‘Phantom Kicks’: Women’s Subjective Experience of Foetal Kicks after the Postpartum Period

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38 **Abstract**

39 During pregnancy, a woman will attribute increased abdominal sensations to foetal movement.
40 Surprisingly, many women report that they feel kick sensations long after the pregnancy, however this
41 experience has never been reported in the scientific literature. Here, we show that almost 40% of women
42 in our sample experienced phantom foetal kicks after their first pregnancy, up to 28-years (average 6.8-
43 years) post-partum. Using a qualitative approach, we found that women describe the phantom sensations
44 as ‘convincing’, ‘real kicks’ or ‘flutters’. Twenty-five percent of women described the experience as
45 positive, and 27% reported felt confused or upset by the experience. Our results demonstrate that phantom
46 kicks in the post-partum period are a widely experienced sensation, that may have implications for a
47 woman’s post-partum mental health. The mechanism behind the phantom kick phenomenon is unknown,
48 but may be related to changes in the somatosensory homunculus or proprioception during pregnancy.

49

50 **Keywords:** foetal kicks, proprioception, phantom, pregnancy, maternity, maternal mental health

51

52 **Significance Statement**

53 We report the first scientific description of a widely experienced sensation, ‘phantom kicks’. Up to 40% of
54 women experience sensations of foetal kicks following their first pregnancy, up to 28-years (average 6.8-
55 years) post-partum. Women describe the phantom kicks as ‘convincing’: some reported the experience was
56 emotionally positive (‘nostalgic’); others described the sensation as negative, particularly cases of stillbirth.
57 Results have implications for maternal healthcare in the peri-natal and post-partum periods. Phantom kicks
58 may be a risk factor for depression and anxiety in vulnerable women. Further, kick frequency is an
59 important indicator of foetal health in pregnant women. Results suggest if women experience foetal kicks
60 in the absence of a foetus, then their perception of true foetal movement may be unreliable.

61

62 Women's health conditions are under-studied compared to men's (1-3). Postnatal health receives more
63 attention than postpartum health, the former being infant-centric, and the latter being mother-centric. Much
64 of the focus on postpartum health is focused upon improving the mother's outcomes for the child's benefit
65 (4). Relatively little is known about how the human brain changes during and after pregnancy, however,
66 changes are seen in brain structure and function (5-9), and these changes may be permanent (10).

67 One understudied phenomenon is the continued sensation of foetal kicks long after the birth of the infant.
68 These 'phantom kicks' are widely discussed anecdotally between women and on online mothers' forums
69 but, to our knowledge, have received no attention in the scientific literature. Women describe these
70 sensations as foetal kick-like sensations, often occurring in the lower abdomen, that continue sometimes
71 for years post-delivery (Supplementary Data 1). The prevalence, frequency, intensity, causes, and
72 consequences of phantom kicks are unknown. Given the dearth of credible scientific information related to
73 this experience, we used an online survey to explore the subjective experiences of postpartum phantom
74 foetal kicks in a population of Australian women. Filling this knowledge gap is important, because
75 pregnancy can be a traumatic experience for women who have miscarried or undergone stressful
76 complications. For women experiencing such difficulties, phantom kicks may exacerbate their trauma. For
77 example, medical professionals who are unaware of this phenomenon may be unable to attend to potential
78 trauma associated with phantom kicks. A scientific description of the phenomenon and a record of its
79 experience and frequency of occurrence is necessary for the education and medical support of women. We
80 argue that such a description is the first step in assessing whether phantom kick sensations are a potential
81 risk factor for mental vulnerability, or an indicator of abnormal postpartum restoration.

82 This study used an online survey and a qualitative approach to address the following key research
83 objectives:

- 84 1) Report the first estimate of occurrence and subjective experiences of foetal kicks in the postnatal period
85 in Australian women.
- 86 2) Obtain preliminary evidence of the relationship between phantom kicks and postnatal mental health,
87 including postnatal depression and anxiety.

88 3) Explore initial hypotheses about the potential causes of the phantom kick phenomenon, including post-
90 natal abdominal resettling, birth interventions and breastfeeding.

91 **Results**

92 *Sample Characteristics*

93 A demographic overview of the sample is provided in Supplementary Data 2. These demographics reflect
94 participant identities at the time of completing the survey. Our sample characteristics were largely
95 comparable to the general Australian population (Supplementary Data 3). Most participants were married
96 (72%), identified as Australian (78%), were in the 18-60 age range (average age = 37.44 years, SD = 7.59
97 years), were working full or part-time (full-time = 19.8%, part-time = 44.2%), and had high household
98 incomes (60.4% of women that responded to the survey had a combined household income of \$90,000 and
99 above).

100 Average age at conception was 28.59yrs (15-44yrs, SD = 5.81yrs) for the first pregnancy. Participants were
101 between 1 and 42 years postpartum, with an average of 8.09 years since conception (median = 6 years, SD
102 = 7.7 years; Figure 1A). For the first pregnancy, 5 (2%) women reported receiving a medical termination
103 ('abortion'), 43 (21%) women reported not reaching full term, and 18 (9%) reported that their baby was
104 not born alive.

105 Forty-four women (22.3%) reported they experienced postpartum depression, 31 of whom reported that the
106 depression was medically diagnosed; 28 reported receiving treatment. Sixty women (30.5%) reported
107 experiencing postpartum anxiety; 31 of whom received treatment. Fifty-seven (28.9%) participants
108 reported experiencing postpartum cognitive change, of which 101 women reported receiving a diagnosis.
109 In the open item response, 1 woman reported an experience that potentially suggests undiagnosed
110 postpartum psychosis ('I had a hysterical moment and thought my husband was going to kill me and my
111 baby').

During their first pregnancies, women varied in their experiences of foetal kicks (Figure 1B): 40% of women reported experiencing foetal kicks ‘most of the time’ during their first pregnancy, 31% experienced kicks ‘sometimes’ or ‘about half the time’, and 10% reported ‘never’ experiencing kicks during pregnancy. Most women who had live births breastfed their babies (81%); 7% of women reported that they did not breastfeed (non-response frequency 12%). Women varied in their duration of breastfeeding after their first pregnancies (Figure 1C): 21% reported breastfeeding for between 12-18 months, with frequencies of around 10-12% for each response option below 12months (non-response frequency=19%).

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Number of Women Reporting Phantom Kicks

Of the 197 participants included, 39.6% of women experienced kick-like sensations after the birth of their first child, consistent with our description of phantom kicks. This does not seem to be related to misattribution of postpartum abdominal movements, as 32.5% of women more than 1yr postpartum reported these sensations. For women who reported having experienced kick-like sensations after their first pregnancy, we examined if they also reported having experienced them in subsequent pregnancies. Indeed, 13.6% of women who experienced kick-like sensations after their first pregnancy reported experiencing them after their second pregnancy; 11.7% reported experiencing them after their third pregnancy, and 20.7% after their fourth. As the sample size for each subsequent pregnancy is small, the rest of the analyses were conducted only with the data collected for the first pregnancy.

The subjective frequency rate at which women reported experiencing phantom kicks after their first pregnancy is shown in Figure 2a. At their highest frequency, 19.7% of women reported experiencing daily sensations whilst 36.9% of women reported them more than once a week (e.g. 4-6 times/week, 2-3 times/week or weekly). For women more than 1yr postpartum, 17.2% reported experiencing sensations daily and 37.5% reported experiencing sensations weekly. Even when women considered their lowest frequency of kick-like sensations, 25% of women reported that they experienced these sensations weekly. Of the women who reported subjective experiences of kick-like sensations post-pregnancy, 27% reported that these sensations did not cease (i.e. women still experienced sensations up until the time of survey

138 completion). Women reporting that the sensations never ended were on average 6.8 years post-conception
139 (range 1-28 years; standard deviation 5.47yrs; see Figure 2b).

140 For women whose first pregnancy ended in termination (n = 5), all reported that they did not experience
141 kick-like sensations after the pregnancy. For women whose baby was not born alive after the first
142 pregnancy (n = 18), 2 reported experiencing kick-like sensations following delivery. Reporting on the
143 sensation, Participant A (delivery at 24 weeks) described as a negative emotional experience:

144 *How did you feel about the movements?* It made me feel really upset that my body was still
145 "fooled" into thinking I was still pregnant.

146 *What did you think the sensations of movement were?* My body returning to normal combined
147 with wishful thinking that my baby did not die.

148

149 *Subjective Experience of Phantom Kicks*

150 11.6% of women responded that the sensations felt like 'real kicks' and 48.8% described them as very
151 'convincing' (Descriptions of phantom kicks are reported in Table 2. Supplementary Data 4 lists participant
152 responses to the open questions). For example:

153 It felt like the first time I felt my baby kick. Little flutters. Then it became more distinguishable as a
154 kick. (Participant B)

155 Very convincing. Still happens now sometimes and I have to convince myself I am not pregnant.
156 (Participant C)

157 Convincing enough that I took a pregnancy test even though my husband had had a vasectomy.
158 (Participant I)

159 If I wasn't holding my baby I would've thought I was still pregnant. – Participant K

160 In response to questions of how women felt following the experience, 25% described the experience as
161 positive and 16.1% as negative. 27% of participants reported that they felt confused, anxious, or upset by
162 the experience, with some even using the term ‘terrified’.

163 Very confusing! I had my hand on my baby in her cradle and she kicked. My mind couldn't make
164 sense of what I felt. That sensation was usually in my abdomen but I felt it in my hand instead. I still
165 can't reconcile the feeling. (Participant G)

166 Strange, a bit sad and mourned the loss of my pregnancy. (Participant D)

167 It was odd and I found it difficult to believe the midwife's explanation, but felt too stupid to ask again.
168 (Participant E)

169 Most (15.7%) women described the experience as nostalgic, with 14.3% of women reporting feeling happy
170 and comforted by the experience.

171 Once I knew I wasn't pregnant again, they made me smile and remember being pregnant. Something I
172 loved. (Participant E)

173 A bit nostalgic actually, I miss feeling the movements. (Participant F)

174 In the open response items (Supplementary Data 4), four women reported that they thought the sensation
175 was related to post-birth abdominal healing. Three women reported that they had wondered if other women
176 experienced the sensation. Indeed, the lack of available information on the experience left women feeling
177 alone in their experiences, which can be confusing and frightening during an already very stressful time as
178 they transition into motherhood:

179 It was odd and I found it difficult to believe the midwife's explanation, but felt too stupid to ask again.
180 - Participant D

181 Of the 21 women who described the experience as ‘negative’ or ‘unsure’, 9.5% reported that their baby
182 was not born alive. A chi-square test for independence indicated no significant association between

women's reports that their baby was not born alive and sensations of movements that were negative or uncertain, $\chi^2(4, n = 69) = 2.59, p = .63, \phi = .19$.

Factors Associated with Phantom Kicks

Age was associated with movement. Women who reported experiencing kick-like sensations were younger at the time of survey completion ($M = 34.7, SD = 6.98$) than those who did not experience the sensations ($M = 39.3, SD = 7.47$) ($t(186) = 4.22, p = .001$). Similarly, women who reported post-partum kick sensations were marginally younger at the time of conception ($M=27.6, SD=4.86$) than those who did not report the sensations ($M=29.6, SD=5.45$) ($t(178) = 2.43, p=.016$).

Women who reported higher frequency of foetal kicks during pregnancy were marginally more likely to report experiencing post-natal kick-like sensations ($\chi^2(4, n=197)=15.75, p=.003, \phi=.283$). This did not survive correction for multiple comparisons. There were no significant relationships between reported kick-like sensations and reported postnatal depression ($p=.64$), anxiety ($p=.52$) or subjective cognition ($p=.86$). Women who breastfed were marginally less likely to experience kick-like sensations ($\chi^2(1, n = 176) = 4.76, p = .03, \phi = -.16$); however, this statistic is unreliable due to the small cell sizes for women who did not breastfeed (Table 6).

Table 6 reports birth interventions for the first pregnancy. We tested association between reported kick-like sensations and six reported interventions (epidural, c-section, forceps, ventouse, induced labour, entenox, TENS machine, pethidine. The use of entenox (gas) ($\chi^2(1, n = 197) = 4.38, p = .036, \phi = .16$) and induced labour ($\chi^2(1, n = 197) = 3.01, p = .08, \phi = .14$) were marginally associated with kick-like sensations, however these did not survive correction for multiple comparisons. For both entenox and induction, the marginal effects were driven by frequency differences for women who did not experience kick-like sensations; rather than women who did experience them (Table 6). In both cases, Cramer's V was small (entenox: $V=0.16, 95\% CI = [0.26, 0.31]$; induction: $V=0.14, 95\% CI = [0,0.28]$). We therefore

207 conclude that there is no evidence to support the hypothesis that postpartum phantom kicks are attributable
208 to birth intervention for the first pregnancy.

209 **Discussion**

210 Here, we report the first scientific description of the phenomenon of postpartum phantom kicks. In this
211 Australian sample, almost 40% of women reported experiencing kick-like sensations following their first
212 pregnancy. Participants who experienced the sensations, described it as ‘real kicks’ or ‘flutters’, with nearly
213 50% saying that they were very ‘convincing’. Most women commented on the nostalgia and emotion
214 associated with the sensations. This is unsurprising given that pregnancy is an emotional experience due to
215 the increased female sex hormones that result in increased sensitivity in women’s emotional processing
216 systems (11).

217 Taken together, this evidence suggests that there may be an association between the emotional relationship
218 to the baby and the sensations of phantom kicks. Despite this, we found no significant relationship between
219 the kick-like sensations and reports of postpartum cognitive or emotional change. We therefore argue that
220 these sensations are unlikely to be delusions, or hallucinations, or a result of postpartum depression,
221 anxiety, or other mental health issues.

222 Although we found no significant association between phantom kicks and postnatal depression or anxiety,
223 our results suggest that the influence of phantom kicks on mood should not be neglected. Content analysis
224 of women’s responses to phantom kicks suggested that the experience could exacerbate symptoms of
225 anxiety, particularly in the case of stillbirth. Additionally, the timing at which the phantom kicks begin
226 could be detrimental to those overcoming depression or anxiety, without having any causal connection to
227 mental health outcomes.

228 *Potential explanations for the phantom kick phenomenon*

229 The subjective experience of phantom kicks is apparently a common sensation post-pregnancy for many
230 Australian women. At this stage, we can only speculate as to the origin or cause of the effect. Here, we will
231 review relevant literature as potential avenues for future research.

232 Misattribution of postpartum body recovery

233 We considered the possibility that women could misattribute normal body recovery sensations to a phantom
234 kick sensation. The postpartum restoration of muscle tone and connective tissue to the pre-pregnant state
235 lasts for approximately 6 months (12) and most acute changes are resolved within the first 26 weeks (6
236 months) (6-months; 13). Thus, we repeated the analysis, excluding women who were 1-year post-birth and
237 found that the frequency of phantom sensations did not change. Rather, in the full sample, 39.7% of women
238 reported experiencing kick-like sensations. Excluding women 1-yr post-birth, 39.1% of women experience
239 the sensations. We believe that in the months post-delivery, some sensations of phantom kicks are probably
240 attributable to bodily recovery. However, as women continue to experience these sensations for many
241 years, postpartum recovery cannot be the only contributor to the experience.

242 Proprioception and Phantom Limbs

243 Phantom kicks appear to have considerable similarities to phantom limb syndrome. Phantom limb
244 syndrome occurs when individuals with a missing or amputated limb feel sensations that suggest the limb
245 is still attached. People with phantom limb syndrome are often said to experience ‘real’ movement (14)
246 and pain (15, 16) suggesting that the phantom limb is still represented in proprioceptive body maps (15).
247 The range of possible phantom phenomena is relatively broad (movement, pain, pins and needles, itching,
248 pressure, etc.), suggesting that ‘kick’ sensations could be possible. It is known that the female
249 somatosensory cortex undergoes reorganisation following mastectomy (17). Around 33% of female
250 mastectomy patients report phantom breast sensations, which emerge soon after amputation and continues
251 up to 12-yrs post-surgery (18, 19). During pregnancy, the innervation of the abdominal region by ongoing
252 foetal movement increases over the ~40week gestation, and rapidly ceases at childbirth. The rapid reduction
253 of abdominal somatosensation at childbirth has some similarities to the rapid cessation of innervation
254 following limb amputation. It is possible that phantom kicks may be phenomenologically like the phantom
255 limb phenomenon.

256 Similarly, misattribution of normal bodily sensations might explain the phantom kick phenomenon. In the
257 non-pregnant state, most spontaneous abdominal sensations are attributed to a digestive cause, and are

likely not regularly attended to. During pregnancy, the largest and most salient somatosensations in the abdominal area are quickly attributed to foetal movements. The mother pays close attention to these sensations and bonds with her baby and obstetric care providers direct her to pay close attention to any reduction in the frequency of movements (e.g., 20). Thus, the mother's self-model of her body, and the origin of sensations within it, is updated. Following childbirth, and the subsequent 'resettling' of the body organs to the non-pregnant state, there is a substantial reduction in abdominal innervations. It is no longer appropriate to attribute abdominal sensations to the foetus. Perhaps women who experience phantom kicks do not re-update their conceptual model of the body following childbirth, and attribute normal (digestive) sensations to a foetus that is no longer there.

Implications of Results for Peri-Natal and Post-Partum Care

Due to our sampling method, we cannot make statements of prevalence of phantom kicks in the postpartum period, but we can say that phantom kicks appear to be a common experience among women following the birth of their first child. In our sample, two in every five women experienced the phenomenon. The experience was described as negative for some women, during a period of high vulnerability for mood disorder and mental illness. Around 16% of participants commented that the experience of phantom kicks was negatively impacting on their wellbeing. Many women described a lack of information and expertise being made available to assuage their fears during a crucial time. The field of medical science should address this shortcoming and inform health care providers of the potential risk that unexpected and unexplained phantom kick sensations may pose.

Women are routinely directed to pay attention to foetal kick rate during late pregnancy, either through the media (e.g., 21), or as directed by their health care provider (20). For example, the Royal College of Obstetricians and Gynaecologists (20) guidelines state that "Women should be advised of the need to be aware of foetal movements up to and including the onset of labour and should report any decrease or cessation of foetal movements to their maternity unit" and that "A significant reduction or sudden alteration in foetal movement is a potentially important clinical sign." Our results raise an intriguing question: if

women report sensations of foetal movement postpartum in the absence of a foetus, how reliable is the perception of foetal kicks during pregnancy? In other words, are all maternal perceptions of foetal kicks attributable to the foetus? Early research using Doppler ultrasound suggested that not all maternal perceptions of movement were detectable using ultrasound: Johnson, Jordan, and Paine (22) found that 12% of maternal sensations of foetal movement were undetected by ultrasound. Recent studies with newer technology show great individual variability in maternal perception of foetal movement, between 2.4 to 81% (23). An interesting corollary of the current study is that perhaps not all sensations attributed to foetal movement during pregnancy is due to the foetus. This result therefore has implications for the reliability of maternal perception as an indicator for reduced foetal movement and subsequently foetal health. It may be useful in future studies of maternal perceptions of antenatal foetal kicks to use a psychophysiological approach (e.g., Signal Detection theory, 24) to systematically quantify the occurrence of hits, misses, false positives and false negatives of abdominal interoceptive signals.

In sum, our study suggests that up to 2 in 5 women experience sensations of foetal movement long after childbirth and the postpartum period. These sensations may have implications for the mother's mental health during a vulnerable time. We have explored potential explanations for the phenomenon to assist in generating hypotheses for further research. Through this study, we hope to build awareness relating to phantom kicks that will ensure that women are given the appropriate information and care they require. Obstetric, gynaecological, and mental health clinicians specialising in postpartum care should be aware of the potential impact that phantom kicks may have on their clients, especially those that experience abortion, miscarriage, stillbirth, or traumatic birth.

Materials & Methods

This research was conducted in accordance with the Australian National Statement on Ethical Conduct in Human Research (2007) and was approved by the Monash University Human Research Ethics Committee.

Recruitment

308 Inclusion criteria were: Women (aged 18+) living in Australia who had been pregnant and had experienced
309 foetal kicks during and after pregnancy. Participants were recruited through online motherhood forums and
310 pregnancy groups (e.g. Huggies Forum, The Bump), as well as through social media platforms (e.g. Twitter,
311 Facebook). Flyers with a scannable barcode and tear-off tabs with the link to the survey were also
312 distributed in community centres and through the Monash University Clayton Campus, Monash Medical
313 Centre Clayton, and the Royal Melbourne Hospital. The term 'phantom kicks' was never used in the
314 research advertisements or in the survey to avoid bias. Participants were directed via web link to an
315 information sheet that provided detail on the background, rationale, and anticipated outcomes of the project.
316 Participants were self-selected and are not necessarily representative of the entire population of women
317 who have experienced phantom kicks (see 'Representativeness of Sample' in discussion).

318 The exploratory and voluntary survey contained 49 questions and was hosted on the Qualtrics platform.
319 The survey was distributed in June 2018 and was open for 3 months. We received 210 survey responses.
320 Analyses are restricted to those participants who provided complete survey data by responding to at least
321 71% of survey items (n=197). Of the included data, one participant did not complete all demographic items
322 (i.e., 71% of all items completed); 5 participants completed 88-94% of items; the remaining 191
323 participants completed all items. The survey consisted of closed and open-ended questions [see
324 Supplementary Data 5]. This format allowed participants to select from pre-determined choices and to
325 provide unrestricted comments. Closed questions were used mainly to gather socio-demographic
326 information (e.g. gender, age, nationality, marital status, ethnic group, income, occupation, and education)
327 and information about relevant experiences of phantom kicks. Open-ended questions were used to gather
328 data on the subjective experiences of phantom kicks (e.g., how did they feel, how did you feel, etc.). To
329 ensure the burden of participation was low, we restricted the survey to a participant's first four pregnancies.

330 **Data Preparation**

331 Incomplete survey responses discussing the pregnancy and postpartum period were filtered and the
332 remaining data was coded and entered into IBM SPSS Statistics (v25). Binary yes/no items were coded as
333 0 for 'no' and 1 for 'yes'. Multiple choice question responses were assigned numbers which replaced text

334 to enable analysis. Open-ended questions were analysed for content (25). Content analysis is a method used
335 to examine what is said in responses; who says what, how is it said, and how often is it said (25). It is used
336 in this study in its simplest form, as an analysis of word frequencies.

337 **Data Analysis**

338 *Number of Women Reporting Phantom Kicks & Subjective Frequency*

339 The first analysis examined the number of women in the sample who experienced phantom kicks. Note
340 that because we used a self-selected sampling method, we cannot infer prevalence of the phantom kick
341 experience on the basis of the current results. The number of women who experienced phantom kicks was
342 determined with the question ‘Did you experience any sensations of movement (e.g. kicks) after the birth
343 of your child?’. Due to the small number of responses we received for second, third and fourth pregnancies
344 (Table 2), the remainder of the analyses were conducted only for the first pregnancy.

345 For women who reported experiencing phantom kicks, we examined the subjective frequency rate of the
346 sensation after the first pregnancy. Subjective frequency was determined using a Likert scale in responses
347 to the question, ‘How often did you feel the kick like sensations?’. Responses ranged from ‘daily’ to ‘only
348 a handful of times’ and were coded from 1 to 9, where 1 represented ‘daily’ and 9 indicated if they felt
349 these kicks ‘only a handful of times’.

350 It is possible that women may misattribute foetal kicks to sensations related to normal resettling of
351 abdominal organs during the postpartum period. To test this hypothesis, we examined frequency of
352 phantom kick sensations (a) for all respondents and (b) excluding women who were 1-year or less
353 postpartum. Postpartum recovery is largely complete by six months post-delivery (12, 13). For the first
354 pregnancy, 24 women were one year or less post-delivery.

355 *Subjective Experience of Phantom Kicks*

356 Subjective experiences of phantom kicks were obtained using the open-ended item ‘How did it feel? How
357 convincing were the kick-like sensations?’ for their first pregnancy. Emotional responses to the phantom
358 kicks were obtained with the item ‘How did you feel about the movement/kicks?’. Participants’ responses

(Supplementary Data 4) were analysed for content to find common themes, words or phrases participants used to describe the phenomenon. The data were grouped into responses that were either positive (e.g., “Familiarity, I would smile at the memory”), indifferent (“Observed them but not too concerned”), negative (“surprised, shocked, scared”), both positive and negative (“+++ excited and + concerned”), or unsure (“unsure”, “I thought it was a bit strange and wondered if the kicks during pregnancy weren’t real either”), and coded with the values 1 to 5 respectively (see Supplementary Data 4 for range of responses received). We tested the following hypothesis using a chi-square test for independence: women who report that their baby (from a first pregnancy) was not born alive (i.e., miscarriage or stillbirth) are more likely to describe the emotional experience of phantom kicks negatively.

Factors associated with Phantom Kicks

We also examined whether phantom kicks are associated with age, postpartum changes in cognition or mood (depression and anxiety), breastfeeding and birth interventions. Using a chi-square test for independence, we analysed effects of postpartum cognition, depression, anxiety, and breastfeeding and cognition. A t-test was used to test the association between phantom kicks and participants’ age.

Multiple Comparisons Correction

In total, we conducted 15 statistical tests examining the relationship between phantom kicks and: age, frequency of foetal kicks during pregnancy, baby not born alive, depression, anxiety, cognitive change, breastfeeding, birth interventions (gas, induction, c-section, ventouse, TENS machine, pethidine, epidural, forceps). To correct for multiple comparisons, all significance tests used a Bonferroni adjusted alpha level of $\alpha = .05/15 = 0.0033$.

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387 **Author Contributions**

388 SJ & PGDW conceived the research question; DS, SJ, PGDW, MN & EO developed the survey; DS & MN
389 analysed the data; DS & SJ wrote the first draft of the manuscript; all authors contributed to manuscript
390 preparation.

391 **Competing Interests**

392 The authors declare no competing interests

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Figure Legends

Figure 1. Pregnancy and Postnatal Characteristics of the Sample. **a.** Reported years since conception for each pregnancy. **b.** Reported subjective frequency of foetal kicks during pregnancy. It is important to

451 interpret this distribution taking into account that women were on average over 8yrs post-natal. So, this
452 data represents the memory of the frequency of the foetal kicks during pregnancy, not the subjective
453 frequency of the kicks per se. **c.** Reported number of months women breastfed. Duration categories
454 represent the response categories available in the survey (see Supplementary Data 1).

455

456 **Figure 2. Experiences of Phantom Kicks.** **a.** Subjective frequency of phantom kicks, during the period
457 when the phantom sensations were at their highest frequency (i) and the lowest frequency (ii). **b.** Years
458 since conception for women who reported that they continue to experience phantom kicks.

459

460

a. Years Since Conception

b. Reported Frequency of Foetal Kicks During Pregnancy

c. Reported Number of Months Women Breastfed

a. Frequency of Phantom Kicks

b. Phantom Kicks Never Ended

Table 1. *The number of women who experienced phantom kicks in their subsequent pregnancies, after having experienced them in their first.*

Pregnancy #	Number of women who reported phantom kicks	Total number of women
2	26	125
3	13	68
4	9	29

Table 2. *Women's description of their experience of the phantom kicks after their first pregnancy.*

Description of phantom kicks	Number of women
Real Kicks	10
Convincing	43
Flutters	15
Odd	2
Cramps	1
Did Not Respond	16

Table 3. *Phrases women used when they described their emotional experience to phantom kicks after their first pregnancy.*

Words women used to describe phantom kicks	Number of women
Nostalgic	11
Comforting/Happy/Wonderful/Excited	10
Weird/Strange	10
Indifferent	8
Anxious/Upset/Uneasy/Terrified	7
Confused	6
Surprised/Scared	4
Curious	3
Surprised	3
Anxious/Confused	3
Anxious/Nostalgic	2
Weird/Comforting	1
Excited/Anxious	1
Unsure	1

Table 4: *Details of pregnancy, birth and postnatal experience for pregnancy 1*

Category	Yes	No	Unsure
Full term pregnancy	151	43	
Baby alive	176	18	
Breastfeeding	162	14	
Postnatal depression	44	134	21
Postnatal anxiety	61	122	16
Changes in cognition	58	128	13

Table 5: *Reported interventions during childbirth for pregnancy 1*

Category	Yes	No
Epidural	80	119
C-section	57	142
Forceps	22	177
Ventouse/Vacuum extractor	22	177
Induced labour	64	135
Gas (entenox)	78	121
TENS machine	19	180
Pethidine	32	167
Non-medical pain relief	7	192
None	44	155
Other	12	187

Table 6: Frequency of phantom kicks for women categorised according to breastfeeding, entenox administration or induced labour.

	Phantom Kicks – No	Phantom Kicks - Yes
Breastfeeding-No	4	10
Breastfeeding-Yes	95	67
Gas – No	81	40
Gas - Yes	39	39
Induction – No	88	47
Induction - Yes	32	32

Phantom Kicks: Women's Experience of Foetal Kicks after the Postpartum Period

~ Supplementary Material ~

Supplementary Data 1: Anecdotal Accounts of Phantom Kicks

We reviewed motherhood forums (e.g., Huggies Forum, www.huggies.com.au/forum; The Bump, www.thebump.com/community) to examine anecdotal accounts of phantom kicks. Women described these sensations as foetal kick-like sensations, that sometimes continue well after delivery.

For example:

Phantom kicks are freaking me out. Surely it's just gas. But I swear it doesn't feel like gas – it feels exactly like a baby is kicking the hell out of my ute [uterus]. - Anon A

It is fairly safe to assume that I am not pregnant. But... I have been experiencing 'phantom kicks' like crazy for a couple weeks. It seemed weird as they had stopped months ago but I just brushed it off. Until tonight when I was nursing a half sleeping LO [little one] and they started again and seemed to immediately wake her up. After I got her back down I sat down to watch and my belly is very visibly twitching. All over the place too. - Anon B

I would have that moment of 'oh! The baby's moving!' and then I'd realise he was actually asleep in his crib next to me. - Anon C

Supplementary Data 2: Full Demographic Details of Sample

Table 1: Demographic details of the sample (n=197).

Category	Number of Women
<i>Relationship Status</i>	
Married	141
Single	8
De Facto	30
Divorced	3
Separated	6
Never married	1
Prefer not to say	2
<i>Highest Level of Education Received</i>	
High school degree or equivalent	13
Vocational education certificate (e.g. TAFE, Cert I-IV, trade certification)	21
Vocational education diploma (e.g., TAFE)	13
Some University but no degree	12
Bachelor degree	47
Postgraduate degree (e.g., graduate certificate, graduate diploma)	39
Masters degree	28
Doctorate (PhD, professional doctorate)	16
Prefer not to say	2
<i>Ethnicity</i>	
Australian	153
Aboriginal and/or Torres Strait Islander	2
Middle Eastern	2
East Asian	3
South Asian	9
Other	20
Prefer not to say	2
<i>Employment Status</i>	
Employed full time (40 or more hours per week)	39
Employed part time (up to 39 hours per week)	87
Unemployed and currently looking for work	6
Unemployed and not currently looking for work	16
Student	22
Retired	1
Self-employed	14
Unable to work	1
Prefer not to say	5
<i>Annual Combined Household Income</i>	
\$0 – \$19,999	3
\$20,000 – \$49,999	11
\$50,000 – \$89,999	34
\$90,000 or more	119
Prefer not to say	24

Supplementary Data 3: Representativeness of Sample

Our sample was largely affluent middle-aged Australian women, who had given birth on average 8.5 years prior to completing the survey. Despite the skewed socioeconomic distribution of the sample obtained here, the pregnancy and birth characteristics were largely comparable with that of the general Australian population.

Age at conception for first pregnancy (28.8yrs) was comparable with the broader Australian population (28.2yrs in 2007 to 29.2yrs in 2017); as was reported rate of induced labour (32% in our sample, 33% in Australian population), and rate of pain relief usage during labour (74% in our sample, 78% in Australian population) (1). Rate of C-section delivery was slightly lower than the Australian population (here, 28%; Australian population, 35%; 1). However, this may be attributed to the fact that our sample included women who were 12 or more years postpartum: the Australian rate of C-sections has increased over time, from 27% in 1998 (2) to 35% in 2017 (1). In Australia 2015-2016, there were 6.8 stillbirths per 1000 births, which has remained relatively unchanged since 1997 (1). So, our finding that 2 out of 197 participants indicated a stillbirth for the first pregnancy is comparable to the broader population.

The rate of postpartum depression in this sample (11%) is comparable to estimates of the Australian average (6-12%, 3). The DSM-V (4) and ICD-11 (5) do not have unique diagnostic criteria for anxiety disorders in the postpartum period, and so prevalence of postpartum anxiety in the greater Australian population is unknown. However, postpartum anxiety is believed to be similar to rate of postpartum depression (6). In our sample, only one response suggested potential undiagnosed postpartum psychosis. This is consistent with the relatively low prevalence of this condition in the general population (7).

Most women in the sample reported breastfeeding their babies: 81% responded 'yes', 7% responded 'no', and 12% did not respond. In the Australian general population, 90% of children aged <1month receive breastmilk (8). In our sample, 21% of women reported breastfeeding their children 12-18 months, which is comparable with the Australian population (18.2% children aged 13-18months receive any breastmilk (8).

In sum, the pregnancy and birth characteristics of our sample are comparable with the general Australian population. This suggests that our results in relation to the phantom kick phenomena are not attributable to an unrepresentative sample.

Supplementary Data 4: Survey Responses to Open Items for Pregnancy 1

Table 2: Women's responses to open comment items describing the sensation of phantom kicks following pregnancy 1. Responses are unsorted.

How did you feel about the kick-like sensations?

Confused

Anxious

It was a nice reminder of when I was pregnant

Startled as I knew I was not pregnant.

Weird. They were very unexpected

Excited

Always made me chuckle

Worried something was wrong in the first few days. now I love the feeling as it reminds me of carrying him.

Confused as I definitely wasn't pregnant again. But overall happy about them as at that point I didn't know if I could/would have any more children and I wanted to enjoy the memories

It made me smile, as well as question if I was pregnant again.

Weird

I enjoyed the feeling as I had whilst my baby was in utero. It was also a little strange.

Strange. Thought i was imagining it

Familiarity, I would smile at the memory

Surprising

Observed them but not too concerned

Excited

Surprised, shocked, scared

Didn't think much of it.

I missed carrying a baby.

A bit nostalgic actually, I miss feeling the movements.

nostalgic

I didn't think too much about it, but it felt comforting in some way.

I missed him being in my tummy

It was odd and I found it difficult to believe the midwife's explanation but felt too stupid to ask again.

It made me feel really upset that my body was still "fooled" into thinking I was still pregnant.

Sentimental

I missed being pregnant

'+++ Excited and + concerned

Curious

Weird

no concerns, just a wonder of what it could be

Curious, very mildly alarmed

Indifferent

nostalgic! Fondness of the feeling of being pregnant. not worried

nostalgic.

Thought it was strange

Happy and excited

Very strange sensation

A bit nervous at first -thinking there might be something else in there! And a bit nostalgic because it was such an exciting/nice feeling when I was pregnant

I thought it was a bit strange and wondered if the kicks during pregnancy weren't real either.

Concerned I was pregnant again

It didn't bother me

Like I knew who she was as I knew those movements so well.

Just thought it was a post pregnancy feeling everyone gets

Took me by surprise and made me feel still pregnant but being so busy with a newborn I didn't think too much into it

Weird

Amused, surprised. no strong feelings. A bit of an eye roll - "I thought it was the baby when I was pregnant but clearly it wasn't!".

Felt normal as was used to these kicks for so many months, then to remember that I was no longer pregnant Can't recall exact duration (when they started, stopped & how often) as I just assumed it was something else & ignored them after the first few times

Worried I was pregnant

I loved it. I really loved being pregnant.

Unsure

Weird

They felt exactly like how my son would kick

Strange but comforting

Concerned

Guess it was all part of it. Didn't know any different

Nervous I'm pregnant again 😊

Excited, nervous

3 times

nostalgic

It wasn't until i was pregnant again and felt proper kicks again that i realised the phantom kicks were slightly weaker. But following the pregnancy and birth they were exactly the same.

I always figured it was just what happened after you had a baby

Strange, odd and kind of laughed and shrugged them off

In my tummy

Weirded out at first. Then I got used to it

Just thought wow felt like a baby kick and moved on.

Strange, a bit sad and mourned the loss of my pregnancy

didn't worry me, but was kind of nice as reminded me of the closeness mum and baby share

What did you think they [the kick-like sensations] were?

Unsure

Another baby!

not sure

I felt like my brain was playing tricks of me. I felt like I was so used to feeling my baby kick that my mind almost expected it.

I was confused and thought that I must be pregnant again but I wasn't

no idea

Just my body playing tricks

At first I thought it was uterine contractions or gas

Gas settling in my lower body, post csection

gas? stomach or digestion related

not sure

no idea

My baby kicking. Then when I remembered i had given birth, perhaps just movement of my organs.

I thought it just of been gas, but it felt different.

Tummy

Gas or muscles healing.

Memory of the feelings of pregnancy

no idea

Thought it was gas at first

Gas

I have no idea

My insides rearranging themselves as my body got back to normal.

Jumpy nerves

Sensations other than feel them [the kick-like sensations] (note n=55 responded 'no')

no I just felt them.

yes

not visible

yes, I saw some movement of my lower abdomen a couple of times

yes visible

Unsure. I never saw one but they felt like they'd be visible if you were watching at the right time.

yes my tummy would move

no, not visible, just a deeply internal flutter, inexplicable rollings.

yes, could feel the outline of her foot with my hand. Incredible. 'baby bump' movement clearly visible.

yes I could see my belly move

Sometimes

A sense of still feeling pregnant

no, but I would place my hand on my belly to feel it better.

yes and sometimes my belly moves up and down like there is a baby in there.

no just the feeling

Further Comments (n=24 responded 'no')

I developed appendicitis shortly afterwards so wondered whether the "kick" sensation was actually related to that.

I thought they were my insides going back to normal

My hands can feel them if I put them on my tummy

I bonded with my baby in utero and loved being pregnant so perhaps the kicks were my body and brain trying to replicate that feeling.

I was quite sure it related to my abdominal muscles healing/spasming

I miss having the baby in my belly. The post partum kicks are so similar to what they were when I was pregnant

They didn't feel like full term kicks. More like the kicks at about 28-30 weeks.

I always enjoy them when they happen.

Discomfort for months after birth felt on upper right abdominal area (like bruised ribs)

I wasn't aware they were a recognised phenomenon until completing this survey, and am interested to know now that they are.

They felt the same as the real kicks

no, it was a one off experience

I loved it. And I've always wondered if anyone else experienced the same thing.

Very strange feeling

They are bizarre

I think they are a natural response from being pregnant

I thought it was pretty normal a lot of my friends get them as well.

Glad I'm not alone I thought I was going crazy!

Supplementary Data 5: Survey Questions

Subjective Experiences of Foetal Kicks During and After Pregnancy

INTRODUCTION

Do you currently reside in Australia? Yes No

[No – exit survey]

[Yes – continue]

What is your postcode? _____

How many times have you been pregnant? _____

PREGNANCY

[Repeat this section for each pregnancy]

1 What year did you conceive? _____

2 Was this a multiple pregnancy? ☐ Yes ☐ No ☐ Unsure

3 How often did you feel movement during pregnancy (e.g. kicks, turns, etc)?

(Likert Scale) 1=not many 5 = lots

4 Placental Placement: ☐ Front ☐ Back ☐ Side ☐ Other ☐ Unsure

5 Did you reach full term? Yes ☐ No ☐

If no, at which point did you deliver _____ weeks

[If No, skip to PP Q4]

6 Was your baby born alive ? Yes No

[If No, skip to PP Q4]

7 Did you have any interventions during the birth? (tick all that apply)

☐ Epidural ☐ C-Section ☐ Forceps

☐ Ventouse/Vacuum extractor ☐ Induced labour ☐ Gas (entenox)

☐ TENS machine ☐ Pethidine ☐ Non-medical pain relief ☐ None

☐ Other (please specify)

POST PARTUM

1 Were there any complications post-birth? Yes No

- If yes, please describe these complications E.g., infections, excessive bleeding, pain, incontinence

2 Do you have any on-going physical side-effects from the pregnancy? Yes ☐ No ☐

3 Did you breast feed? Yes ☐ No ☐

- If 'Yes', how long did you breastfeed?

1-3 months

3-6 months

6-9 months

9-12 months

12-18 months

18-24 months

more than 24 months

4 Did you experience post-natal depression? Yes ☐ No ☐ Unsure ☐

- Was it diagnosed? Yes ☐ No ☐

- Did you undergo treatment? Yes ☐ No ☐

- Do you have any other information to add?

5 Did you experience post-natal anxiety? Yes ☐ No ☐ Unsure ☐

- Was it diagnosed? Yes ☐ No ☐

- Did you undergo treatment? Yes ☐ No ☐

- Do you have any other information to add?

6 Did you experience any changes in your thinking e.g., memory problems, post-natal psychosis, etc. ? Yes ☐ No ☐ Unsure ☐

- Was it diagnosed? Yes ☐ No ☐

- Did you undergo treatment? Yes ☐ No ☐

- Do you have any other information to add?

7 Did you experience any sensations of movement (e.g. kicks) after the birth of your child?

Yes ☐ No ☐

[If no, go to demographics]

8 When did they start? _____

9 How did it feel? How convincing were the kick like sensations?

10 How often did you have the kick like sensations?

- At their highest frequency, how often did you have them?

Likert scale 1-7

- At their lowest frequency, how often did you have them?

Likert scale 1-7

11 How did you feel about the movement/kicks?

12 What did you think the sensations of movement were?

13 Did the 'kicks' end? Yes No

14 Did you have other sensations other than feeling them? e.g. were the 'kicks' visible?

15 Do you have other comments or thoughts on the experience of the post-partum 'kicks' in general?

--

DEMOGRAPHICS

1 What is your relationship status?

- Married
- Single
- De Facto
- Widowed
- Divorced
- Separated
- Never married
- Prefer not to say

2 What is the highest level of education you have received?

- Less than high school degree
- High school degree or equivalent
- Vocational education certificate (e.g. TAFE, Cert I-IV, trade certification)
- Vocational education diploma (e.g., TAFE)
- Some University but no degree
- Bachelor degree
- Postgraduate degree (e.g., graduate certificate, graduate diploma)
- Masters degree
- Doctorate (PhD, professional doctorate)

3 Do you identify as a woman? Yes No

4 What year were you born? _____

5 What is your country of birth?

6 Please specify your ethnicity:

- Australian
- Aboriginal and/or Torres Strait Islander
- Middle Eastern

East Asian

South Asian

African

Other

Prefer not to say

7 What is your current employment status?

Employed full time (40 or more hours per week)

Employed part time (up to 39 hours per week)

Unemployed and currently looking for work

Unemployed and not currently looking for work

Student

Retired

Self-employed

Unable to work

Prefer not to say

8 What is your total combined household income per year?

\$0 – \$19,999

\$20,000 – \$49,999

\$50,000 – \$89,999

\$90,000 or more

unsure

Prefer not to say

CONCLUSION

1 Are you interested in being contacted for future information/surveys?

Yes ☐ No ☐

Email address:

This concludes the survey. Thank you so much for taking the time to participate and complete this survey.

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