a seat, please? I really need to sit down". But I had to
270 psyche myself up between leaving the house, getting to the train station, that if there wasn't a
271 seat when I got on, then I was adamant that, the minute I stepped on the train, I had to put

272 myself in quite a – I wouldn't say an aggressive mindset, but quite adamant as to what it was
273 I was looking for, which is just so not me. I'm usually quite quiet and like to get on about my
274 day.' (P1) Participants said that commuters generally gave up their seat if they asked,
275 but that they were often visibly unhappy about it. Some participants felt that women
276 were more likely than men to offer their seat. Some participants also reported that other
277 commuters asked for a seat on their behalf or made a comment about nobody offering
278 a seat, which would also make them feel uncomfortable. Not feeling as if you can ask
279 for a seat may thus result in anxiety and stress for pregnant women.

280 **Impact of Commuting on Pregnancy**

281 *Travel Adjustments*

282 Commuting experiences (e.g. feeling unwell or vulnerable, overcrowding, seat
283 availability) resulted in some pregnant women altering the mode by which they
284 commuted. Participants chose to drive instead of take public transport on occasions,
285 would take the train or bus instead of the tube, would take public transport rather than
286 walk, or would take a slower train service. Assessing their transport needs appeared
287 to be a daily requirement for pregnant commuters:

288 '...I'd get up in the morning and worry a bit about, oh, how do I feel today, am I going to
289 be sick in front of people on the train, shall I go for that slow train, am I going to get a seat
290 if I get the fast train – and I find that I'm strategically choosing what time train I get based
291 on how busy I think it's going to be...' (P12)

292

293 The need for flexibility in commuting time was a theme across participant interviews. Many
294 participants found the morning commute more challenging than the afternoon commute. This
295 was often because fatigue from work was greater, symptoms being greater in the morning or
296 being under greater time pressure to get to work. Further, participants reported allowing

297 themselves more time to travel, particularly when walking to and from the station, as during
298 pregnancy they were not able to walk as quickly. A more pleasant commuting experience was
299 achieved by traveling outside of peak times:

300 'Prior to Christmas it would probably be I was getting my normal train which would be, I
301 think it was about 8.15 in the morning quite a busy train. Then post-Christmas my boss
302 let me get the later one so it'd just be generally a bit quieter, easier to get a seat, less
303 stressful as well and that's like about an hour later.' (P4)

304 *Physical Symptoms*

305 Findings suggested that there was a bidirectional relationship between commuting and physical
306 pregnancy symptoms. For example, participants often reported that commuting led to extreme
307 tiredness and nausea, but that nausea also made commuting more challenging:

308 '...I would get to work feeling very tired generally, and I would often be sick as I went into
309 [work]...' (P11)

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311 This bidirectional relationship was also apparent for health conditions. Participants reported
312 that commuting resulted in them regularly fainting:

313 '...on the first occasion I didn't get a seat and I collapsed and I got dragged off the other
314 end by a police officer, who very kindly took me to work in her car afterwards. And then,
315 on the two subsequent occasions, I think they'd got used to me being around, because
316 the third time that it happened, they sat me on the platform, and they knew that I carried
317 my maternity notes in my rucksack, and things like that, so they were just waiting for me
318 to wake up and help me from there.' (P1)

319 However, existing health conditions were exacerbated by commuting. This included both
320 pregnancy related conditions, such as hip and back pain as well as Symphysis Pubis

321 Dysfunction (pelvic pain) as well as non-pregnancy related conditions that participants already
322 had (e.g. brain tumour).

323 '...I also got that pelvic girdle pain condition so then the actual commute really affected
324 my upper back because of the train and sitting on it for a long time...I think it made my
325 upper back pain worse because I would have been tense and I used to often take a
326 pillow with me on the train to prop up my back to help the pain really and to stop it from
327 hurting anymore.' (P9)

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329 *Psychological Symptoms*

330 Anxiety associated with the commute to work was a central theme across nine participant's
331 interviews. The commute was often found to be 'traumatic' and associated with 'mental stress'.
332 Participants reported that they would worry about the commute beforehand in relation to getting
333 a seat, feeling unwell, or being stuck on a train. Participants who worked late into their
334 pregnancies (e.g. 38 weeks) were concerned about going into labour during their commute.
335 There was an underlying sense that participants felt vulnerable and were concerned about
336 protecting their 'bump' from being pushed:

337 'It's not only tiring in terms of physically, it also causes a lot of anxiety. After my sick leave I
338 felt vulnerable and I just wanted people to just keep away from me instead of pushing,
339 because they could push me the wrong way. In the same way with the bump – sometimes,
340 as I said, people just turn around and rush off without thinking that you've got a bump. And I
341 just felt very anxious and very – it was a bit mentally stressing...' (P14)

342 One participant found the experience of commuting so challenging that she could not foresee
343 herself having further children unless her work situation changed:

344 '...I think my baby might be an only child unless I don't have to go to work anymore...I've
345 said to my husband if I still have to continue working, which at the moment that's the situation
346 I couldn't get pregnant again because I just couldn't do that commute anymore.' (P13)

347 In addition, participants discussed the impact commuting had on their mood. Participants stated
348 that the commute made them feel stressed and that they arrived at work frustrated and angry:

349 'I would sometimes be pretty angry as well by the time I got to work....I'm a physio by
350 background, so I'm very aware that a lot of people sitting down may have issues that mean
351 they need the seat too, but I would often get to work feeling really frustrated that in a whole
352 carriage nobody had looked around. There's no way round that really.'(P11)

353 Two participants also felt that the commute impacted their mental health:

354 'I had antenatal depression in my third trimester and I do believe the long commute
355 contributed to this. It was just so long and exhausting and uncomfortable.' (P16)

356 **Work**

357 Having an employer that was supportive of flexible commuting and working patterns was found
358 to have a positive impact on well-being in pregnancy. For instance, participants discussed that
359 their work allowed them to be flexible with their hours to commute at different times of the
360 day. However, participants were sometimes required to make up hours if they worked shorter
361 days, which was an added burden during pregnancy. Participants reported that they worked
362 from home more during their pregnancy. They felt this reduced their tiredness associated with
363 the commute and boosted their productivity:

364 '...I think two of my five days I started working from home then which made like a huge
365 difference to sort of my overall wellbeing with work, it made things a lot easier and cut out
366 a lot of travel time for me as well, probably about an hour and a half in the whole day
367 which was quite a lot.' (P8)

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369 Participants stated that they had to start their maternity leave earlier than they initially planned
370 due to the stress of commuting:

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'...I ended up stopping work – I think it was about five or six weeks before I actually gave

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birth – it was four weeks before due date, because I just couldn't handle the walk anymore

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and couldn't deal with the whole claustrophobia thing, so I guess, in that sense, I stopped

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work quite a bit earlier than I would have liked to; I would have liked to have stopped

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maybe two weeks before.' (P10)

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It was felt that the option of working from home would have allowed participants to be more

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productive and reduced the need for time off work:

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'If I didn't feel up to it – the commute, that is – I either wouldn't go in, and I'd ring in and

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say it's pregnancy related. As we all know, people are mostly bullet proof when they're

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pregnant at work, so there wasn't a huge amount that they could do about that.' (P1)

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Supporting flexible commuting therefore was found to not just have positive impacts

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on women's well-being but also their productivity and enabled them to work longer

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into their pregnancies.

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Baby-on-Board Badge

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Attitude towards the badge

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Most participants interviewed (67%) wore the Baby-on-Board badge and did so because they

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felt awkward or embarrassed about asking for a seat and were anxious of confrontation. In

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addition, participants felt vulnerable and protective over their baby and felt the badge may

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encourage others to give them more space or not push into them. Despite this, the majority felt

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that the badge was advertising their pregnancy and they were uncomfortable wearing it:

391 '...I didn't really want to wear it because...I feel like advertising my right to sit somewhere
392 just because I'm pregnant- I mean it's difficult because having been in the situation like I
393 don't think I'd give up wearing it but I don't think it's really successful in that sense, I didn't
394 like advertising like showing off like oh I need a seat because I'm pregnant.' (P15)

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396 If they were not offered a seat, even if they were wearing a badge, most participants did not feel
397 they were able to ask for a seat and would instead stand, sit on the floor, or change trains. It was
398 frequently reported by participants that other pregnant women had had negative experiences
399 asking for a seat:

400 'I generally didn't ask if there wasn't a seat available because a friend of mine had had a
401 situation where she had asked for a seat and the guy looked at her, he was sitting in a
402 priority seat, he looked up at her and said, 'Well, I didn't knock you up did I?' (P2)

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404 There was, thus, an underlying sense that the badge was a way of obtaining a seat or
405 more space during pregnancy but that it was drawing attention to women in a negative
406 way.

407 *Awareness of Baby-on-Board badge*

408 There were also issues relating to the visibility of the badge. Participants reported that
409 commuters were not often aware they were pregnant because it was masked by their clothes or
410 not obvious when they were not facing someone, commuters were distracted (intentionally or
411 unintentionally), or due to the setup of the train:

412 '...the only issue was if I was getting on a train that was already busy and I was just too far
413 away from a seat that people would be able to see me. I don't know if you are familiar with
414 the Overground setup, but there's quite a wide bit in the middle where you get on at the

415 doors. You would have to have a lot people conveying a message that a pregnant lady
416 needs to sit down, like six or seven potentially.' (P11)

417 **Offered a seat**

418 Effectiveness of the badge was mixed; sometimes they were offered a seat and other times
419 they were not:

420 '...it was different every day, but you got some absolutely lovely people who would go
421 massively out of their way to – someone from miles away down the train would go, "Oh,
422 do you want a seat?" And you would be, "Er, okay, no, I've got to climb over there, but
423 thank you", whereas people right next to you sometimes wouldn't. So, yeah, it was
424 definitely mixed – a mixed bag.' (P10)

425 Participants stated that wearing the badge meant commuters knew they were pregnant and this
426 removed the concern of offending someone by assuming they were pregnant:

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428 '...I think it makes it easier for people to know that you actually are pregnant because I
429 think sometimes they might just be a bit, "Are they pregnant? I'm not sure, I don't want
430 to offend them by suggesting that they are if they're not". So I think that it helps other
431 people.' (P5)

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433 Participants also reported ensuring they showed they were grateful when commuters offered
434 them a seat.

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Discussion

437 Commuting to work can be a major challenge for women during pregnancy. It was often a
438 source of stress and anxiety and had detrimental effects on women's health and well-being,
439 especially where they had pre-existing medical disorders. Women often had to make
440 adjustments to their commute, such as travelling outside peak times. Although the majority of

441 women wore the TfL Baby-on-Board badge during pregnancy, its effectiveness at
442 encouraging commuters to offer their seat or give more space to expectant mothers was
443 mixed. Many women felt the badges were ignored or difficult to see during crowded
444 commutes.

445 **Impact of Commuting to Work on Pregnant Women**

446 Commuting to work while pregnant impacted women's physical and mental health as well as
447 their employment, suggesting that commuting to work is a potential risk factor in pregnancy
448 that needs further study. Expectant mothers reported that commuting exacerbated their
449 pregnancy symptoms, including nausea, exhaustion, and hip and back pain. Commuting for
450 longer than 30 minutes has been linked to exhaustion (Hansson et al., 2011). Consequently
451 exhaustion may be increased for expectant mothers with long commutes, especially during
452 the first and third trimester when fatigue is a common pregnancy symptom (Bossuah, 2017).
453 Indeed, several factors associated with commuting were highlighted as challenging for
454 pregnant women. In particular, overcrowding on public transport and stations increased
455 symptoms such as nausea and claustrophobia. Delays and cancellations to services lead to
456 more severe overcrowding. Overcrowding was also associated with overheating, especially
457 during the winter when pregnant women were wearing more layers of clothing.

458 In more severe cases, expectant mothers fainted resulting in them falling during their
459 commute to work. Expectant mothers are more likely to be injured by falling than women
460 who are not pregnant (Cakmak, Ribeiro, & Inanir, 2016) and are more likely to be
461 hospitalised following a fall (Weiss, 1999). Falls during pregnancy can result in minor
462 injuries, such as sprains and muscle injuries, or more serious injuries, including head trauma,
463 preterm delivery, abruption of the placenta, or uterine rupture (Mirza, Devine, & Gaddipati,

464 2010). Identifying risk factors for fainting, such as commuting in overcrowded conditions, is
465 therefore beneficial to both the health of the mother and foetus.

466 The onus was often on pregnant women to make adjustments to their commute to reduce the
467 impact of commuting on their health. For instance, pregnant women frequently reported
468 changing their method of transport or traveling outside of peak times. However, this often
469 meant that their commutes were longer, which may increase tiredness and stress as well as
470 poorer health (Hansson et al., 2011; Stone & Schneider, 2016). Not all pregnant women are
471 able to adjust their commuting times due to their employment conditions. A further
472 adjustment was that pregnant women often used public transport rather than walking as they
473 felt less able to undertake their usual walk during their pregnancy. Active travel can have a
474 positive impact on health (NICE, 2012; Flint et al., 2014; Lavery et al., 2013), so supporting
475 pregnant women to use active travel methods may be beneficial. Added to this, exercise is
476 beneficial in improving mental health and cardiovascular fitness and reducing back pain,
477 urinary incontinence, and weight gain during pregnancy (Nascimento, Surita, & Cecatti,
478 2012). Identifying effective methods of supporting pregnant women during commuting may
479 consequently have important health benefits, especially for those women who are less able to
480 make adjustments.

481 In addition to impacting physical symptoms in pregnancy, commuting also impacted women
482 psychologically. Although the online survey found that commuting to work did not have a
483 significant impact on general health, the qualitative interviews revealed that women
484 commuting to work while pregnant exacerbated symptoms of pregnancy. This contrast in
485 findings may reflect the fact that the GHQ assesses physical and mental health more broadly
486 rather than pregnancy specific symptoms. Further, it may also reflect the stage of pregnancy.
487 Women reported that commuting had more of an impact on their pregnancy symptoms during

488 the first and third trimester. Severity of nausea and vomiting severity was significantly
489 positively correlated with GHQ score (higher score indicating poorer health) in women 8-18
490 weeks pregnant (Swallow, Lindow, Masson, & Hay, 2009).

491 The commute was felt by pregnant women to be stressful; they reported being anxious and
492 worrying about commuting, whether they would get a seat, as well as being stuck on the
493 train. Pregnant women felt particularly vulnerable during their commute as they were
494 protective over their baby. This builds on prior work that has found women typically feel
495 more unsafe and vulnerable when commuting compared to men (Ait Bihi Ouali et al., 2019;
496 Gardner, Cui, & Coiacetto, 2017; Smith, 2008). Feelings of vulnerability may be heightened
497 during pregnancy. Future work examining changes in perceptions of safety with pregnancy
498 would provide further insight. Later in their pregnancies women were also concerned about
499 going into labour during the commute. Stress and anxiety during pregnancy are risk factors
500 for detrimental outcomes for mothers and children (Dunkel Schetter & Tanner, 2012;).

501 Commuting impacted women's mood during pregnancy. Women found the commute
502 significantly less enjoyable and reported feeling frustrated and angry after commuting.
503 Satisfaction with commuting to work influences an individual's overall happiness (Olsson et
504 al., 2013) and feeling highly angry during the second trimester of pregnancy is associated
505 with growth delays and more active foetuses as well as greater maternal anxiety (Field et al.,
506 2002).

507 Women reported that their employers were supportive during their pregnancies and many had
508 flexible working arrangements that allowed them to commute outside of peak times or to
509 work from home. Women felt these flexible arrangements boosted their productivity. Some
510 women felt that they had to begin their maternity leave earlier than they were planning due to
511 the challenges of commuting.

512 Effectiveness of the Transport for London Baby-on-Board Badge

513 Although the majority of women interviewed reported wearing the TfL Baby-on-Board badge
514 many women felt uncomfortable doing so. Women felt that the badge was advertising their
515 pregnancy. Further, many women did not want to wear the badge during the first 12 weeks of
516 their pregnancy as they had not often told their employer or others about their pregnancy.
517 However, the majority of women wore the badge as they felt they needed a seat during their
518 commute but felt embarrassed or uncomfortable asking for one. Women were concerned
519 about being refused a seat if they asked and some women reported knowing someone who
520 had received a negative reaction when they asked for a seat. Indeed, women reported sitting
521 on the floor or changing train services rather than asking for a seat. These findings indicate
522 that the Baby-on-Board badge may not be the most suitable approach to supporting pregnant
523 commuters.

524 The online survey revealed that the majority of commuters would give up their seat for a
525 pregnant commuter. However, in contrast interviews with pregnant commuters revealed that
526 it was mixed whether they were offered a seat or not. This included when they were wearing
527 the badge. Women reported that commuters often ignored the badge, either intentionally or
528 unintentionally. The interviews suggested commuters are often distracted with technology or
529 reading material when commuting and do not look up to see whether someone is in need of a
530 seat. Further, in crowded conditions commuters may be unable to see the pregnant commuter
531 or their badge. This contradicting finding with the survey may reflect a social desirability bias
532 and the fact that reported attitudes do not necessarily reflect behaviours. Observational
533 research of commuter's actual behaviour would be beneficial to further unpacking these
534 contradictory findings.

535

536 Policy Impact

537 The present research indicates that the commute to and from work can be a significant
538 stressor during pregnancy and highlights the need for this to be further considered in research
539 and practice. A multi-agency approach is needed to effectively address commute stress
540 during pregnancy.

541 **Transport Agencies.** Transport agencies need to work to support pregnant commuters.
542 However, they need to ensure they are raising awareness of these methods (e.g. baby-on-
543 board badge) amongst commuters. The online survey revealed that some passengers would
544 only offer their seat to a visibly pregnant woman. Educating public transport users of
545 pregnancy symptoms that result in a greater need for a seat may be effective. Perhaps via
546 educational posters in stations and on trains near priority seating. Methods that do not
547 highlight that a woman is pregnant may reduce embarrassment for pregnant women and they
548 may feel more comfortable with this approach during the first trimester. A general badge that
549 highlights the passenger is in need of a seat or more priority seating may be effective or more
550 priority seating/carriages. In addition, incidents that result in train cancellations and/or
551 overcrowding may lead to challenges for pregnant commuters that need to be addressed by
552 transport agencies. A solution may be providing waiting areas, carriages/seating areas for
553 these commuters, or offering priority boarding to those who may find overcrowding
554 challenging.

555 **Employers.** Risk assessments of pregnant employees should consider the commute to work,
556 especially where there is a prior medical diagnosis or a pregnancy related diagnosis. Many
557 pregnant women have long commutes that involve multiple transport methods and they found
558 this impacted not only their wellbeing but their productivity. Working from home at least part
559 of the week was found to be most beneficial in reducing physical symptoms and anxiety.

560 Where this was not possible, flexible working hours to allow pregnant women to travel
561 outside of peak times was also beneficial. Supporting pregnant women with their commute
562 may increase productivity and allow women to work longer during their pregnancy.

563 **Midwives.** Due to the reported impact on the physical and mental wellbeing of commuting
564 during pregnancy, including assessments and discussions of the impact of commuting on
565 pregnancy could be included in antenatal appointments. Women may not be aware of the
566 impact of the commute or may be experiencing stress and anxiety. Midwives may also be
567 able to raise awareness of support that women can access (e.g. baby-on-board badge), advise
568 women on steps they can take to improve their commuting experience, or monitor the impact
569 the commute is having on the pregnancy and woman.

570 **Strengths and Limitations**

571 This study contributed to a limited research field and provided a more in-depth qualitative
572 exploration of women's experiences. The sample included women who were currently and
573 previously pregnant. Experiences may have changed over time and comparing current and
574 historic experiences may highlight differences. The sample focused on women commuting in
575 London. There may be regional variation in experiences of commuting while pregnant. In
576 addition, the period at which previously pregnant women had commuted was not assessed.
577 There may have been differences in relation to the period of time women were commuting.
578 For example, the baby-on-board badge may not have been available. The present study did
579 not take into account the impact of stage of pregnancy, whether the pregnancy was IVF, or if
580 the woman had previous miscarriages, all of which may have affected how women felt and
581 responded to pregnancy. Added to this, the survey did not assess whether participants had
582 health related conditions that may have impacted their commuting experience, such as a
583 disability.

584 Conclusions

585 Commuting to work can be a major source of stress and anxiety for pregnant women and can
586 have detrimental effects on women's health and well-being, especially where they have pre-
587 existing medical disorders. There is limited support for pregnant commuters. The main
588 approach to supporting pregnant commuters is the TfL Baby-on-Board badge, but the
589 effectiveness of this badge is mixed and women do not always feel comfortable wearing it. A
590 badge based approach may thus not be the most effective solution to supporting pregnant
591 women during their commute and the TfL Baby-on-Board badge may need to be
592 reconsidered. A multi-agency approach, that involves Transport, midwives, employers and
593 pregnant women may result in a less stressful commute experience and improve women's
594 well-being and productivity at work. In particular, supporting with flexible commuting
595 arrangements may have a positive impact on well-being and health during pregnancy.

596 Future research is needed to further explore the impact of commuting on pregnancy. In
597 particular, further work exploring the impact of commuting at different stages of pregnancy
598 and how women's perceptions of commuting change with pregnancy is needed. In addition,
599 the impact of women commuting while pregnant on partners should be taken into account to
600 explore the wider impacts. Further work is needed on identifying effective methods to reduce
601 the impact of commuting on pregnancy. Commuters behaviours as well as attitudes should be
602 taken into account.

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