

1 **Title:** Patterns in the provision of government-subsidized hormonal postpartum  
2 contraception in Queensland Australia between 2012 and 2018: A population-based  
3 cohort study

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24 **Key words**

25 Family planning services; reproductive techniques; contraceptive agents; health  
26 equity; postpartum period

27

28 **Abstract:**

29 **Background:** Short birth intervals and unintended pregnancy are associated with  
30 poorer maternal and infant outcomes. There is a risk of pregnancy during the  
31 immediate postpartum period unless contraception is initiated. This retrospective  
32 cohort study aimed to capture the current patterns of hormonal contraceptive  
33 provision within 12 months postpartum in a high-income country.

34 **Methods:** We used a linked administrative dataset comprising all women who gave  
35 birth in Queensland, Australia between 1 July 2012 and 30 June 2018. We described  
36 our cohort by whether they were provided with government-subsidized hormonal  
37 contraception within 12 months postpartum. The associations between hormonal  
38 postpartum contraceptive provision and demographic and clinical characteristics  
39 were examined using univariate and multivariate logistic regression and presented in  
40 terms of crude and adjusted odds ratios with 95% confidence intervals (CI).

41 **Results:** Of the 339,265 pregnancies eligible for the analysis, a majority of women  
42 (60.2%) were not provided government-subsidized hormonal postpartum  
43 contraception within 12 months postpartum. Women who were younger (<25 years),  
44 overweight or obese, smoked, born in Australia, non-Indigenous, gave birth in a  
45 public hospital, or were in the lowest socioeconomic status group were more likely to  
46 be provided hormonal postpartum contraception after adjusting for other co-variates,  
47 compared to their counterparts.

48 **Conclusions:** Strategies to increase the provision and uptake of contraception in the  
49 immediate postpartum period are needed to prevent short birth intervals and  
50 unintended pregnancy and ensure women's fertility intentions are enacted. Ongoing  
51 research is needed to examine the factors influencing women's access to  
52 contraceptive services and, further, the types of contraception provided.

53

54 **What is known already:** The provision of postpartum contraception plays a vital role  
55 in maternity care, namely achieving healthy birth spacing and reducing subsequent  
56 unintended pregnancy and its consequences.

57 **What this study adds:** This study identified a low prevalence of government-  
58 subsidized hormonal contraception provision in Queensland, Australia, particularly  
59 the more effective forms (long-acting reversible contraception). Women experiencing  
60 disadvantage or at higher risk of adverse pregnancy outcomes, including younger  
61 women, women who were overweight or obese, smokers, and women of lowest  
62 socioeconomic status, were more likely to be provided with hormonal contraception  
63 compared to their counterparts.

64 **How this study might affect research, practice or policy:** The co-development of  
65 a multifaceted postpartum implementation program and shared decision-making  
66 model is essential to ensuring women's fertility intentions are enacted and promoting  
67 woman-centered maternity care. Future research should aim to better understand  
68 patterns of hormonal postpartum contraception provision, how economic, social, and  
69 political factors influence access to contraceptives services, and opportunities to  
70 enhance the rate of use and efficacy of contraceptive options postpartum women  
71 use.

72

73 **Abbreviations**

74 Adjusted odds ratio (aOR); Odds ratio (OR); Postpartum contraception (PPC);  
75 Pharmaceutical Benefits Scheme (PBS); 95% confidence intervals (95%CI); World  
76 Health Organization (WHO); Body mass index (BMI); Socio-Economic Indexes for  
77 Areas (SEIFA)

78

79 **1. Introduction**

80 The World Health Organization (WHO) recommends birth intervals of 2-3 years,(1)  
81 as shorter intervals increase the risk of adverse maternal and infant outcomes  
82 including preterm birth, low birth weight, and infant mortality.(2, 3) Unintended  
83 pregnancy is also associated with poorer maternal and infant outcomes, such as  
84 lower breastfeeding rates, maternal depression, preterm birth, and low birth  
85 weight,(2, 4) and exposes women to obstetric risks arising from undesired fertility,  
86 unsafe abortions, inadequate birth intervals, and pregnancies in high-risk groups.(5,  
87 6) Because sexual activity and fertility can resume shortly after childbirth, there is a  
88 risk of pregnancy during the first 12 months postpartum unless contraception is  
89 initiated.(2) Further, low breast-feeding rates globally in the first 6 months after birth  
90 limit natural contraception.(7) The provision of postpartum contraception (PPC),  
91 therefore, plays a vital role in maternity care and women's self-determination, namely  
92 achieving healthy birth spacing and preventing adverse consequences associated  
93 with short birth intervals.

94

95 Despite WHO recommendations of 2-3-year birth intervals, prevalence of PPC use  
96 within 12 months of birth is only 41.2% in low- and middle-income countries.(3) Still,  
97 a greater proportion of women report a desire to either space their pregnancies

98 (54.8%) or complete (36.5%) their childbearing following birth.(3) Historically, studies  
99 assessing PPC provision have focused on low- and middle-income countries, and  
100 there remains a dearth of evidence regarding provision in high-income countries.  
101 Discrepancies regarding recommended healthy birth intervals and PPC use in high-  
102 income countries,(8, 9) as well as evidence of unintended pregnancy within 12  
103 months postpartum,(10) illustrates a gap in the provision of contraception in the  
104 immediate postpartum period and potential opportunity to improve maternity care.  
105 Understanding current PPC provision rates can inform efforts to optimize PPC and  
106 meet women’s contraceptive needs and preferences in the postpartum period.

107

108 The primary aim of this study was to describe government-subsidized hormonal  
109 contraceptive provision within 12 months postpartum in Australia. The secondary aim  
110 was to test associations between hormonal PPC provision and demographic and  
111 clinical characteristics.

112

## 113 **2. Methods**

### 114 **2.1 Setting**

115 Australia’s universal healthcare system includes the provision of antenatal,  
116 intrapartum, and postnatal care (up to six weeks post-birth) through a mix of public  
117 and private services. The Pharmaceutical Benefits Scheme (PBS) subsidizes the  
118 cost of certain medications. A list of all medicines that the federal government  
119 subsidizes through the PBS is available here.(11)

120

### 121 **2.2 Study design and data source**

122 This is a retrospective cohort study using a linked administrative dataset from the  
123 Queensland Perinatal Data Collection,(12) which covers all live births, and stillbirths  
124 of at least 20 weeks' gestation and/or at least 400 grams in weight that occurred in  
125 Queensland, Australia, between 1 July 2012 and 30 June 2018. The dataset  
126 contains anonymized data pertaining to all individuals who access antenatal care  
127 services and their resultant children's demographic and clinical characteristics, which  
128 was subsequently linked to the PBS claims records from the onset of pregnancy to  
129 30 June 2019. Further information about the dataset and variables is described  
130 elsewhere.(13) The same woman may be included more than once if she had  
131 multiple pregnancies between 1 July 2012 and 30 June 2018. Women with missing  
132 values of included characteristics were removed from the analysis.

133

### 134 **2.3 Study outcomes**

135 The primary outcome of interest was the proportion of women provided hormonal  
136 contraception by a health practitioner within 12 months postpartum. PBS-listed PPC  
137 includes subdermal hormonal implants, hormonal intrauterine devices, contraceptive  
138 injections, and certain oral contraceptive pills (inclusive of progestin-only pills and  
139 combined oral contraceptive pills) (corresponding item codes for each category are  
140 available in Appendix 1). This study was limited to PPC listed on the PBS—the  
141 primary government funder of prescription pharmaceuticals in Australia. As such, this  
142 study relates to 'PBS-listed hormonal PPC', but we will use the phrase 'hormonal  
143 PPC' for simplicity. *Provision* refers to a woman who received a subdermal hormonal  
144 implant, hormonal intrauterine device, or contraceptive injections by a health  
145 practitioner, or in the case of oral contraceptive pills, collected a dose or set of doses  
146 prescribed by a health practitioner. Permanent contraception/ sterilisation (e.g., tubal

147 sterilisation and vasectomy) were not included in this study due to low numbers  
148 (0.5% and 0.1%, respectively).

149

150 The secondary outcome of interest was the association between hormonal PPC  
151 provision and the following demographic and clinical characteristics of women: age  
152 (<25 years, 25-34 years, or ≥35 years), pre-pregnancy body mass index (BMI)  
153 (underweight <18.5, healthy weight 18.5 – 24.9, overweight 25.0 – 29.9, or obese ≥  
154 30.0), smoking status (non-smoker, or smoker), marital status (never married,  
155 married/ de Facto/ domestic partner, widowed, or divorced/ separated), country of  
156 birth (born in Australia or born outside of Australia), cultural identity (identified as  
157 Indigenous or non-Indigenous), private or public place of birth, socioeconomic status  
158 (defined using quintiles, where Quintile 1 = most disadvantaged and Quintile 5 =  
159 most advantaged), gravidity, previous pregnancy termination, and belonging to a  
160 private health insurance scheme. BMI was calculated based on women's self-  
161 reported weight four to six weeks prior to or at conception and categorized based on  
162 the WHO classifications (14). We categorized mothers' socioeconomic status based  
163 on the postcode of usual residence using the Socio-Economic Indexes for Areas  
164 (SEIFA) - a classification system developed by the Australian Bureau of Statistics  
165 that ranks areas in Australia according to relative socioeconomic advantage and  
166 disadvantage (15).

167

#### 168 **2.4. Analysis**

169 Data were analyzed using SAS 9.4. Values of  $p < 0.05$  were considered statistically  
170 significant. Women's demographic and clinical characteristics were described using  
171 frequencies and percentages, and the statistical significance of categorical variables

172 was tested using the Wald Chi-Square between women provided hormonal PPC and  
173 women not provided hormonal PPC within 12 months postpartum (16). The types  
174 and prevalence of hormonal PPC provision to women within 12 months postpartum  
175 were also described using frequencies and percentages. The associations between  
176 hormonal PPC provision and demographic and clinical characteristics were  
177 examined using univariate logistic regression and multivariate logistic regression and  
178 presented in terms of crude odds ratio (OR) and adjusted odds ratios (aOR) with  
179 95% confidence intervals (95% CI).

180

## 181 **2.5. Ethical Approval**

182 This study received ethical approval from the Townsville Hospital and Health  
183 Services Human Research Ethics Committee (HREC/16/QTHS/223) and the  
184 Australian Institute of Health and Welfare Human Research Ethics Committee  
185 (EO2017-1-338). Public Health Act approval was also obtained (RD007377).  
186 Permission to waive consent was acquired from Queensland Health under the Public  
187 Health Act 2005.

188

## 189 **3. Results**

### 190 **3.1 Types and prevalence of postpartum contraception provision**

191 There were 339,265 pregnancies included in our analysis. Of these, a majority of  
192 women (60.2%) were not provided hormonal PPC within 12 months postpartum  
193 (Table 1). A greater proportion of women who were not provided with hormonal PPC,  
194 compared to women who were provided with hormonal PPC, were above the age of  
195 25 years, underweight or normal weight, non-smoker, married, born outside  
196 Australia, non-Indigenous, gave birth in a private hospital, were of the highest socio-



197 economic status, had two or more previous pregnancies, and were a private health  
 198 insurance member.

199

200 **Table 1:** Demographic and clinical characteristics of Queensland women provided with hormonal PPC within 12  
 201 months postpartum relative to all Queensland women who gave birth between July 2012 and June 2018

Characteristics	Women provided with PPC N(%)	Women not provided with PPC N(%)	All women who gave birth in Queensland N(%)
	134,931 (39.8%)	204,334 (60.2%)	339,265 (100.0%)
<b>Age (in years)*</b>			
<25	30,873 (22.9%)	28,220 (13.8%)	59,093 (17.4%)
25-34	80,682 (59.8%)	123,505 (60.4%)	204,187 (60.2%)
≥35	23,376 (17.3%)	52,609 (25.8%)	75,985 (22.4%)
<b>Body mass index (kg/m<sup>2</sup>)*</b>			
Underweight (<18.5)	7,075 (5.2%)	12,301 (6.0%)	19,376 (5.7%)
Normal weight (18.5-24.9)	66,002 (48.9%)	108,778 (53.2%)	174,780 (51.5%)
Overweight (25.0-29.9)	32,674 (24.2%)	45,434 (22.2%)	78,108 (23.0%)
Obese (≥30.0)	29,180 (21.6%)	37,821 (18.5%)	67,001 (19.8%)
<b>Smoking status*</b>			
Non-smoker	116,564 (86.4%)	182,700 (89.4%)	299,264 (88.2%)
Smoker	18,367 (13.6%)	21,634 (10.6%)	40,001 (11.8%)
<b>Marital status*</b>			
Single	21,576 (16.0%)	26,017 (12.7%)	47,593 (14.0%)
Married/ de Facto / domestic partner	111,377 (82.5%)	175,315 (85.8%)	286,692 (84.5%)
Widowed	126 (0.1%)	62 (0.1%)	188 (0.1%)
Divorced/ separated	1,916 (1.4%)	2,876 (1.4%)	4,792 (1.1%)
<b>Country of birth*</b>			
Born in Australia	108,758 (80.6%)	139,601 (68.3%)	248,359 (73.2%)
Born outside of Australia	26,173 (19.4%)	64,733 (31.7%)	90,906 (26.8%)
<b>Cultural identity*</b>			
Indigenous	8,243 (6.1%)	10,812 (5.3%)	19,055 (5.6%)
Non-indigenous	126,688 (93.9%)	193,522 (94.7%)	320,210 (94.4%)
<b>Public or private hospital birth place*</b>			
Public hospital	92,393 (68.5%)	122,835 (60.1%)	215,228 (63.4%)
Private hospital	42,538 (31.5%)	81,499 (39.9%)	124,037 (36.6%)
<b>Socioeconomic status (SEIFA) quintiles*</b>			
Quintile 1 (The most disadvantaged)	11,010 (8.2%)	12,786 (6.3%)	23,796 (7.0%)
Quintile 2	6,798 (5.0%)	7,678 (3.8%)	14,476 (4.3%)
Quintile 3	25,580 (19.0%)	33,733 (16.5%)	59,313 (17.5%)
Quintile 4	53,085 (39.3%)	75,070 (36.7%)	128,155 (37.8%)
Quintile 5 (The most advantaged)	38,458 (28.5%)	75,067 (36.7%)	113,525 (33.5%)
<b>Gravidity*</b>			
No previous pregnancy	41,943 (31.1%)	61,488 (30.1%)	103,431 (30.5%)

1 previous pregnancy	41,205 (30.5%)	59,382 (29.1%)	100,587 (29.7%)
2 previous pregnancy	24,946 (18.5%)	37,848 (18.5%)	62,794 (18.5%)
≥3 previous pregnancy	26,837 (20.0%)	45,616 (22.3%)	72,453 (21.4%)

#### **Previous termination**

Yes	740 (0.6%)	1,074 (0.5%)	1,814 (0.5%)
No	134,191 (99.5%)	203,260 (99.5%)	337,451 (99.5%)

#### **Private health insurance member\***

Yes	38,248 (28.4%)	67,513 (33.0%)	105,761 (31.2%)
No	96,683 (71.7%)	136,821 (67.0%)	233,504 (68.8%)

Note: PPC = Postpartum contraception. \* Significantly different at 0.001 level.

202

203

204 The most common forms of PPC were progestin-only pills (17.6%) and combined  
 205 oral contraceptive pills (13.1%). The least common forms were intrauterine devices  
 206 (6.3%) and contraceptive injections (4.3%) (Table 2).

207

208 Table 2: Type of Postpartum Contraception provided based on Pharmaceutical Benefit Scheme items, up to 12  
 209 months postpartum

<b>Pharmaceutical contraceptive use within 12 months postpartum</b>	<b>Number of pregnancies (%)</b>
No	204,334 (60.2%)
Yes	134,931 (39.8%)
1 form of contraceptive	109,021 (32.1%)
2 forms of contraceptive	24,318 (7.2%)
≥3 forms of contraceptive	1,592 (0.5%)

<b>Type of Contraceptive<sup>a</sup></b>	<b>Number of pregnancies (%)</b>
Subdermal hormonal implant (Implanon)	22,320 (6.6%)
Intrauterine Device	21,341 (6.3%)
Contraceptive Injection (Medroxyprogesterone)	154,498 (4.3%)
Progestin-only pill	59,838 (17.6%)
Combined oral contraceptive pill	44,498 (13.1%)

Note: PPC= government-subsidized hormonal postpartum contraception; <sup>a</sup>Women may have been provided more than one contraceptive.

210

211

### **3.2. Associations between government-subsidized hormonal postpartum 213 contraception provision and women's demographic and clinical 214 characteristics**

215 Younger women (<25 years) were more likely to be provided any hormonal PPC  
 216 compared to older women (aOR of women 25-34 years= 0.67; 95% CI= 0.65-0.68)

217 and aOR of women 35 years or above= 0.48; 95% CI= 0.47-0.50) (Table 3). Women  
218 who were overweight or obese were 1.15 and 1.17 times more likely to be provided  
219 with any hormonal PPC compared to women with a BMI of 18.5-24.9, respectively  
220 (aOR of women who were overweight= 1.15; 95% CI= 1.13-1.17 and aOR of women  
221 who were obese= 1.17; CI= 1.15-1.20). Women who smoked compared to non-  
222 smokers were more likely to be provided with any hormonal PPC (aOR of women  
223 who smoked= 1.07; 95% CI= 1.05-1.10).

224

225 Women who were born in Australia were more likely to be provided any hormonal  
226 PPC compared to women born outside of Australia (aOR of women who were born  
227 outside of Australia= 0.57; 95% CI= 0.56-0.58). Non-Indigenous women were more  
228 likely to be provided any hormonal PPC compared to Indigenous women (aOR of  
229 Indigenous women= 0.77; 95% CI= 0.74-0.79). Women who gave birth in a public  
230 hospital setting were more likely to be provided any hormonal PPC compared to their  
231 counterpart (aOR of women who gave birth in a private hospital setting= 0.83; 95%  
232 CI= 0.81-0.85). Women of lowest socioeconomic status (Quintile 1) were more likely  
233 to be provided with any hormonal PPC compared to women of higher socioeconomic  
234 status (aOR of women in Quintile 4= 0.94; 95% CI= 0.91-0.97 and OR of women in  
235 Quintile 5= 0.84; 95% CI= 0.81-0.86). Women who had one previous pregnancy  
236 were more likely to be provided any hormonal PPC compared to women with no  
237 previous pregnancies (aOR of women with one previous pregnancy= 1.07; 95% CI=  
238 1.05-1.08).

239

240 Women who were overweight or obese were more likely to be provided with a  
241 subdermal hormonal implant (aOR of women who were overweight= 1.19; 95% CI=

242 1.15-1.24 and OR of women who were obese= 1.39; CI= 1.34-1.44), intrauterine  
243 device (aOR of women who were overweight= 1.21; 95% CI= 1.06-1.13 and aOR of  
244 women who were obese= 1.08; CI= 1.04-1.12), or contraceptive injection (aOR of  
245 women who were overweight= 1.26; 95% CI= 1.21-1.31 and aOR of women who  
246 were obese= 1.55; CI= 1.49-1.62), compared to women with a BMI of 18.5-24.9.

247

248 Women who smoked compared to non-smokers were more likely to be provided with  
249 a subdermal hormonal implant (aOR of women who smoked= 1.22; 95% CI= 1.17-  
250 1.26) or contraceptive injections (aOR of women who smoked=1.62; 95% CI= 1.55-  
251 1.69).

252

253 Whereas single women were more likely to be provided a subdermal hormonal  
254 implant (aOR of married women=0.81; 95% CI= 0.78-0.84) or contraceptive injection  
255 (aOR of married women= 0.74; 95% CI= 0.71-0.77) than married women, married  
256 women were more likely to be provided an intrauterine device (aOR of married  
257 women= 1.12; 95% CI= 1.07-1.18) or oral contraceptive pill (aOR of married  
258 women= 1.13; 95% CI= 1.11-1.16) compared to single women.

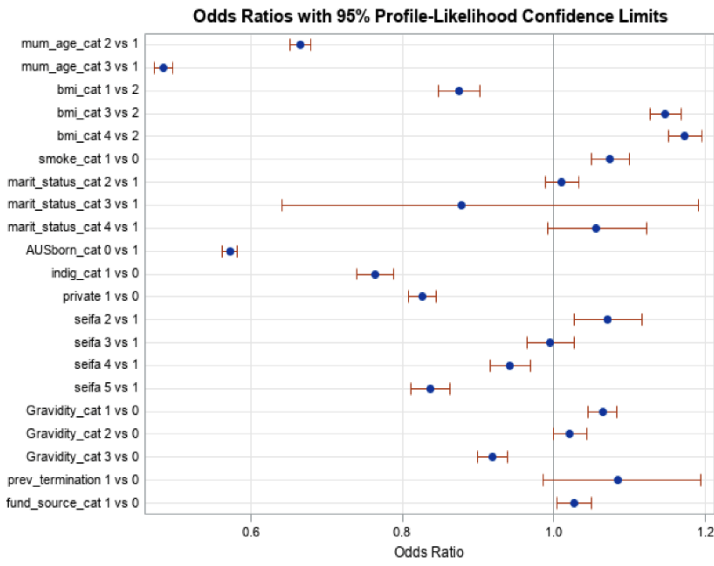
259

260 Although women born outside of Australia and Indigenous women were less likely to  
261 be provided with any contraceptive compared to their counterparts, they were 1.34  
262 and 1.76 (respectively) more likely to be provided a subdermal hormonal implant  
263 compared to their counterparts. Women who had private health insurance were more  
264 likely to be provided an intrauterine device (aOR= 1.70; 95% CI= 1.63-1.77) or oral  
265 contraceptive pill (aOR=1.06; 95% CI= 1.03-1.08) compared to women who did not

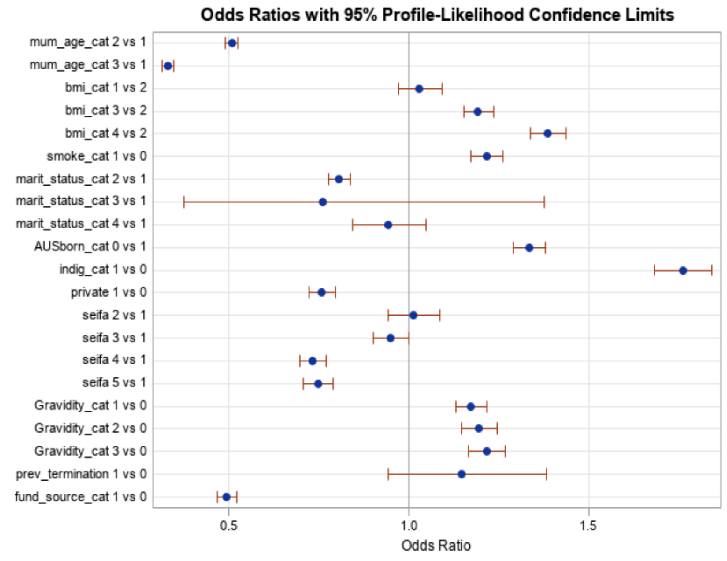
266 have private health insurance. Appendix 2 presents crude odds ratios (ORs) with  
267 95% CI, and Appendix 3 presents aORs with 95% CI.

268

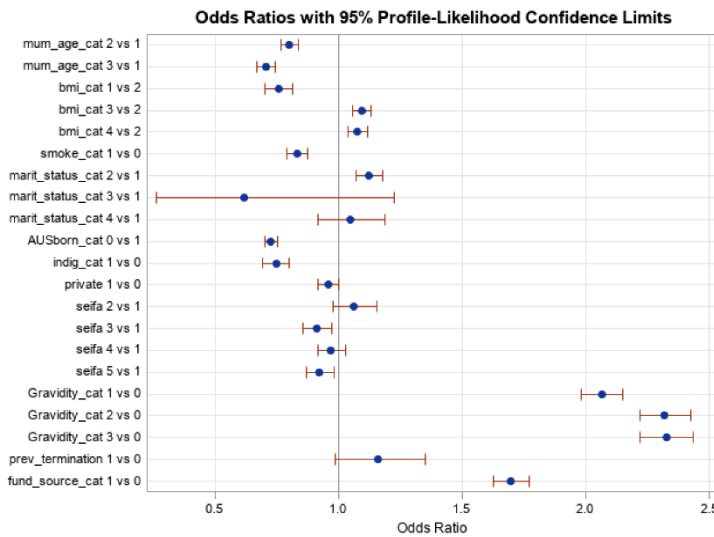
269 Figure 1 (a-e) illustrates associations between government-subsidized hormonal  
270 postpartum contraception provision within 12 months postpartum and the  
271 demographic and clinical characteristics of women who gave birth in Queensland  
272 Australia between July 2012 and June 2018, using multivariate logistic regression  
273 models.



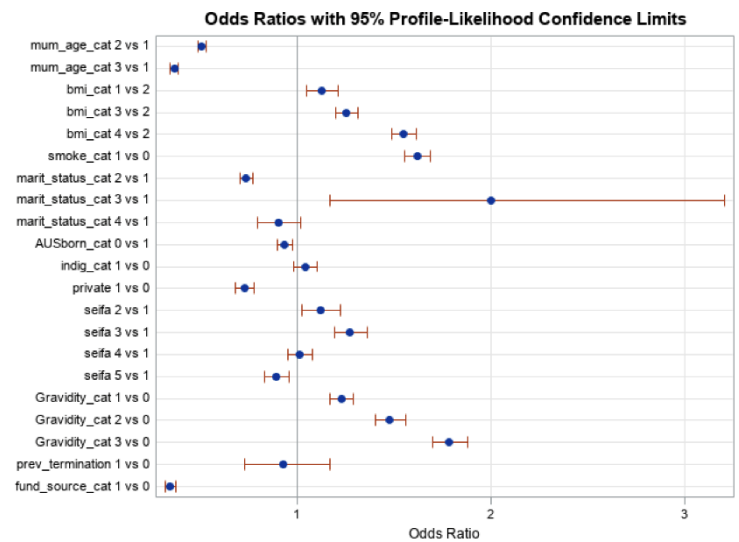
a) Any contraceptive provision



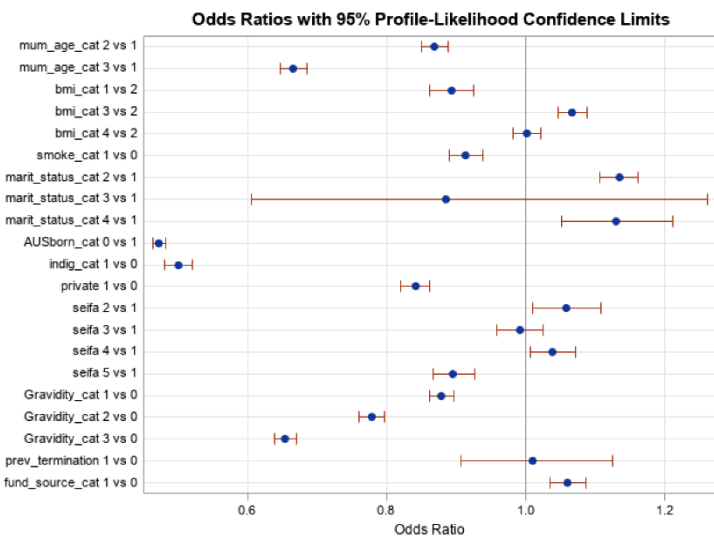
b) Subdermal hormonal implant



c) Hormonal intrauterine device



d) Contraceptive injection



e) Oral contraceptive pill

310 Figure 1: Multivariate logistic regression analysis illustrating the association  
311 between government-subsidized hormonal postpartum contraception provision and  
312 women's demographic and clinical characteristics

313

#### 314 **4. Discussion**

315 Using a state-wide, administrative dataset, this population-based cohort study  
316 captured the provision of government-subsidized hormonal PPC within 12 months  
317 postpartum in Queensland, Australia between 2012 and 2018 and tested  
318 associations between provision and demographic and clinical characteristics. Most  
319 (60.2%) women were not provided government-subsidized hormonal PPC, and the  
320 most common type of government-subsidized contraceptive provided was progestin-  
321 only pill (17.6%) or combined oral contraceptive pill (13.1%). Women who were  
322 younger (<25 years), were overweight or obese, smoked, born in Australia, non-  
323 Indigenous, gave birth in a public hospital, or were in the lowest socioeconomic  
324 status group were more likely to be provided hormonal PPC compared to their  
325 counterparts.

326

327 The provision of contraception within 12 months postpartum is a key intervention in  
328 the prevention of short birth intervals and associated consequences.(2) Yet, this  
329 study identified most (60.2%) women were not provided with government-subsidized  
330 hormonal PPC during this time. It is possible that these women were using non-  
331 prescription methods (e.g., fertility awareness method, lactational amenorrhoea,  
332 condoms, and/or the diaphragm), abstinence, withdrawal, or spermicides. These  
333 non-hormonal methods, however, are less effective than hormonal methods with  
334 perfect use, and their efficacy is further reduced with typical use.(17) Additionally,

335 sexual activity and fertility can resume shortly after childbirth.(18) Given a majority of  
336 unintended pregnancies are caused by non-use or use of less effective methods of  
337 contraception,(19) women who use non-hormonal methods as their primary method  
338 of PPC are at risk of another pregnancy soon after delivery.

339

340 In our study, most women were provided with the oral contraceptive pill, which is less  
341 effective than long-acting reversible contraceptives (i.e., intrauterine devices and  
342 subdermal hormonal implants) (20) This aligns with previous research that  
343 determined postpartum women were more likely to not use contraceptive methods or  
344 to use methods that provide short-term coverage with higher potential failure than to  
345 use contraceptive methods of greater efficacy.(3, 5, 21) Long-acting reversible  
346 contraceptive methods that are initiated in the postpartum period are the most  
347 effective reversible methods to optimize birth spacing and planning.(8, 22, 23) These  
348 methods can be instigated immediately after birth, have no adverse impact on  
349 breastfeeding, and yield high continuation rates.(18) The most commonly reported  
350 reasons for non-use of contraception are low perceived risk of getting pregnant and  
351 fear of side effects,(3) which is indicative of gaps in knowledge of PPC. Further,  
352 there are inconsistencies in international guidelines and product information with  
353 regards to the provision of long-acting reversible contraception at four to six weeks  
354 postpartum, as well as a lack of evidence-based clinical practice guidelines for PPC  
355 provision in Australia.(24) The co-development of a multifaceted PPC implementation  
356 program including educational efforts, behavior change techniques, and freely  
357 accessible resources for women and healthcare providers is recommended to  
358 increase uptake of PPC generally and more effective forms of PPC in particular.

359



360 Women experiencing disadvantage or at higher risk of adverse pregnancy  
361 outcomes—women who were young (<25 years), overweight or obese, smoked, and  
362 were in the lowest socioeconomic status group—were more likely to be provided with  
363 government-subsidized hormonal PPC within 12 months postpartum compared to  
364 their counterparts. This was particularly surprising given that women experience  
365 vulnerabilities and socio-economic and structural disadvantage are generally  
366 reported as having reduced access to health care and low levels of health  
367 literacy.(25, 26) This finding aligns with a previous United States study demonstrating  
368 Black and Hispanic women were more likely to choose any method of PPC than  
369 White women.(27) It is possible that health promotion programs aimed at ensuring  
370 universal access to more effective forms of contraception (i.e., long-acting reversible  
371 contraceptives) have disproportionately targeted “high-risk” populations. While use of  
372 contraception is influenced by a complex set of factors including access, healthcare  
373 providers can influence women’s ability to use contraception.(28) Bias and  
374 discrimination in the provision of contraceptive counselling and reproductive  
375 oppression and coercion among young women, low-income women, and women of  
376 color have been reported.(17, 29, 30) Ongoing research is needed to examine the  
377 intersection of economic, social, and political factors influencing women’s access to  
378 contraceptive services and, further, the types of contraception provided. This will  
379 safeguard universal access to PPC and advance health equity. Further, greater  
380 research is needed to understand whether the patterns of hormonal PPC provision  
381 seen in this study are universal, and what predicts these hormonal PPC provision  
382 patterns.

383

384 Barriers to high-quality contraceptive care may include limited health literacy of  
385 contraceptive options, limited access to healthcare, and receiving biased care.(17)  
386 Reproductive autonomy requires the development of a shared decision-making  
387 model that accounts for women’s fertility intentions. Fertility intentions refer to a  
388 women’s preference for birth spacing and desired number of children.(31) The  
389 development of a shared decision-making model that incorporates education  
390 regarding the risks associated with use, non-use, and discontinuation of PPC, and  
391 behavior change techniques that increase appropriate use and user knowledge of  
392 the risks associated with use, non-use, and discontinuation of PPC, will be critical to  
393 ensuring women’s fertility intentions are enacted. Thus, shared decision-making  
394 models aim to promote women-centered maternity care.

395

#### 396 **4.1 Strengths & Limitations**

397 This large-scale, population-based study based on robustly linked data focused on  
398 the gap in evidence regarding hormonal PPC provision in high-income country  
399 settings, but the interpretation of these results must be considered in light of  
400 limitations. This analysis was unable to record other methods of contraceptives—  
401 namely, non-hormonal and non-prescriptive methods—or the typical use versus ideal  
402 use of user-dependent hormonal contraceptives. Purely assessing the hormonal  
403 PPCs dispensed, as opposed to whether PPC was used, may underestimate the  
404 differences identified between the groups of women. Thus, the interpretation of our  
405 results considered this limitation and focused on prescribing behaviors and women’s  
406 preferences, as opposed to contraceptive effectiveness.

407

408 Limitations associated with the dataset include being unable to account for hormonal  
409 PPC supplied outside of the PBS, including women using a prescription from a  
410 private practice and women accessing free contraceptives from a health clinic.  
411 Women of higher socioeconomic status, for example, may use a hormonal PPC  
412 prescription from a private script for contraception that is not subsidized through the  
413 PBS. Additionally, the extent to which data on immediate postpartum long-acting  
414 reversible contraception is captured through the PBS is uncertain. However, we  
415 found higher provision of government-subsidized hormonal PPC amongst women  
416 who gave birth in a public hospital, and the population-level prevalence of long-  
417 acting reversible contraceptive use among all women in Australia is low–  
418 approximately 11%.(32) Furthermore, the majority of those who had a subsequent  
419 pregnancy within 12 months postpartum (n=19,640/27,457; 71.5%) were not  
420 provided government-subsidized hormonal PPC identified with our dataset. Hence,  
421 the limitation of our dataset would likely not account for this study's findings.

422

## 423 **4.2 Conclusion**

424 The provision of contraception during the postpartum period is an important and  
425 potentially life-saving intervention, given the maternal and infant health risks  
426 associated with short birth intervals. This study identified that most women in a high-  
427 income country were not provided with government-subsidized hormonal PPC within  
428 12 months postpartum. Additionally, women experiencing disadvantage were more  
429 likely to be provided with government-subsidized hormonal PPC compared to their  
430 counterparts. Future research should aim to better understand patterns of hormonal  
431 PPC provision and opportunities to enhance the rate of use and efficacy of PPC  
432 options women use.

433

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437

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442

**443 Conflicts of interest**

444 The authors have no competing interests to declare.

445

**446 Data statement**

447 Data may be obtained from a third party and are not publicly available. Data include  
448 deidentified patient data, and can be accessed upon application to Queensland's  
449 Perinatal Data Collection (please visit:

450 <https://www.health.qld.gov.au/hsu/collections/pdc>).

451

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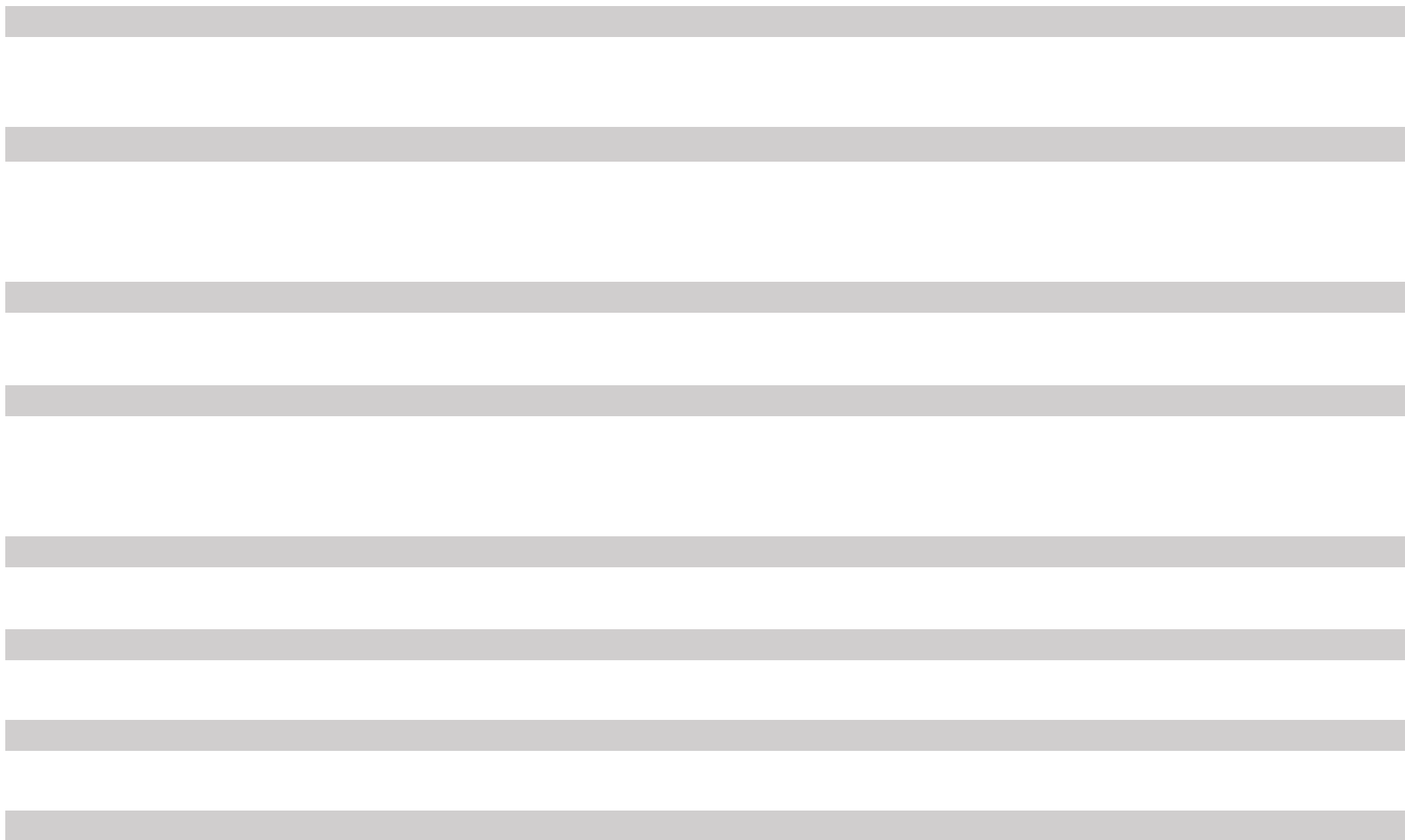
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549

## 550 Appendix 1 Item code used to define the hormonal contraceptive provision

<b>Item code</b>	<b>Description (Name, form &amp; strength and pack size)</b>	<b>Category</b>
8487Q	Etonogestrel 68 mg implant, 1	Subdermal hormonal implants
8633J	Levonorgestrel 52 mg intrauterine drug delivery system, 1 system	Hormonal intrauterine devices
3118D	Medroxyprogesterone acetate 150 mg/ml injection, 1 ml vial	Contraceptive injections
1967M	Norethisterone 350 microgram tablet, 4 x 28	Progestin-only pills
2913H	Levonorgestrel 30 microgram tablet, 112 tablets [4 x 28]	
1392G	Levonorgestrel 50 microgram + ethinylestradiol 30 microgram tablet [6] (&) levonorgestrel 75 microgram + ethinylestradiol 40 microgram tablet [5] (&) levonorgestrel 125 microgram + ethinylestradiol 30 microgram tablet [10] (&) inert substance tablet [7], 4 x 28	Combined oral contraceptive pills
1394J	Levonorgestrel 150 microgram + ethinylestradiol 30 microgram tablet [21] (&) inert substance tablet [7], 4 x 28	
1456P	Levonorgestrel 125 microgram + ethinylestradiol 50 microgram tablet [21] (&) inert substance tablet [7], 4 x 28	
2416E	Levonorgestrel 100 microgram + ethinylestradiol 20 microgram tablet [21] (&) inert substance tablet [7], 4 x 28	
2774B	Norethisterone 500 microgram + ethinylestradiol 35 microgram tablet [21] (&) inert substance tablet [7], 4 x 28	
2775C	Norethisterone 1 mg + ethinylestradiol 35 microgram tablet [21] (&) inert substance tablet [7], 4 x 28	
2776D	Norethisterone with ethinyloestradiol tablets 500/35ug 12, 1000/35ug 9 + 7 inert	
3179H	Norethisterone 1 mg + mestranol 50 microgram tablet [21] (&) inert substance tablet [7], 4 x 28	

551





553 Appendix 2 Associations between government-subsidized hormonal postpartum contraception provision within 12 months  
 554 postpartum and the demographic and clinical characteristics of women who gave birth in Queensland Australia between July 2012  
 555 and June 2018, using univariate logistic regression models

Characteristics	Any contraceptive provision <sup>a</sup>		Subdermal hormonal implant		Intrauterine device		Contraceptive injection		Oral contraceptive pill <sup>b</sup>	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Age (years)</b>										
<25	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
25-34	0.60	0.59-0.61	0.37	0.36-0.39	1.10	1.06-1.15	0.38	0.36-0.39	0.82	0.80-0.83
≥35	0.41	0.40-0.42	0.23	0.22-0.24	1.14	1.09-1.19	0.25	0.24-0.27	0.56	0.55-0.57
<b>BMI (kg/m<sup>2</sup>)</b>										
Underweight (<18.5)	0.95	0.92-0.98	1.36	1.28-1.44	0.70	0.65-0.75	1.53	1.43-1.64	0.89	0.86-0.92
Normal weight (18.5-24.9)	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Overweight (25.0-29.9)	1.19	1.17-1.21	1.27	1.23-1.32	1.13	1.09-1.17	1.39	1.34-1.45	1.07	1.05-1.09

Obese ( $\geq 30.0$ )	1.27	1.25-1.30	1.62	1.56-1.67	1.11	1.07-1.15	1.96	1.88-2.04	1.03	1.00-1.05
<b>Smoking status</b>										
Non-smoker	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Smoker	1.33	1.30-1.36	2.18	2.10-2.25	0.79	0.76-0.83	3.06	2.95-3.18	0.93	0.90-0.95
<b>Marital status</b>										
Never married	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Married/ de Facto / domestic partner	0.77	0.75-0.78	0.45	0.43-0.46	1.33	1.27-1.39	0.40	0.39-0.42	1.01	0.99-1.03
Widowed	0.59	0.44-0.80	0.42	0.21-0.75	0.74	0.31-1.46	1.16	0.69-1.83	0.66	0.46-0.94
Divorced/ separated	0.80	0.76-0.85	0.67	0.60-0.75	1.17	1.03-1.33	0.77	0.69-0.87	0.88	0.82-0.94
<b>Country of birth</b>										
Born in Australia	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Born outside of Australia	0.52	0.51-0.53	0.97	0.94-1.00	0.68	0.66-0.70	0.71	0.68-0.74	0.48	0.47-0.49
<b>Cultural identity</b>										
Indigenous	1.17	1.13-1.20	3.23	3.10-3.36	0.73	0.68-0.78	2.44	2.32-2.58	0.62	0.59-0.64
Non-indigenous	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
<b>Public or private hospital birth place</b>										
Public hospital	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Private hospital	0.69	0.68-0.70	0.34	0.33-0.35	1.27	1.23-1.30	0.25	0.24-0.26	0.85	0.84-0.86
<b>Socioeconomic status (SEIFA) quintiles</b>										
Quintile 1 (The most disadvantaged)	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Quintile 2	1.03	0.99-1.07	0.90	0.84-0.97	1.10	1.01-1.19	1.00	0.92-1.09	1.06	1.01-1.11
Quintile 3	0.88	0.85-0.91	0.84	0.80-0.88	0.90	0.84-0.96	1.09	1.02-1.16	0.91	0.88-0.95
Quintile 4	0.82	0.80-0.84	0.54	0.52-0.57	1.00	0.94-1.06	0.71	0.67-0.76	1.01	0.98-1.04
Quintile 5 (The most advantaged)	0.60	0.58-0.61	0.41	0.39-0.43	0.93	0.88-0.98	0.42	0.39-0.45	0.76	0.73-0.78
<b>Gravidity</b>										
No previous pregnancy	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
1 previous pregnancy	1.02	1.00-1.04	1.06	1.02-1.09	2.03	1.95-2.11	1.11	1.06-1.17	0.87	0.85-0.89
2 previous pregnancy	0.97	0.95-0.99	1.07	1.03-1.11	2.19	2.10-2.29	1.35	1.28-1.42	0.77	0.75-0.78
$\geq 3$ previous pregnancy	0.86	0.85-0.88	1.15	1.10-1.19	2.00	1.92-2.09	1.78	1.70-1.86	0.62	0.61-0.63

<b>Previous termination</b>										
Yes	1.04	0.95-1.15	1.02	0.84-1.22	1.60	1.36-1.86	0.98	0.77-1.22	0.91	0.82-1.01
No	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
<b>Private health insurance member</b>										
Yes	0.80	0.79-0.81	0.26	0.25-0.27	1.58	1.53-1.62	0.17	0.16-0.18	1.01	0.99-1.02
No	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref

Note: OR = Odds ratio, 95% CI = 95% Confidence interval, ref = reference population,

<sup>a</sup>Any contraceptive provision refers to the provision of a Pharmaceutical Benefits Scheme-listed hormonal contraceptive, inclusive of subdermal hormonal implants, intrauterine devices, contraceptive injections, and oral contraceptive pills.

<sup>b</sup>Oral contraceptive pill is inclusive of combine oral contraceptive pill and progestin-only pill.

557 Appendix 3 Associations between government-subsidized hormonal postpartum contraception provision within 12 months  
 558 postpartum and the demographic and clinical characteristics of women who gave birth in Queensland Australia between July 2012  
 559 and June 2018, using multivariate logistic regression models

Characteristics	Any contraceptive provision <sup>a</sup>		Subdermal hormonal implant		Intrauterine device		Contraceptive injection		Oral contraceptive pill <sup>b</sup>	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
<b>Age (years)</b>										
<25	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
25-34	0.67	0.65-0.68	0.51	0.49-0.53	0.80	0.77-0.84	0.51	0.49-0.53	0.87	0.85-0.89
≥35	0.48	0.47-0.50	0.23	0.31-0.35	0.71	0.67-0.75	0.37	0.35-0.39	0.67	0.65-0.69
<b>BMI (kg/m<sup>2</sup>)</b>										
Underweight (<18.5)	0.88	0.85-0.90	1.03	0.97-1.09	0.76	0.71-0.81	1.13	1.05-1.21	0.90	0.86-0.93
Normal weight (18.5-24.9)	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Overweight (25.0-29.9)	1.15	1.13-1.17	1.19	1.15-1.24	1.21	1.06-1.13	1.26	1.21-1.31	1.07	1.05-1.09
Obese (≥30.0)	1.17	1.15-1.20	1.39	1.34-1.44	1.08	1.04-1.12	1.55	1.49-1.62	1.00	0.98-1.02
<b>Smoking status</b>										
Non-smoker	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Smoker	1.07	1.05-1.10	1.22	1.17-1.26	0.83	0.79-0.87	1.62	1.55-1.69	0.91	0.89-0.94
<b>Marital status</b>										
Never married	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Married/ de Facto / domestic partner	1.01	0.99-1.03	0.81	0.78-0.84	1.12	1.07-1.18	0.74	0.71-0.77	1.13	1.11-1.16
Widowed	0.88	0.64-1.19	0.76	0.37-1.38	0.62	0.26-1.23	1.98	1.16-3.18	0.89	0.61-1.27
Divorced/ separated	1.06	0.99-1.12	0.94	0.84-1.05	1.05	0.92-1.19	0.90	0.80-1.02	1.13	1.05-1.2
<b>Country of birth</b>										
Born in Australia	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Born outside of Australia	0.57	0.56-0.58	1.34	1.29-1.38	0.73	0.70-0.75	0.94	0.90-0.98	0.47	0.46-0.48
<b>Cultural identity</b>										
Indigenous	0.77	0.74-0.79	1.76	1.68-1.84	0.75	0.70-0.81	1.04	0.98-1.10	0.50	0.48-0.52
Non-indigenous	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
<b>Public or private hospital birth place</b>										

Public hospital	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Private hospital	0.83	0.81-0.85	0.76	0.72-0.80	0.96	0.92-1.00	0.73	0.68-0.78	0.84	0.82-0.86
<b>Socioeconomic status (SEIFA) quintiles</b>										
Quintile 1 (The most disadvantaged)	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Quintile 2	1.07	1.03-1.12	1.01	0.94-1.09	1.06	0.98-1.15	1.13	1.03-1.23	1.06	1.01-1.11
Quintile 3	1.00	0.96-1.03	0.95	0.90-1.00	0.91	0.86-0.97	1.28	1.20-1.36	0.99	0.96-1.02
Quintile 4	0.94	0.91-0.97	0.73	0.70-0.77	0.97	0.92-1.03	1.02	0.96-1.08	1.03	1.00-1.07
Quintile 5 (The most advantaged)	0.84	0.81-0.86	0.75	0.71-0.79	0.92	0.87-0.98	0.90	0.84-0.97	0.89	0.86-0.92
<b>Gravidity</b>										
No previous pregnancy	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
1 previous pregnancy	1.07	1.05-1.08	1.17	1.13-1.22	2.07	1.99-2.15	1.23	1.17-1.29	0.88	0.86-0.90
2 previous pregnancy	1.02	1.00-1.04	1.20	1.15-1.25	2.32	2.22-2.43	1.47	1.40-1.55	0.78	0.76-0.80
≥3 previous pregnancy	0.92	0.90-0.94	1.22	1.16-1.27	2.33	2.23-2.44	1.77	1.68-1.86	0.66	0.64-0.68
<b>Previous termination</b>										
Yes	1.09	0.99-1.05	1.15	0.79-1.38	1.16	0.99-1.35	0.93	0.73-1.17	1.01	0.91-1.13
No	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
<b>Private health insurance member</b>										
Yes	1.03	1.00-1.05	0.49	0.47-0.52	1.70	1.63-1.77	0.35	0.32-0.38	1.06	1.03-1.08
No	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref

Note: aOR = adjusted odds ratio, 95% CI = 95% Confidence interval, ref = reference population.

<sup>a</sup>Any contraceptive provision refers to the provision of a Pharmaceutical Benefits Scheme-listed hormonal contraceptive, inclusive of subdermal hormonal implants, intrauterine devices, contraceptive injections, and oral contraceptive pills.

<sup>b</sup>Oral contraceptive pill is inclusive of combine oral contraceptive pill and progestin-only pill.