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# BMJ Open

## Assessing Australian women's knowledge and knowledge preferences about long-term health after hypertensive disorders of pregnancy: a survey study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-042920
Article Type:	Original research
Date Submitted by the Author:	21-Jul-2020
Complete List of Authors:	Roth, Heike; University of Technology Sydney, Faculty of Health Homer, Caroline; University of Technology Sydney, Centre for Midwifery, Child and Family Health; Burnet Institute, Maternal and Child Health LeMarquand, Grace; University of New South Wales Roberts, Lynne M.; Saint George Hospital, Women's and Children's Health; University of New South Wales, Medicine Hanley, Lisa; Saint George Hospital, Maternity Consumer Brown, Mark; Saint George Hospital, Renal Medicine; University of New South Wales, St George Clinical School Henry, Amanda ; University of New South Wales Faculty of Medicine, Women's and Children's Health
Keywords:	Hypertension < CARDIOLOGY, Maternal medicine < OBSTETRICS, PRIMARY CARE

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# 1           **Assessing Australian women’s knowledge and** 2           **knowledge preferences about long-term health after** 3           **hypertensive disorders of pregnancy: a survey study**

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21  
22    **Word Count:** (excl. title page, abstract, references, figures and tables): 3650

23  
24    **Keywords:** Cardiovascular risk, women, preeclampsia, gestational  
25    hypertension, long-term cardiovascular health, preventive health

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3 **27 ABSTRACT**  
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6 **28**

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8 **29 Objective(s):** To (a) assess women's current knowledge regarding long-term  
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10 cardiovascular health after hypertensive disorders of pregnancy (b) elicit  
11  
12 women's preferred educational content and format regarding health after  
13  
14 hypertensive disorders of pregnancy.  
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17 **33 Design and setting:** A custom-created online survey exploring Australian  
18  
19 women's knowledge about long-term health after hypertensive disorders of  
20  
21 pregnancy, distributed through consumer groups and social media.  
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24 **36 Participants:** 266 women with (n=174) or without (n=92) a history of  
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26 hypertensive disorders of pregnancy.  
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29 **38 Primary and secondary outcome measures:** 1) Proportion of women  
30  
31 identifying long-term health risks after hypertensive disorder of pregnancy using  
32  
33 a 10-point risk knowledge score with 0-4 'low', 4.1-7.0 'moderate' and 7.1-10  
34  
35 'high'. 2) Exploration of preferred content, format and distribution of educational  
36  
37 material post hypertensive disorder of pregnancy.  
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40 **43 Results:** Knowledge scores about health after hypertensive disorder of  
41  
42 pregnancy were moderate in groups with and without a history of the disorder.  
43  
44 Knowledge was highest regarding risk of recurrent hypertensive  
45  
46 disorders in a subsequent pregnancy, 'moderate' for chronic hypertension and  
47  
48 heart attack, 'moderate' and 'low' regarding risk of heart disease and 'low' for  
49  
50 diabetes and renal disease. Only 36% of all participants were aware that risks  
51  
52 start within 10 years after the affected pregnancy. The majority of respondents  
53  
54 with a history of hypertensive disorder of pregnancy (76%) preferred receiving  
55  
56 information about long-term health 0-6 months postpartum from a healthcare  
57  
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52 provider (80%), key organisations (60%), social media (47%) and  
53 brochures/flyers (43%).

54 **Conclusion(s):** Women's knowledge regarding health risks after hypertensive  
55 disorder of pregnancy was 'moderate', although with important disease-specific  
56 gaps such as increased risk of diabetes. Most women wanted to be informed  
57 about their long-term health from a healthcare provider.

58

## 59 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

- 60 • Consumer co-created survey exploring health knowledge after hypertensive  
61 pregnancy.
- 62 • For the first time survey results include findings from women with a history of  
63 gestational hypertension as well as from women without a history of hypertensive  
64 disorder of pregnancy.
- 65 • Recruitment from groups with potentially greater baseline knowledge may bias  
66 results, although substantive knowledge gaps still found.
- 67 • Although surveys were available in English, Arabic and Mandarin, there remains  
68 potential sub-optimal coverage of culturally and linguistically diverse groups.

69

## 70 **INTRODUCTION**

71 Hypertensive disorders of pregnancy (HDP) include chronic hypertension (CH),  
72 preeclampsia (PE) and gestational hypertension (GH) and complicate 5-10% of  
73 pregnancies<sup>1</sup>. PE is a multi-system disorder characterised by new-onset  
74 hypertension after 20 weeks' gestation and involvement of one or more other  
75 organ systems and/or the fetus<sup>2 3</sup>. GH is new-onset hypertension after 20

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3 76 weeks' gestation without any other complications, and apart from increased risk  
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5 77 of progression to PE<sup>2 3</sup>, is not associated with adverse pregnancy outcomes.  
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7 78 However, both conditions are associated with long-term cardiovascular  
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10 79 sequelae<sup>4 5</sup>. CH is defined as hypertension that is confirmed before pregnancy  
11  
12 80 or before 20 completed weeks gestation, which may worsen during pregnancy  
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14 81 and/or on which preeclampsia may be superimposed<sup>2</sup>. Globally, cardiovascular  
15  
16 82 disease (CVD) is one of the leading causes of death in women,<sup>6</sup> and for women  
17  
18 83 who have experienced an HDP, it is 2-3 times higher compared with those who  
19  
20 84 did not<sup>4 7 8</sup>. This risk of premature death is present within 10 years after the  
21  
22 85 affected pregnancy<sup>7 9 10</sup> and remains after adjusting for the presence of other  
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24 86 cardiovascular risk factors.  
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30 88 Both Australian and international societies, including the Society of Obstetric  
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32 89 Medicine of Australia and New Zealand (SOMANZ) and the International  
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34 90 Society for the Study of Hypertension in Pregnancy (ISSHP), recommend that  
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36 91 women and healthcare providers (HCP) are provided with information about  
37  
38 92 HDP and later CVD<sup>2 3</sup>. This includes recommending that women have a clinical  
39  
40 93 review several months postpartum, and regular general practitioner (GP) follow-  
41  
42 94 up to monitor blood pressure, fasting lipids and blood sugar<sup>2</sup>. Adopting a  
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44 95 healthy lifestyle with maintenance of an ideal weight and regular aerobic  
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46 96 exercise is emphasised<sup>2 3</sup>. The aims of this study were to (a) explore Australian  
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48 97 women's current knowledge on the topic of long-term CVD health after any  
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50 98 HDP, not just PE (b) elicit women's preferred educational content and format  
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52 99 regarding health after HDP, as a basis for creating tailored information and  
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58 100 health advice for women after HDP.  
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6 102 **METHOD**

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9 103 A national survey of women with and without a history of HDP was conducted,  
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11 104 using a custom-created, face-validated online survey. Ethical approval was  
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13 105 provided by the relevant Human Research Ethics Committee (HREC  
14  
15 106 18/POWH/326, REGIS 2019/PID05668).  
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21 108 **Patient and Public involvement**

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23 109 As a validated instrument to assess women's knowledge was unavailable, a  
24  
25 110 survey was custom designed. Initially, women with a history of HDP, comprising  
26  
27 111 nine volunteers from the *Postpartum physiology, psychology and paediatric*  
28  
29 112 *follow up study (P4 Study)*<sup>11</sup> and Australian Action on Preeclampsia (AAPEC),  
30  
31 113 were invited to take part in group interviews which addressed the possible  
32  
33 114 content and design of the survey, tested the survey for face validity and  
34  
35 115 provided feedback for improvement. The topics discussed during the interviews  
36  
37 116 were sourced from findings from a scoping literature review<sup>12</sup> and further  
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39 117 complemented by questions specifically exploring the Australian context for  
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41 118 women experiencing HDP. Following feedback, the survey was modified. The  
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43 119 survey was made available in English, Arabic and Mandarin.  
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51 121 **Data collection**

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53 122 The final survey was targeted at women in Australia, 18 years and older with a  
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55 123 history of pregnancy in the last 3 years. The online survey, using  
56  
57 124 SurveyMonkey™, was open from July to August 2019. Survey distribution  
58  
59 125 occurred through the P4 study participants, organisations such as AAPEC,  
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3 126 maternity consumer groups as well as via the project's consumer representative  
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5 127 and social media (Facebook and Twitter) including multicultural networks in  
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7 128 order to reach Arabic and Mandarin speaking communities.  
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### 11 12 130 **The data collection instrument**

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14 131 The survey for women (Appendix 1) explored demographic details, assessed  
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16 132 obstetric history, history of HDP and other medical history including family  
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18 133 history. The survey was tailored to women's self-reported HDP history (GH, PE,  
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20 134 CH with or without worsening in pregnancy or superimposed PE, no  
21  
22 135 hypertension history), with women given definitions of HDP conditions early in  
23  
24 136 the survey to aid their self-report. Questions focused on knowledge of risk after  
25  
26 137 pregnancy, provision of care and education following birth and what information  
27  
28 138 and education women would like to receive. Women with a history of HDP were  
29  
30 139 asked to classify their risk of various long-term health outcomes as greater, less  
31  
32 140 than or equal to that of a woman with a normotensive pregnancy. Women after  
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34 141 normotensive pregnancy were also asked to classify whether they believed  
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36 142 women who had had HDP were at greater, lesser, or equal risk. The survey  
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38 143 included two 'distractor' conditions not known to have an increased risk after  
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40 144 HDP (breast cancer and seizures) to elicit negative answers and ascertain  
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42 145 whether women could identify what they were not at increased risk of after HDP  
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44 146 as well as what they were at risk of. At survey completion, women were  
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46 147 provided with a correct risk profile summary and a link to further information.  
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### 55 56 149 **Data Analysis**

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3 150 Quantitative survey analysis was undertaken using SPSS Version 25 (SPSS  
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5 151 Statistics for Windows, Armonk, NY). Demographic data and responses to  
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7 152 individual questions were analysed descriptively. To examine difference in  
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9 153 knowledge levels amongst the targeted subgroups, (GH, PE, CH in pregnancy,  
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11 154 no hypertension history) responses regarding HDP and future health risks were  
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13 155 compared using Chi-squared testing or likelihood ratio for categorical data (as  
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15 156 appropriate to subgroup sample size) and one-way ANOVA testing for  
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17 157 continuous data. A *p* value of <0.05 was considered statistically significant.  
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24 159 A knowledge score was created for the risk matrix, whereby 1 point was  
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26 160 allocated to the correct answer, 0 for the incorrect answer, 0 for 'I do not know'  
27  
28 161 and 0 for no answer/left blank. A mean score for each risk factor was calculated  
29  
30 162 and a scale of 'low', 'moderate' and 'high' knowledge was established. The  
31  
32 163 ranking classifications were divided into three score categories. For individual  
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34 164 risk mean scores, 'low knowledge' equated to a mean of 0.00-0.40, 'moderate  
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36 165 knowledge' was 0.41-0.70 and 'high knowledge' a mean of 0.71-1.00. An overall  
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38 166 mean score out of 10 (as there were 10 conditions) was given for the HDP and  
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40 167 non-HDP groups and were classified as 'low' 'moderate' or 'high' using the  
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42 168 same mean ranges as were used for the individual conditions. Categorical  
43  
44 169 analysis for proportions of each knowledge group ('high', 'moderate' and 'low')  
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46 170 was also conducted to provide a further perspective.  
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## 52 53 54 172 **RESULTS**

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57 173 In total, 308 survey responses were received (Figure 1). Forty-two were  
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59 174 excluded: 40 for discontinuing the survey and not answering the question  
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175 asking about their perception of lower/same/higher risk with regards to 10  
 176 health conditions, and two with 'CH only' (no worsening hypertension or  
 177 superimposed PE in pregnancy). Of 266 included responses, 174 (65%) women  
 178 had a history of any HDP (HDP group) and 92 (35%) did not (non-HDP group).  
 179 The HDP group consisted of 15 women with GH only (9%), 143 women with PE  
 180 only (82%) and 16 women with CH plus superimposed pregnancy hypertension  
 181 or PE (9%; will be known as CH). Of the HDP group, 123 (71%) had their most  
 182 recent experience with HDP less than three years prior (32% <1 year prior and  
 183 39% 1-3 years prior).

184

185 Most respondents were in the 26-35 or 36-45 year age groups (91%), 89% were  
 186 of Caucasian ethnicity, 90% pursued education beyond secondary school and  
 187 96% were in a relationship (Table 1). HDP women were more likely to be  
 188 Caucasian, to have a history of diabetes, renal problems, be overweight and to  
 189 have at least one additional cardiovascular risk factor than non-HDP women  
 190 (Supplementary Table 1), and less likely to be university-educated. Half of all  
 191 participants were sourced through social media (50%), with most of the  
 192 remainder (45%) recruited via the P4 study (8% of HDP women, 46% of non-  
 193 HDP women) and AAPEC (35% of HDP women).

194  
 195 Table 1: Respondent demographics

	GH	PE	CH	Total HDP	Non HDP	Total	P
	n=15	n=143	n=16	n=174	n=92	n=266	HDP vs non-HDP
	n (%)*	n (%)*	n (%)*	n (%)*	n (%)*	n (%)*	
AGE							
18-25	2 (13)	8 (6)	0 (0)	10 (6)	2 (2)	12 (5)	0.157
26-35	5 (33)	68 (48)	8 (50)	81 (47)	36 (39)	117 (44)	0.246
36-45	8 (53)	60 (42)	8 (50)	76 (44)	50 (54)	126 (47)	0.097

45+	0 (0)	7 (5)	0 (0)	7 (4)	3 (3)	10 (3)	0.753
prefer not to answer	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (0)	-
<b>TOTAL</b>	15 (100)	143 (101)	16 (100)	174 (101)	92 (99)	266 (99)	
<b>ETHNICITY</b>							
Caucasian	14 (93)	138 (97)	13 (81)	165 (95)	71 (77)	236 (89)	<0.001
Asian	1 (7)	3 (2)	1 (6)	5 (3)	18 (20)	23 (9)	<0.001
Other <sup>1</sup>	0 (0)	2 (1)	2 (13)	4 (2)	3 (8)	7 (3)	0.646
<b>TOTAL</b>	15 (100)	143 (100)	16 (100)	174 (100)	92 (100)	266 (101)	
<b>HIGHEST EDUCATIONAL ATTAINMENT</b>							
Secondary School	1 (7)	20 (14)	2 (13)	23 (13)	2 (2)	25 (9)	0.003
Diploma/Trade Certificate	5 (33)	47 (33)	8 (50)	60 (35)	9 (10)	69 (26)	<0.001
University Degree	9 (60)	75 (52)	6 (38)	90 (52)	81 (88)	171 (64)	<0.001
Prefer not to answer	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	1 (0)	-
<b>TOTAL</b>	15 (100)	143 (100)	16 (101)	174 (101)	92 (100)	266 (99)	
<b>RELATIONSHIP STATUS</b>							
In a relationship	15 (100)	133 (93)	14 (88)	162 (93)	92 (100)	254 (96)	0.001
Not in a relationship	0 (0)	9 (6)	2 (13)	11 (6)	0 (1)	11 (4)	
Prefer not to answer	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	1 (0)	-
<b>TOTAL</b>	15 (100)	143 (100)	16 (101)	174 (100)	92 (100)	266 (100)	
<b>RECRUITED TO SURVEY VIA</b>							
P4 Newsletter	2 (13)	11 (8)	1 (6)	14 (8)	42 (46)	56 (21)	<0.001
AAPEC	1 (7)	57 (40)	3 (19)	61 (35)	1 (1)	62 (23)	<0.001
Social Media	12 (80)	74 (52)	11 (69)	97 (56)	37 (40)	134 (50)	0.016
Other <sup>2</sup>	0 (0)	1 (1)	1 (6)	2 (1)	12 (13)	14 (5)	<0.001
<b>TOTAL</b>	15 (100)	143 (101)	16 (100)	174 (100)	92 (100)	266 (99)	

\* Percentages may not add to 100% as figures are rounded to whole numbers only

<sup>1</sup> Other: Indigenous Australian (n=1), Polynesian or Maori (n=2), mixed ethnicity (n=4).

<sup>2</sup> Other: Friend (n=11), ACM (n=1), Clinic (n=1), Maternity Consumer group other than AAPEC (n=1).

PE = preeclampsia GH = gestational hypertension CH = chronic hypertension, worsening in pregnancy and/or superimposed preeclampsia P4= Postpartum Physiology, Psychology, and Paediatric Study AAPEC= Australian Action on Preeclampsia ACM= Australian College of Midwives.

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205 Table 2: Means of risk factor knowledge of women

	GH	PE	CH	P	P	P	HDP	Non-HDP	P HDP vs non-HDP
	n=15	n=14 3	n=16	HDP GH vs PE vs CH	GH vs PE	CH vs PE	n=174	n=92	
Chronic Hypertension	0.53	0.78	0.81	0.10	0.10	0.49	0.76	0.62	0.023
Diabetes	0.27	0.24	0.31	0.84	0.72	0.30	0.25	0.35	0.115
Renal Disease	0.27	0.54	0.69	0.06	0.044	0.25	0.53	0.21	<0.001
Heart Attack	0.53	0.69	0.75	0.40	0.14	0.23	0.68	0.52	0.014

Repeat HDP	0.87	0.90	0.94	0.81	0.52	0.27	0.90	0.71	<0.001
Stroke	0.47	0.62	0.81	0.14	0.37	0.10	0.63	0.53	0.144
Heart Disease	0.47	0.69	0.75	0.17	0.12	0.29	0.68	0.50	0.005
PVD	0.33	0.50	0.50	0.46	0.42	0.98	0.32	0.45	<0.001
Breast Cancer*	0.20	0.52	0.31	0.026	0.013	0.12	0.47	0.65	0.004
Seizures*	0.27	0.29	0.13	0.39	0.74	0.10	0.27	0.44	0.009
<b>OVERALL MEAN KNOWLEDGE SCORE (OUT OF 10)</b>	<b>4.2</b>	<b>5.8</b>	<b>6.0</b>	0.09	0.19	0.80	<b>5.6</b>	<b>5.2</b>	0.21

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy, PVD= Peripheral Vascular Disease

\* Breast cancer and seizures are distractors within the survey. These were included despite being conditions that women after HDP are not at greater risk of.

The colour coding in addition to the mean scores aims to highlight the areas of 'low' (red), 'moderate' (orange) and 'high' (green) knowledge.

MEAN SCORE	
LOW	0-0.40
MODERATE	0.41-0.70
HIGH	0.71-1

214

215 Average knowledge scores are shown in Table 2 and detailed results on which  
 216 these scores are based on are shown in Supplementary Tables 2-11. Overall  
 217 knowledge of the 10 conditions in the survey was 'moderate' for both groups  
 218 (5.6/10 amongst HDP and 5.2/10 amongst non-HDP, p=0.21), with 33% in both  
 219 groups having "high" overall knowledge, 32% and 40% respectively having "low"  
 220 overall knowledge (Supplementary Table 12). Women with a history of HDP had  
 221 'high' knowledge with regards to HDP recurrence in a subsequent pregnancy  
 222 (0.90) and CH (0.76); and 'moderate' knowledge regarding HDP's increased  
 223 chance of conditions such as heart attack (0.68), heart disease (0.68) and  
 224 stroke (0.63). Women without HDP history had 'high' knowledge (0.71) for HDP  
 225 recurrence in a subsequent pregnancy. The same group of women had  
 226 moderate knowledge of chronic hypertension (0.62) and stroke (0.53). Lowest  
 227 knowledge across both groups was around the risk of future diabetes (0.25

228 HDP group and 0.35 for non-HDP group). Further 'low' scoring conditions were  
 229 peripheral vascular disease (PVD) and renal disease. HDP women for most  
 230 conditions had significantly higher knowledge than the non-HDP group,  
 231 however the non-HDP group were more likely to correctly identify that there is  
 232 not an increased risk of the two 'distractor' conditions after HDP.

233

234 Table 3 shows knowledge score breakdown by recency of pregnancy. In the  
 235 subgroup of HDP women who experienced PE (n=143), average knowledge  
 236 was similar amongst women who experienced HDP within the last three years  
 237 (5.8/10), compared to those who experienced HDP more than three years ago  
 238 (5.7/10).

239

240 Table 3: Means of risk factor knowledge of women with a history of  
 241 preeclampsia listed by time elapsed since HDP

	PE n=143	PE n=143					P	PE n=143		P	
	ALL COMBI NED	0 mont h- 6 mont h	6 mont h - 12 mont h	1-2 years	2-3 years	>3 year s		betw een grou ps	UND ER 3		OV ER 3
		n=26	n=19	n=32	n=20	n=46			n=97		n=46
Chronic Hypertension	0.78	0.77	0.89	0.78	0.80	0.72	0.648	0.80	0.72	0.272	
Diabetes	0.24	0.23	0.42	0.31	0.10	0.20	0.144	0.27	0.20	0.350	
Renal Disease	0.54	0.50	0.74	0.41	0.65	0.52	0.169	0.55	0.52	0.784	
Heart Attack	0.69	0.58	0.89	0.66	0.70	0.67	0.248	0.69	0.67	0.841	
Repeat HDP	0.90	0.88	0.89	0.94	0.95	0.85	0.675	0.92	0.85	0.253	
Stroke	0.62	0.65	0.68	0.50	0.65	0.65	0.619	0.61	0.65	0.616	

Heart Disease	0.69	0.62	0.79	0.63	0.65	0.76	0.498	0.66	0.76	0.209
PVD	0.50	0.54	0.53	0.53	0.40	0.50	0.895	0.51	0.50	0.954
Breast Cancer*	0.52	0.46	0.37	0.63	0.40	0.59	0.245	0.48	0.59	0.255
Seizures*	0.29	0.15	0.16	0.41	0.45	0.26	0.066	0.30	0.26	0.641
<b>OVERALL MEAN KNOWLEDGE SCORE OUT OF 10</b>	<b>5.8</b>	<b>5.4</b>	<b>6.4</b>	<b>5.8</b>	<b>5.8</b>	<b>5.7</b>	0.825	<b>5.8</b>	<b>5.7</b>	0.890

242 The colour coding in addition to the mean scores aims to highlight the areas of 'low' (red),  
 243 'moderate' (orange) and 'high' (green) knowledge.

MEAN SCORE	
LOW	0-0.40
MODERATE	0.41-0.70
HIGH	0.71-1

244

245 Of the HDP women, only 32% were aware that the cardiovascular conditions  
 246 may start manifesting within 10 years after an affected pregnancy, compared  
 247 with 45% of women in the non-HDP group (p=0.036). About a third in each  
 248 group (30% HDP, 36% non-HDP) were unsure about timing of risk rise/when  
 249 health conditions manifest (Supplementary Table 13).

250

251 Women with HDP history were asked about their personal experience of risk  
 252 discussion with healthcare providers (Table 4). The most frequent discussions  
 253 about future health were regarding HDP in subsequent pregnancies (45%), risk  
 254 of chronic hypertension (43%), and 'No discussion' (37%). Risk discussions  
 255 were no more likely to have occurred in women with HDP less than 3 years ago  
 256 or over 3 years ago.

257 Table 4: Proportion of conditions discussed when addressing future risk  
 258 (multiple answers collected) within and over 3 years since last HDP

	<b>GH n=15</b>	<b>PE n=143</b>	<b>CH n=16</b>	<b>TOTAL n=174</b>	<b>OVERALL TOTAL n=174</b>	<b>P &lt; vs &gt; 3 yrs since</b>



	<3 yrs n=13	>3 yrs n=2	<3 yrs n=97	>3 yrs n=46	<3 yrs n=13	>3 yrs n=3	<3 yrs n=123	>3 yrs n=51	n (%)	HDP
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)		
HDP next pregnancy	3 (23)	1 (50)	47 (48)	21 (46)	5 (38)	2 (67)	55 (45)	24 (47)	79 (45)	0.777
Chronic Hypertension	4 (31)	1 (50)	47 (48)	16 (35)	4 (31)	2 (67)	55 (45)	19 (37)	74 (43)	0.365
<b>No discussion</b>	<b>7 (54)</b>	<b>1 (50)</b>	<b>33 (34)</b>	<b>17 (37)</b>	<b>5 (38)</b>	<b>1 (33)</b>	<b>45 (37)</b>	<b>19 (37)</b>	<b>64 (37)</b>	<b>0.934</b>
Lifestyle changes	4 (31)	0 (0)	26 (27)	6 (13)	2 (15)	2 (67)	32 (26)	8 (16)	40 (23)	0.140
Heart Attack	1 (8)	0 (0)	20 (21)	6 (13)	1 (8)	1 (33)	22 (18)	7 (14)	29 (17)	0.503
Renal Disease	1 (8)	0 (0)	20 (21)	3 (7)	2 (15)	1 (33)	23 (19)	4 (8)	27 (16)	0.072
Stroke	1 (8)	1 (50)	18 (19)	4 (9)	1 (8)	1 (33)	20 (16)	6 (12)	26 (15)	0.449
Peripheral vascular disease	0 (0)	0 (0)	15 (15)	5 (11)	1 (8)	0 (0)	16 (13)	5 (10)	21 (12)	0.555
Cannot remember	1 (8)	0 (0)	4 (4)	2 (4)	1 (8)	0 (0)	6 (5)	2 (4)	8 (5)	0.781

\*Table represents frequency of each option; percentages add to over 100% as women were asked to select any/all that applied. PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

When asked about preferences of the timing of a future risk discussion, the majority (76%) of women wanted a discussion 0-6 months postpartum. The topics women most wished to discuss (Table 5) are ‘impact on my children from the pregnancy affected by HDP’ (73%), ‘signs and symptoms of the conditions’ (67%), ‘when does risk rise’ (54%) and ‘risk reduction for subsequent pregnancy’ (54%). Women’s preference for receiving information on long-term health after HDP is via a medical professional (80%), through key organisations (60%) and social media (47%).

Table 5: HDP women’s preferences for content and distribution of information/education on future risk after HDP (multiple answers collected) in order of preference

	GH	PE	CH	Total HDP
	n=15	n=143	n=16	n=174
	n (%)*	n (%)*	n (%)*	n (%)*



PREFERENCE OF DISCUSSION TOPICS				
Impact on my children from the pregnancy affected by HDP	11 (73)	115 (80)	10 (63)	136 (73)
Signs and Symptoms of the conditions	12 (80)	101 (71)	11 (69)	124 (67)
Risk reduction for subsequent pregnancy	6 (40)	88 (62)	7 (44)	101 (54)
When does the risk rise	6 (40)	87 (61)	8 (50)	101 (54)
Statistics	6 (40)	86 (60)	6 (38)	98 (53)
Reducing risk behaviours (diet, exercise, smoking cessation)	6 (40)	80 (56)	5 (31)	91 (49)
Where to find information	6 (40)	73 (51)	2 (13)	81 (44)
How to discuss the matter with my Healthcare provider	4 (27)	57 (40)	4 (25)	65 (35)
PREFERENCE OF DISTRIBUTION				
Medical professionals	11 (73)	117 (82)	12 (75)	140 (80)
Key organisations	8 (53)	87 (61)	10 (63)	105 (60)
Social Media	6 (40)	73 (51)	3 (19)	82 (47)
Brochures/Flyers	6 (40)	64 (45)	5 (31)	75 (43)
Online Videos	3 (20)	35 (24)	4 (25)	42 (24)
Podcast/Media	2 (13)	33 (23)	4 (25)	39 (22)

276 \*Table represents frequency of each option; percentages add to over 100% as women were  
 277 asked to select any/all that applied. PE = preeclampsia GH = gestational hypertension CH= chronic  
 278 hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive  
 279 disorder of pregnancy  
 280

## 281 DISCUSSION

282 This study found overall, ‘moderate’ knowledge of health conditions after HDP  
 283 amongst both HDP and non-HDP women. Amongst women with a history of  
 284 HDP, highest knowledge was identified with regards to future risk of  
 285 hypertension and repeat HDP in subsequent pregnancies. Conversely,  
 286 knowledge of future risk of diabetes was low, as was knowledge of the  
 287 “distractor” conditions among HDP women particularly. Diabetes as a future risk  
 288 factor post HDP has previously not been reported on in studies of women’s  
 289 knowledge, and our findings suggest this is an important knowledge gap to  
 290 address.

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292 Other novel aspects of our study are inclusion of women who had a history of  
 293 GH as well as those with a history of PE, and assessing knowledge of non-HDP

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3 294 women's knowledge. Women after HDP had somewhat higher knowledge of  
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5 295 most health risks than the non-HDP group, however non-HDP group also had  
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7 296 better knowledge of some aspects such as timing of risk increase. However,  
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9 297 both groups' knowledge of the early increase in risk was low, adding further  
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11 298 concern and reason to address the knowledge gap. When looking at the  
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13 299 proportion of participants scoring "high", these were equal between the HDP  
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15 300 (33%) and non-HDP groups (33%), whilst proportions scoring "low" were similar  
16  
17 301 enough (32% HDP versus 40% non-HDP) to not to show statistical significance.  
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19 302 This further highlights that the HDP group remain underinformed about their  
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21 303 increased CVD risk.  
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28 305 A further important finding was that many HDP women were not made aware of  
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30 306 future health risks, with 37% of HDP women reporting to have had 'no  
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32 307 discussion' about their increased long-term risk. Concerningly, women with  
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34 308 more recent HDP were no more likely than women with HDP>3 years ago to  
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36 309 report having risks discussed. This finding suggests risk discussions may not  
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38 310 have improved in recent years despite updated guidelines emphasising long-  
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40 311 term health<sup>2 3</sup>, and that the extensive evidence regarding long-term implications  
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42 312 for women after HDP continues to be lost in the translation of research to  
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44 313 practice.  
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51 315 Women's knowledge after GH has not been previously reported as far as we  
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53 316 are aware even though GH has similar frequency and similar future CVD risk as  
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55 317 PE<sup>4 13</sup>. Although only 9% of our sample were GH, this group had somewhat  
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57 318 lower knowledge than the PE and CH groups regarding conditions after HDP  
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3 319 (although mostly not reaching statistical significance). Over half reported  
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5 320 receiving no discussion of health risks after GH. This suggests substantive  
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7 321 knowledge gaps after GH to address in both women and healthcare providers.  
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12 323 International studies exploring women's knowledge have predominantly  
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14 324 reported limited or no knowledge about the link between HDP and CVD<sup>12</sup>,  
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16 325 though our study found overall, 'moderate' knowledge of health conditions after  
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18 326 HDP. The two conditions associated with highest knowledge were repeat HDP  
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20 327 and risk of future hypertension. Findings were similar in Traylor et al.'s<sup>14</sup> survey  
21  
22 328 where 146 women post HDP were included (PE n=76, PE with severe features  
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24 329 n=41, CH=29). Future hypertension and repeat HDP were correctly identified by  
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26 330 women as risk factors, however this knowledge was mainly reflected in the  
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28 331 group of women who had experienced PE with severe features. Brown et al.<sup>15</sup>  
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30 332 (n=12 women attending postnatal follow-up clinic) also found that women are  
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32 333 aware of repeat HDP risks, however despite postnatal risk counseling,  
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34 334 perception of hypertension and CVD risk was mainly associated with  
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36 335 participants who had a family history of CVD. More recently, Hutchesson et al.<sup>16</sup>  
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38 336 surveyed 127 women with PE in the two years prior, finding very high  
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40 337 knowledge about future hypertension risk (96%, higher than our post-PE  
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42 338 findings) and most were aware of stroke (67%) and CVD (66%) risks (similar to  
43  
44 339 our findings). Over a third of women after PE had 'no discussion' about future  
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46 340 risk in our study. Hutchesson et. al<sup>16</sup> reported over one third of their participants  
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48 341 remained unaware of increased CVD risks, which is similar to our findings.  
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50 342 Similarities may be explained by the fact that major source of PE participants for  
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52 343 both, the Hutchesson et. al<sup>16</sup> survey and ours, was the patient support/advocacy  
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3 344 group AAPEC. Recruitment from this advocacy group may also explain a higher  
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5 345 post-PE knowledge than other studies have reported.  
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10 347 Our study findings resonate with those from similarly targeted women in Canada,  
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12 348 Portugal, United Kingdom, the United States of America and a previous Australian  
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14 349 study, all conducted between 2013 and 2017<sup>12</sup>. Therefore, from a global perspective,  
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16 350 these findings reinforce a persisting, and concerning, research to consumer gap. With  
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18 351 international guidelines, including ISSHP<sup>2</sup>, specifically targeted to assist HCPs  
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20 352 providing care to women on an international scale to better manage and address health  
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22 353 after HDP, this practice gap of knowledge transmission to women would be expected to  
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24 354 narrow.  
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## 30 356 **Education preferences**

### 31 357 Content

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33 358 Women mostly wanted educational materials to address HDP impact on their  
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35 359 children, signs and symptoms of conditions they are at higher risk of, the timing  
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37 360 of when their risks rise, and how to best reduce risk of recurrent HDP. Similar  
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39 361 preferences were expressed by the women included in Seely et al.'s<sup>17</sup> focus  
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41 362 group of 20 women after PE, with the key concern being the impact the PE  
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43 363 pregnancy may have had on the health of their children.  
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### 49 365 Format of education and access

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51 366 Our study identified that women mostly wanted to receive information about  
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53 367 long-term health after HDP from medical professionals. Key organisations who  
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55 368 are experts on the topic, via social media and through information brochures  
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3 369 were other acceptable avenues of access to information. This is in contrast to  
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5 370 Skurnik et al's<sup>18</sup> focus group of 14 women after PE, whose preferences for  
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7 371 educational materials about the link between CVD and PE were via pamphlets  
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9 372 available in doctor's offices as well as via online communities and topical blogs.  
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12 373 However, Hird et al's<sup>19</sup> participants also expressed preference for healthcare  
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14 374 providers as their information source, including wanting healthcare providers to  
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16 375 guide them towards reliable online/external information sources rather than  
17  
18 376 encounter irrelevant or potentially inaccurate information due to their self-  
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20 377 initiated search. Hutchesson et al.<sup>16</sup> report that high knowledge amongst  
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22 378 participants was mainly due to the women's own research rather than receiving  
23  
24 379 all possible, relevant information from their healthcare provider. Overall, existing  
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26 380 studies including ours would suggest that although women are very open to the  
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28 381 use of online sources or information packs, their healthcare providers are seen  
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30 382 as central to closing their knowledge gaps.  
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#### 384 Time of risk discussion

385 An important element to consider when communicating about risk with women  
386 who have experienced GH or PE is the timing of these discussions, as  
387 situational factors of being a new mother may alter when women are most  
388 receptive to follow-up. In our study, three-quarters of the women preferred this  
389 to occur in the first six months after birth. As well as being their preference, this  
390 also aligns with the potential benefits of early intervention, and would allow for  
391 addressing knowledge gaps found in this study around how soon the risk rises  
392 after HDP. Addressing future risk early but not immediately is also supported by  
393 Brown et al.'s study of women after PE, where participants suggested that six

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3 394 months postpartum was the timeframe where they felt they had transitioned into  
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5 395 a more comfortable stage of parenting and were able to focus more on  
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8 396 themselves again<sup>15</sup>.

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### 11 398 **Strengths and limitations**

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14 399 The survey was co-created via a formalised process of seeking input and  
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17 400 feedback on the usability, language and content from women who have  
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19 401 previously experienced HDP. This creation and face validation process  
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21 402 involving consumers gives added value to the survey.

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26 404 Our knowledge score is both a strength, as it allows for a summary of findings  
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28 405 across all the conditions and risks, and a limitation, as assigning cut-points for  
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30 406 knowledge ranking is an arbitrary designation. Having included the distractor  
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32 407 conditions (breast cancer and seizures) may also have altered the overall score.  
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35 408 However, we believe it is important for women to not incorrectly believe they are  
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37 409 at increased risk of more conditions than they are, as well as having knowledge  
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39 410 of their increased cardiovascular risk. The addition of women with a history of  
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41 411 GH as well as women without any history of HDP, is also a strength to add  
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43 412 broader perspective on this topic.

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49 414 Limitations include demographic make-up of respondents, with HDP  
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51 415 participants predominantly English speaking and Caucasian (95%) despite the  
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53 416 survey being available in Arabic and Mandarin as well as English. The non-HDP  
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55 417 group (20% Asian background) had similar background demographics of  
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58 418 Australian reproductive-aged women<sup>20</sup>, and as HDP is more prevalent amongst  
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3 419 the Caucasian population<sup>21</sup>, the sample actually is likely close to representative  
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5 420 of Australian HDP and non-HDP women. However, it would have been  
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7 421 preferable to also gain insight from more culturally and linguistically diverse  
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9 422 groups in order to understand their knowledge base and address their needs  
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11 423 within this context.  
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17 425 In the survey, women were asked to select their HDP history which was then  
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19 426 used to group them for analysis. Women's diagnosis of HDP is by self-report is  
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21 427 a limitation, as some bias may be introduced through inaccurate self-report of  
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23 428 diagnosis. The broad geographical range and anonymous nature of the survey  
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25 429 precluded any verification of diagnosis. However, women were provided with  
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27 430 definitions of the various HDP conditions at the start of the survey to aid them in  
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29 431 their self-report. Another limitation is where participants were recruited from,  
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31 432 with close to half either drawn from the P4 study (an Australian post-HDP  
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33 433 research study) or consumer group AAPEC. Therefore, there may be  
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35 434 knowledge bias in the sample (i.e. a more knowledgeable group of participants  
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37 435 than the overall HDP or non-HDP population). However, as even this group with  
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39 436 potentially greater baseline knowledge had substantive knowledge gaps, our  
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41 437 study highlights the need for interventions to improve knowledge of health after  
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43 438 HDP.  
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#### 50 51 440 **Implications**

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53 441 Close to two decades worth of data have been collected<sup>8</sup> since research on the  
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55 442 link between HDP and increased CVD risk emerged in the early 2000s, with the  
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57 443 first systematic review published in 2007<sup>22</sup>. It could be expected that this  
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3 444 knowledge, by now, would have been translated into practice and shared with  
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5 445 HDP women, however our findings suggest that this is still not the case. This  
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7 446 study is valuable from the public health perspective, given the wider context of  
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9 447 prevalence and importance of cardiovascular disease in women.  
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14 449 Guidelines such as ISSHP<sup>2</sup> and SOMANZ<sup>3</sup> suggest regular follow-up after HDP  
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16 450 as well as counselling women with regards to their individual long-term CVD  
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18 451 risk. Although available to the public, these are not designed for women.  
19  
20 452 Compiling suitable information for women would be an important step towards  
21  
22 453 closing the knowledge gap. It is important to establish preferred content,  
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24 454 presentation and timing of education for post-HDP health for women as we  
25  
26 455 have in this study, to maximise the chance that women will engage with and  
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28 456 benefit from education.  
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## 33 34 35 458 **CONCLUSION**

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37 459 This Australian survey of women's knowledge of risks after HDP, found varying  
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39 460 knowledge from the targeted groups. Despite 'high' knowledge being  
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41 461 demonstrated regarding some risks, overall significant knowledge gaps were  
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43 462 identified for certain conditions, particularly diabetes, and for knowledge about  
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45 463 the relatively early timing of when health risks increase after HDP. Identifying  
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47 464 these gaps are important in planning tailored education for women, and to  
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49 465 improve early intervention for modifiable CVD risks in women after HDP.  
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51 466 Addressing these women's preferences for content and to have this delivered  
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53 467 by their healthcare provider may further lead to enhanced counselling,  
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55 468 management and improved women's health trajectories.  
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5 470 **LIST OF ABBREVIATIONS**

7 471 AAPEC - Australian Action on Preeclampsia

9 472 CH - chronic hypertension worsening in pregnancy and/or with superimposed  
11  
12 preeclampsia

14 474 CVD - cardiovascular disease

16 475 GH - gestational hypertension

18 476 GP - general practitioner

20 477 HCP - healthcare provider

22 478 HDP - hypertensive disorder of pregnancy

24 479 ISSHP - International Society for the Study of Hypertension in Pregnancy

26 480 PE - preeclampsia

28 481 PVD - peripheral vascular disease

30 482 SOMANZ - Society of Obstetric Medicine Australia New Zealand

32 483

34 484 **STATEMENTS**

36 485 **Ethical approval**

38 486 Ethical approval has been provided by South-Eastern Sydney Local Health  
40 487 District Human Research Ethics Committee (Ref: 18/POWH/326). The  
42 488 ratification for the University of Technology Sydney has also been obtained  
44 489 under ETH18-3061.

46 490

48 491 **Sources of funding**

50 492 Amanda Henry is supported by a National Health and Medical Research  
52 493 Council (Australia) Early Career Fellowship (APP 1141570). Caroline Homer  
54 494 is supported by a NHMRC Principal Research Fellowship (APP1137745).  
56 495 Heike Roth is supported by an Australian Government Research Training  
58 496 Program Stipend (RTPS) UTS and RTP Fees Offset (RTPFO) Scholarship:

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2  
3 497 The stipend is a 'salary' to support Heike Roth in completing her PhD full time.

4 498 The Scholarship supports her enrolment fees for the PhD.

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8 **500 Access to data examined in this study**

9  
10 501 The authors have full access to all data reported in the study.

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12 502

13  
14 **503 Transparency statement and competing interests**

15 504 The article is the authors' original work, has not received prior publication and

16 505 is not under consideration for publication elsewhere. All the authors have

17 506 seen and approved the manuscript being submitted. The manuscript is an

18 507 honest, accurate, and transparent account of the study being reported, no

19 508 important aspects of the study have been omitted. We have read and

20 509 understood BMJ policy on declaration of interests and declare that we have

21 510 no competing interests. This manuscript presents partial results from Heike

22 511 Roth's PhD research. The project is supervised by Caroline Homer and

23 512 Amanda Henry.

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26  
27 **514 Authors contributions**

28 515 Heike Roth, Amanda Henry and Caroline Homer contributed to the conception

29 516 and design of the study as well as the distribution of the survey and writing of

30 517 the manuscript. Heike Roth led the analysis of the survey data, drafting and

31 518 designed the Tables, Figures and Appendixes and wrote the first draft. Grace

32 519 LeMarquand was a medical Honours student assisting with pre-survey

33 520 interviews as well as initial data analysis. Lynne Roberts assisted in the

34 521 survey development, supported the distribution, the interpretation of the

35 522 findings and the discussion. Mark Brown contributed to the design of the

36 523 survey and supported the interpretation of the findings and the discussion. As

37 524 a maternity consumer, Lisa Hanley has assisted with the survey design and

38 525 ensured appropriate use of language and content as well as supported the

39 526 distribution. All authors contributed to drafts and revising of the paper and all

40 527 approved the final version.

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44 **529 Acknowledgements**

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3 530 We thank all women who took the time to respond to the survey. We also  
4  
5 531 thank the organisations and their social media networks who assisted with the  
6  
7 532 distribution of the survey: The *Postpartum physiology, psychology and*  
8  
9 533 *paediatric follow up study (P4 Study)* research team, Australian Action on  
10  
11 534 Preeclampsia, maternity consumer groups, Lisa Hanley who is our volunteer  
12  
13 535 consumer representative and the various shares by consumers via social  
14  
15 536 media (Facebook and Twitter) including multicultural networks.

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17 538 **Authors' information (optional)**

18  
19 539 This manuscript presents partial results from Heike Roth's PhD research. The  
20  
21 540 project is supervised by Caroline Homer and Amanda Henry.

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## TABLES, SUPPLEMENTARY TABLES, APPENDICES AND FIGURES

### Table legend

Table 1: Respondent demographics

Table 2: Means of risk factor knowledge of women

Table 3: Means of risk factor knowledge of women with a history of preeclampsia listed by time elapsed since HDP

Table 4: Proportion of conditions discussed when addressing future risk (Multiple answers collected) within and over 3 years since last HDP

Table 5: HDP women's preferences for content and distribution of information/education on future risk after HDP (Multiple answers collected) in order of preference

### Supplementary data

Supplementary Table 1: Current CVD risk factors of HDP and non-HDP women (Multiple answers collected) in order of frequency

Supplementary Table 2: Chronic Hypertension

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 3: Diabetes

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 4: Renal Disease

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 5: Heart Attack

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 6: HDP next pregnancy

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3 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
4 a lower/same/higher chance of getting the following”)

5 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
6 a lower/same/higher chance of getting the following”)  
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8  
9 **Supplementary Table 7: Stroke**

10 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
11 a lower/same/higher chance of getting the following”)

12 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
13 a lower/same/higher chance of getting the following”)  
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15  
16 **Supplementary Table 8: Heart Disease**

17 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
18 a lower/same/higher chance of getting the following”)

19 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
20 a lower/same/higher chance of getting the following”)  
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23 **Supplementary Table 9: Peripheral Vascular Disease**

24 a) - Women with HDP likelihood of risk compared to non-HDP (“Do you think you a)  
25 Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a  
26 lower/same/higher chance of getting the following”)

27 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
28 a lower/same/higher chance of getting the following”)  
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31 **Supplementary Table 10: Breast Cancer**

32 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
33 a lower/same/higher chance of getting the following”)

34 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
35 a lower/same/higher chance of getting the following”)  
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38 **Supplementary Table 11: Seizures**

39 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
40 a lower/same/higher chance of getting the following”)

41 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
42 a lower/same/higher chance of getting the following”)  
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45 **Supplementary Table 12: Proportion of participants scoring ‘high’, ‘moderate’ and  
46 ‘low’ by type of HDP and non-HDP**  
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49 **Supplementary Table 13: HDP and non-HDP women’s answers to timing of rise of  
50 risk with signs and symptoms starting to show**  
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52 **Appendices**

53 Appendix 1: Survey for women  
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55 **Figure legend**

56 Figure 1: Survey inclusion  
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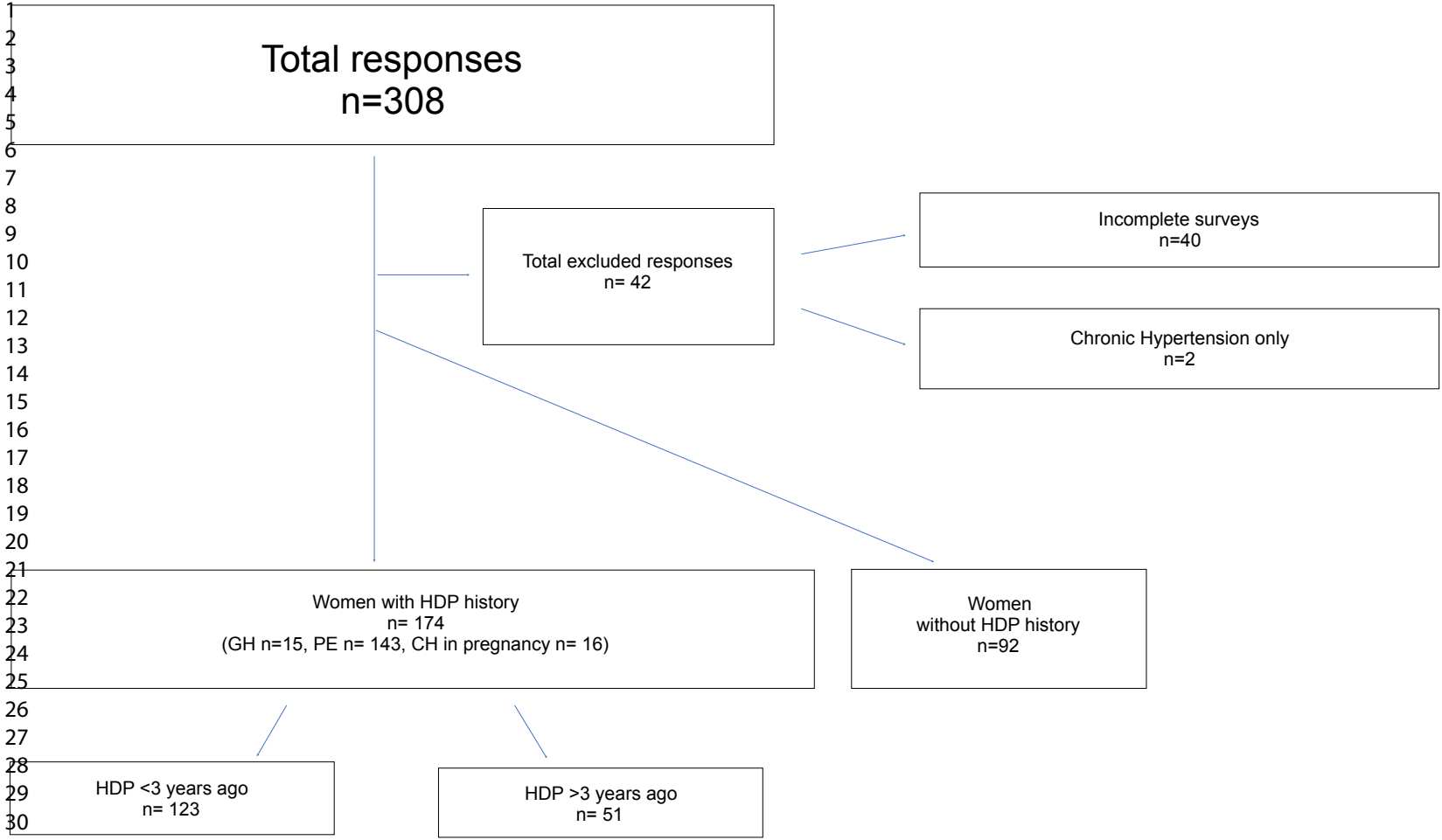
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HDP- hypertensive disorder of pregnancy, GH - gestational hypertension, PE - preeclampsia, CH in pregnancy - chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia

Supplementary Table 1: Current CVD risk factors of HDP and non-HDP women (Multiple answers collected) in order of frequency

	<b>GH</b>	<b>PE</b>	<b>CH</b>	<b>Total HDP</b>	<b>non-HDP</b>	<b>P HDP vs non HDP</b>
	<b>n=15</b>	<b>n=143</b>	<b>n=16</b>	<b>n=174</b>	<b>n=92</b>	
	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	
None of the options	6 (40)	52 (36)	2 (13)	60 (34)	57 (62)	<0.001
Obesity	5 (33)	38 (27)	7 (44)	50 (29)	10 (11)	0.001
Family History Heart disease	3 (20)	37 (26)	6 (38)	46 (26)	14 (15)	0.037
Hypertension	3 (20)	30 (21)	12 (75)	35 (20)	0 (0)	<0.001
Renal problems	0 (0)	21 (15)	2 (13)	23 (13)	0 (0)	<0.001
Smoking	0 (0)	10 (7)	3 (19)	13 (7)	2 (2)	0.075
History of cardiovascular event**	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	0.356
Diabetes	0 (0)	5 (3)	2 (13)	7 (4)	0 (0)	0.014
Alcohol consumption	0 (0)	0 (0)	1 (6)	1 (1)	0 (0)	0.356
High Cholesterol	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	-

\*Table represents frequency of each option; percentages add to over 100% as women were asked to select any/all that applied.

\*\*angina, stroke or heart attack

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 2: Chronic Hypertension

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	2 (13)	14 (10)	1 (6)	17 (10)
More likely (correct)	8 (53)	111 (78)	13 (81)	132 (76)
I do not know	5 (33)	17 (12)	2 (13)	24 (14)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	57 (62)
Same likelihood	22 (24)
More likely	1 (1)
I do not know	12 (13)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 3: Diabetes

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	3 (20)	61 (43)	5 (31)	69 (40)
More likely (correct)	4 (27)	35 (25)	5 (31)	44 (25)
I do not know	8 (53)	44 (31)	6 (38)	58 (33)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n= 92</b>
	<b>n (%)</b>
Less likely (correct)	32 (35)
Same likelihood	39 (42)
More likely	4 (4)
I do not know	17 (19)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 4: Renal Disease

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	2 (1)	0 (0)	2 (1)
Same likelihood	2 (14)	30 (21)	1 (7)	33 (19)
More likely (correct)	4 (29)	77 (55)	11 (73)	92 (54)
I do not know	8 (57)	32 (23)	3 (20)	43 (25)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	39 (42)
Same likelihood	31 (34)
More likely	0 (0)
I do not know	22 (24)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 5: Heart Attack

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	1 (7)	20 (14)	1 (7)	22 (13)
More likely (correct)	8 (53)	98 (69)	12 (80)	118 (69)
I do not know	6 (40)	23 (16)	2 (13)	31 (18)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	48 (53)
Same likelihood	23 (25)
More likely	0 (0)
I do not know	20 (22)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 6: HDP next pregnancy

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	2 (1)	0 (0)	2 (1)
Same likelihood	0 (0)	9 (6)	0 (0)	9 (5)
More likely (correct)	13 (87)	128 (89)	15 (100)	156 (90)
I do not know	2 (13)	4 (3)	0 (0)	6 (4)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	65 (71)
Same likelihood	19 (21)
More likely	0 (0)
I do not know	8 (9)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy



Supplementary Table 7: Stroke

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	1 (7)	18 (13)	1 (7)	20 (12)
More likely (correct)	7 (47)	89 (63)	13 (87)	109 (64)
I do not know	7 (47)	33 (23)	1 (7)	41 (24)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	49 (53)
Same likelihood	24 (26)
More likely	0 (0)
I do not know	19 (21)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 8: Heart Disease

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	2 (13)	18 (13)	1 (7)	21 (12)
More likely (correct)	7 (47)	99 (70)	12 (80)	118 (67)
I do not know	6 (40)	24 (17)	2 (13)	32 (19)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	46 (50)
Same likelihood	27 (29)
More likely	0 (0)
I do not know	19 (21)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 9: Peripheral Vascular Disease

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	0 (0)	0 (0)	0 (0)
Same likelihood	2 (13)	20 (14)	1 (7)	23 (13)
More likely (correct)	5 (33)	72 (51)	8 (53)	85 (50)
I do not know	8 (53)	50 (35)	6 (40)	64 (37)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	41 (45)
Same likelihood	29 (32)
More likely	0 (0)
I do not know	22 (24)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 10: Breast Cancer

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	0 (0)	0 (0)	0 (0)
Same likelihood (correct)	3 (20)	74 (53)	5 (36)	82 (48)
More likely	1 (7)	1 (1)	1 (7)	3 (2)
I do not know	11 (73)	66 (47)	8 (57)	85 (50)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely	6 (7)
Same likelihood (correct)	60 (65)
More likely	1 (1)
I do not know	25 (27)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 11: Seizures

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	0 (0)	0 (0)	0 (0)
Same likelihood (correct)	4 (27)	41 (29)	2 (13)	47 (27)
More likely	1 (7)	41 (29)	4 (27)	46 (27)
I do not know	10 (67)	60 (42)	9 (60)	79 (46)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely	25 (27)
Same likelihood (correct)	40 (44)
More likely	0 (0)
I do not know	27 (29)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 12: Proportion of participants scoring 'high', 'moderate' and 'low' by type of HDP and non-HDP

	<b>GH</b> n=15 n(%)	<b>PE</b> n=143 n(%)	<b>CH</b> n=16 n(%)	<b>P</b> GH vs PE	<b>P</b> GH vs CH	<b>P</b> PE vs CH	<b>HDP</b> n=174 n(%)	<b>non-HDP</b> n=92 n(%)	<b>P</b> HDP vs non- HDP
High (score 8-10)	4 (27)	48 (34)	5 (31)	0.59	0.78	0.67	57 (33)	30 (33)	0.98
Moderate (score 5-7)	3 (20)	52 (36)	7 (44)	0.21	0.16	0.56	62 (36)	25 (27)	0.16
Low (score 0-4)	8 (53)	43 (30)	4 (25)	0.67	0.11	0.85	55 (32)	37 (40)	0.16
Total	15 (100)	143 (100)	16 (100)	-	-	-	174 (101)	92 (100)	-

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy.

The colour coding in addition to the mean scores aims to highlight the areas of 'low' (red), 'moderate' (orange) and 'high' (green) knowledge.

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	MODERATE
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Supplementary Table 13: HDP and non-HDP women’s answers to timing of rise of risk with signs and symptoms starting to show

	<b>GH</b>	<b>PE</b>	<b>CH</b>	<b>HDP</b>	<b>Non HDP</b>	<b>P</b>
	<b>n=15</b>	<b>n=143</b>	<b>n=16</b>	<b>n=174</b>	<b>n=92</b>	<b>HDP vs non-HDP</b>
	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	
<10 years	4 (27)	42 (29)	9 (56)	55 (32)	41 (45)	0.036
10-15 years	3 (20)	28 (20)	2 (13)	33 (19)	15 (16)	0.591
16-20 years	0 (0)	13 (9)	0 (0)	13 (8)	1 (1)	0.013
>20 years	3 (20)	5 (4)	0 (0)	8 (5)	2 (2)	0.302
Not sure/don't know	1 (7)	48 (34)	1 (6)	52 (30)	33 (36)	0.319
I don't think I will get any of these as I maintain a healthy lifestyle	4 (27)	7 (5)	2 (13)	13 (8)	N/A	-
<b>TOTAL</b>	<b>15 (101)</b>	<b>143 (101)</b>	<b>16 (101)</b>	<b>174 (102)</b>	<b>92 (100)</b>	

\* Percentages may not add to 100% as figures are rounded to whole numbers only  
 PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia,  
 HDP= hypertensive disorder of pregnancy

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### LONG TERM HEALTH AFTER BLOOD PRESSURE PROBLEMS IN PREGNANCY

You are invited to take part in a survey to gain insight into what women like yourself who have been pregnant before know about women's heart health. We are interested in the views of all women especially women who had high blood pressure (hypertension) or preeclampsia in pregnancy.

You can complete the survey if you are currently pregnant (with no major issues so far this pregnancy) or have been pregnant in the last three (3) years. You may have experienced high blood pressure in pregnancy OR you may have experienced a pregnancy without any serious complications.

The study is being conducted by the University of NSW, University of Technology Sydney and the Sydney Partnership for Health, Education, Research and Enterprise (SPHERE). The study is being undertaken by:

- Dr. Amanda Henry - Obstetrician at St George and Royal Hospital for Women, Randwick, Senior Lecturer UNSW and SPHERE member
- Distinguished Professor Caroline Homer - UTS, Midwifery Faculty of Health and SPHERE member
- Dr. Clare Arnott - Cardiologist, Royal Price Alfred Hospital
- Mrs. Heike Roth - PhD Candidate at University of Technology, Sydney
- Mrs. Lynne Roberts - Research Midwife at St George Hospital, SESLHD.

This work is occurring as part of Mrs Heike Roth's PhD studies and the NHMRC Fellowship of Dr. Henry. Apart from salary support for Dr. Henry, the study is otherwise unfunded.

If you agree to take part in this survey, it should only take about 15 minutes to complete and will involve answering questions about you, your pregnancy and your understanding of long term health in women who have been diagnosed with blood pressure problems in pregnancy.

Participation in this study is entirely voluntary and if you do not wish to take part it will have no effect on the care you are currently receiving. If you decide to participate, and throughout the survey think you would like to withdraw/not complete the survey, you can simply stop and not submit your answers. If you have already submitted your survey, it will not be possible to withdraw the data you have provided as the surveys are anonymous.

The information you provide will not be identifiable and will be kept securely until destroyed as per the South East Sydney Local Health District's requirements.

The study results will be published in a research thesis, in peer reviewed journals and presented at conferences and other professional forums. No one will be able to identify you from this information.



1 **If you would like to personally receive results, you will have the option to leave your email details.**  
2 **The results will be available one (1) year after conclusion of the survey and your email will not be**  
3 **used for any other purpose.**  
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6 **If you would like any further information about the study or you experience any distress or concern**  
7 **as a result of completing this survey, please contact the Principal Investigator, Dr Amanda Henry on**  
8 **02 91132315 or via email [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au). For medical assistance you can**  
9 **consult your General Practitioner. If you would like further information about the topic addressed in**  
10 **this study, you can visit the Australian Heart Foundation on the following link:**  
11 **<https://www.heartfoundation.org.au/your-heart/women-and-heart-disease/womens-stories>.**  
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15 **If you have any concerns or complaints about the conduct of this study, you should contact the**  
16 **Research Support Office of the South Eastern Sydney Local Health District Human Research Ethics**  
17 **Committee which is nominated to receive complaints from research participants. You should**  
18 **contact them on 02 9382 3587, or email [SESLHD-RSO@health.nsw.gov.au](mailto:SESLHD-RSO@health.nsw.gov.au) and quote HREC 18/156.**  
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21 \* 1. I acknowledge that participation in the survey is voluntary

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# LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## ABOUT YOU

These first few questions are to find out about you, your background, and occupation. Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 2. What age group are you in?

- 18-25  46-55  
 26-35  56+  
 36-45  Prefer not to answer

\* 3. What ethnic group do you identify with? (Please select one answer)

- Caucasian  Aboriginal or Torres Strait Islander  
 Asian  European  
 Polynesian or Maori  Prefer not to answer  
 Other (please specify)

\* 4. What is your highest level of formal education?

- Secondary school  University degree  
 Trade Certificate/Diploma  Prefer not to answer  
 Other (please specify)

5. What is your usual occupation/profession?

\* 6. Are you currently in a relationship?

- Yes  Prefer not to answer  
 No

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\* 7. Where did you hear about this survey?

- P4 Newsletter
- Australian Action on Preeclampsia (AAPEC)
- Tresillian
- Maternity Choices Australia
- Other (please specify)
- Maternity Consumer Network
- Maternity Clinics
- Social media (Facebook, Twitter)
- Australian College of Midwives

For peer review only

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for  
women

ABOUT YOUR HEALTH

These next questions are about your general health.

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 8. Are you currently pregnant?

Yes

Prefer not to answer

No

For peer review only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### ABOUT YOUR HEALTH

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

9. How many weeks pregnant are you? (provide whole numbers only, for example: 24)

10. How many children have you given birth to (20 weeks gestation and over)?

\* 11. Have you ever had any of the following, whilst pregnant or before or after pregnancy? (select all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> High blood pressure    | <input type="checkbox"/> Stroke   |
| <input type="checkbox"/> High BMI (overweight)  | <input type="checkbox"/> Significant illness  |
| <input type="checkbox"/> Angina                 | <input type="checkbox"/> Heart attack   |
| <input type="checkbox"/> Diabetes               | <input type="checkbox"/> None of the above/ no significant other medical complication |
| <input type="checkbox"/> Kidney problems        |   |
| <input type="checkbox"/> Other (please specify) |   |

\* 12. From the list below, which currently apply to you? (select all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> Smoking                         | <input type="checkbox"/> High cholesterol    |
| <input type="checkbox"/> Obesity                         | <input type="checkbox"/> High blood pressure |
| <input type="checkbox"/> Alcohol consumption             | <input type="checkbox"/> Diabetes            |
| <input type="checkbox"/> Family history of heart disease | <input type="checkbox"/> None of the above   |

Other (please specify)

13. Please provide the details of any prescribed medications you are taking

- I do not take any prescribed medication
- I take prescribed medication (please list the medications or leave blank if you prefer not to answer)

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## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### PREGNANCY

**This section is about your pregnancy history.**

**Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.**

#### DEFINITIONS OF BLOOD PRESSURE PROBLEMS

Here are some definitions of certain types of blood pressure problems in pregnancy. You may find these useful in order to more easily understand and answer the next questions.

**Chronic hypertension:** is if you had high blood pressure before falling pregnant, have high blood pressure outside of pregnancy, or were found to already have high blood pressure in the first half of your pregnancy. Chronic hypertension may have no known underlying cause (this is sometimes called "essential" hypertension), or it may be as a result of another underlying condition, such as kidney disease.

**Gestational hypertension:** is when you might have had high blood pressure for the first time in your pregnancy (after 20 weeks of pregnancy) but were otherwise well (that is, high blood pressure only but no effect on your baby's growth or on your health otherwise).

**Preeclampsia:** is when you have had high blood pressure in pregnancy (after 20 weeks of pregnancy) and some additional signs or issues in you and/or your baby. For example, you might have had protein in your urine, liver or kidney problems that showed up on blood tests, or there may have been concerns about the growth of your baby while you were pregnant.

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## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### PREGNANCY

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

We understand that you may find some of the questions difficult to answer as they might remind you of a challenging time in your life. We are grateful for your participation and contribution to improving knowledge on future health for women who had blood pressure problems in pregnancy. You will find some explanations at the end of the survey and a contact, in case you would like to seek further clarification and/or assistance.

\* 14. Choose the situation which best describes your pregnancy history

- |  |  |
|--|--|
| <input type="radio"/> At least one pregnancy is/was affected by gestational hypertension | <input type="radio"/> I had chronic hypertension before pregnancy and had/have pregnancies that were complicated further by higher than usual blood pressure |
| <input type="radio"/> At least one pregnancy is/was affected by preeclampsia             | <input type="radio"/> I had chronic hypertension before pregnancy and had/have pregnancies that were complicated further by preeclampsia                     |
| <input type="radio"/> I have only been diagnosed with chronic hypertension               | <input type="radio"/> No pregnancy is/was affected   |



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## YOUR HEALTH DURING YOUR PREGNANCY

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 15. As someone who has chronic hypertension are you aware of any long term health issues that you are at risk of? (select all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> Diabetes   | <input type="checkbox"/> Leukaemia  |
| <input type="checkbox"/> Kidney disease   | <input type="checkbox"/> Seizures   |
| <input type="checkbox"/> Breast cancer  | <input type="checkbox"/> Overall mortality risk is higher   |
| <input type="checkbox"/> Cardiac death  | <input type="checkbox"/> Ischaemic heart disease/heart attack   |
| <input type="checkbox"/> High blood pressure complications in another pregnancy | <input type="checkbox"/> I think there are health risks but unsure which conditions I may be at risk of |
| <input type="checkbox"/> Stroke   | <input type="checkbox"/> I do not think that there are increased risks                                  |
| <input type="checkbox"/> Peripheral vascular disease                            |   |
| <input type="checkbox"/> Other (please specify)                                 |   |

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LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

\* 16. How many years after blood pressure problems in pregnancy do you think the various signs and symptoms of the potential risks may start to appear?

- < 10 years after pregnancy  > 20 years after pregnancy
- 10-15 years after pregnancy  Not sure/do not know
- 16-20 years after pregnancy
- Other (please specify)

peer review only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## Chronic Hypertension only -TYPE OF CARE RECEIVED DURING PREGNANCY

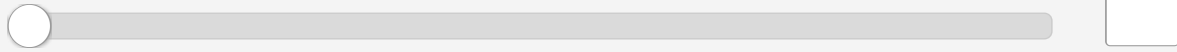
Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

17. If a healthcare provider did speak to you about your future health risks, when did this occur?

- |  |   |
|--|---|
| <input type="checkbox"/> Before birth            | <input type="checkbox"/> 6 months to 1 year |
| <input type="checkbox"/> Immediately after birth | <input type="checkbox"/> 1 year and over    |
| <input type="checkbox"/> Within first 6 weeks    | <input type="checkbox"/> I cannot remember  |
| <input type="checkbox"/> 6 weeks to 6 months     |   |

\* 18. When would be a good time to receive information about long term health risks in your gestational hypertension or preeclampsia experience?

During pregnancy/at birth      12 months after birth      24 months after birth



\* 19. As a result of your pregnancy affected by blood pressure problems, were you referred to any of the below after your baby was born? (tick all that apply)

- |   |  |
|---|--|
| <input type="checkbox"/> Cardiologist             | <input type="checkbox"/> Fitness centre for exercise         |
| <input type="checkbox"/> Renal (kidney) Physician | <input type="checkbox"/> Nutritionist for dietary adjustment |
| <input type="checkbox"/> General Practitioner     | <input type="checkbox"/> I cannot remember                   |
| <input type="checkbox"/> Other (please specify)   |  |

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

20. During your pregnancies over the last 3 years (20 weeks pregnancy and over), which blood pressure problem were you diagnosed with?

	Gestational Hypertension	Preeclampsia	No blood pressure problem diagnosed this pregnancy	I cannot remember	Not applicable
First Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Second Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any comments?

\* 21. How long ago was your most recent pregnancy that was affected by a blood pressure problem?

- 0-6 months
- 6-12 months
- 1-2 years
- 2-3 years
- more than 3 years ago

\* 22. At what point in time were you diagnosed? (Choose a most accurate time frame)

	20-28 weeks	28-34 weeks	34-37 weeks	37-40 weeks	40-42 weeks	During or after giving birth	No diagnosis of blood pressure problem this pregnancy	I cannot remember	Not applicable
First Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Second Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any comments?

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

PREGNANCY

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 23. Did you have a *planned* induction of labour or *planned* caesarean section due to your blood pressure problems?

	Yes, planned induction of labour because of blood pressure issues in pregnancy	Yes, planned caesarean section because of blood pressure issues	Yes, planned caesarean for other reasons than blood pressure	No planned induction and no planned caesarean section	I cannot remember	Not applicable
First Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Second Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any Comments?

view only

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

LONG TERM HEALTH RISKS

**This section is about some long term health risks that some women may experience after having had blood pressure problems in pregnancy.**

For this section we would like you to think about the long-term health risks of a woman who has been diagnosed with high blood pressure in pregnancy.

**Not everyone who experienced blood pressure problems in pregnancy will necessarily have health issues in the future. We would not want you to unnecessarily worry about any of these risks, therefore we will provide you with further information about long-term health after high blood pressure in pregnancy at the end of the survey.**

\* 24. FOR WOMEN **WITH** HISTORY OF BLOOD PRESSURE PROBLEMS IN PREGNANCY:

Compare yourself to a woman who has NOT had blood pressure problems in pregnancy.

Do you think you have a lower/same/higher chance of getting the following:

	Less chance than a woman without blood pressure in pregnancy	Same chance as a woman without blood pressure in pregnancy	Higher chance than a woman without blood pressure in pregnancy	Not sure/I do not know
High blood pressure later in life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kidney disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breast cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart attack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High blood pressure in another pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stroke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seizures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vascular Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**If you are concerned by any of the above potentially affecting you, information is available at the end of the survey where risks are explained.**

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

For this section we would like you to think about the long term health risks of a woman who has been diagnosed with high blood pressure in pregnancy.

\* 25. FOR WOMEN WITHOUT HISTORY OF BLOOD PRESSURE PROBLEMS IN PREGNANCY:

Compare yourself to a woman who HAS had blood pressure problems in pregnancy.

Do you think you have a lower/same/higher chance of getting the following:

	Less chance than a woman with blood pressure in pregnancy	Same chance as a woman with blood pressure in pregnancy	Higher chance than a woman with blood pressure in pregnancy	Not sure/I do not know
High blood pressure later in life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kidney disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breast cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart attack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High blood pressure in another pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stroke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seizures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vascular Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 26. How many years after blood pressure problems in pregnancy do you think the various signs and symptoms of the potential risks may start to appear?

- < 10 years after pregnancy
  > 20 years after pregnancy  
 10-15 years after pregnancy
  Not sure/do not know  
 16-20 years after pregnancy  
 Other (please specify)

If you are concerned by any of the above potentially affecting you, information is available at the end of the survey where risks are explained.

For peer review only



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

\* 27. How many years after blood pressure problems in pregnancy do you think the various signs and symptoms of the potential risks may start to appear?

- < 10 years after pregnancy
- > 20 years after pregnancy
- 10-15 years after pregnancy
- Not sure/do not know
- 16-20 years after pregnancy
- I don't think I will get any of these as I maintain a healthy lifestyle
- Other (please specify)

### IN CASE OF DISTRESS

If you experience any distress caused due to the completion of this survey, please contact your GP or the Principal Investigator of this study, Dr Amanda Henry on 02 91132315 or [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au)

For more information on this topic please visit The Australian Heart Foundation on the following link:  
<https://www.heartfoundation.org.au/your-heart/women-and-heart-disease/womens-stories>

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## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### TYPE OF CARE RECEIVED DURING PREGNANCY WHERE A BLOOD PRESSURE PROBLEM WAS DIAGNOSED

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

It is quite likely that some of the following questions may bring back some memories or bring rise to emotions that you find difficult to deal with. Please contact the Principal Investigator, Dr Amanda Henry on 02 91132315 or via email [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au) if you would like to discuss these concerns. For medical assistance you can consult your General Practitioner.

\* 28. Have you ever been admitted to a 'High Dependency Unit' or 'Intensive Care Unit' as a result of your blood pressure problem in pregnancy?

- Yes
- No
- I am not sure
- I cannot remember

\* 29. Have any of your babies been admitted to 'Neonatal Intensive Care', 'High Dependency Unit' or 'Special Care Nursery' as a result of your blood pressure problem in pregnancy?

- Yes
- No
- I am not sure

30. After your baby was born have you had any of the following? (select all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> Blood pressure measurement in hospital | <input type="checkbox"/> Consultation with a renal (kidney) specialist  |
| <input type="checkbox"/> Blood pressure measurement with my GP  | <input type="checkbox"/> Consultation with an obstetric medicine specialist (doctor who specialises in complications of pregnancy like high blood pressure) |
| <input type="checkbox"/> Consultation with an obstetrician      | <input type="checkbox"/> I cannot remember  |
| <input type="checkbox"/> Other (please specify)                 |   |

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\* 31. After your baby was born, did someone speak to you about any of the below future health risks? (select all that apply)

- Increased risk of high blood pressure
- Risk of hypertensive disease in your next pregnancy
- Increased risk of kidney problems
- I was told to eat a healthy diet, do some exercise and live normally
- Increased risk of stroke
- No risks were discussed
- Increased risk of heart attack
- I cannot remember
- Increased risk of vascular disease
- Other (please specify)

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LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

TYPE OF CARE RECEIVED DURING PREGNANCY WHEN A BLOOD PRESSURE PROBLEM WAS DIAGNOSED

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

32. If a healthcare provider did speak to you about your future health risks, when did this occur?

- Before birth
- Immediately after birth
- Within first 6 weeks
- 6 weeks to 6 months
- 6 months to 1 year
- 1 year and over
- I cannot remember

\* 33. When would be a good time to receive information about long term health risks in your gestational hypertension or preeclampsia experience?

During pregnancy/at birth      12 months after birth      24 months after birth     

\* 34. As a result of your pregnancy affected by blood pressure problems, were you referred to any of the below after your baby was born? (tick all that apply)

- Cardiologist
- Renal (kidney) Physician
- General Practitioner
- Other (please specify)
- Fitness centre for exercise
- Nutritionist for dietary adjustment
- I cannot remember

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### EDUCATION

In this section we would like to find out about your preferred ways of getting information about long term health after gestational hypertension and preeclampsia.

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 35. After experiencing gestational hypertension or preeclampsia what do you want to know about your long term health? (select all that apply)

- Risk reduction for subsequent pregnancies
- Reducing risk behaviours (eg. diet, exercise, smoking cessation)
- Statistics (eg. increased risk)
- At what point does the risk increase
- Signs and Symptoms
- Where to find information
- How to discuss the matter with my healthcare provider
- Impact on my children from the pregnancy affected by blood pressure problems
- Other (please specify)

\* 36. How do you want to receive the information? (select all that apply).

- Key organisations addressing heart health (e.g. The Australian Heart Foundation or Her Heart)
- Social Media channels (e.g. Instagram, Facebook, Twitter)
- Brochures/Flyers
- Medical Professionals
- Podcasts/Media
- Online videos
- Other (please specify)

1 37. Is there anything else you would like to tell us?  
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## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### POST-SURVEY OPTIONS AND SUMMARY OF RISK PROFILE

**Some further things we would like you to consider:**

38. We would like to have your opinion on what you think would be appropriate education material to improve women's knowledge. We would also like to know how the education could best be distributed to women. Would you like to participate in a **focus group** (one off - 2hrs max at St George Hospital, Sydney) or a **telephone interview** (one off 30 mins max)? By involving 'consumers', meaning women like you, the education package will have added value.

If you are interested in participate in either, you can leave your details here.

**Name**

**Email Address**

**Phone Number**

39. Please leave your email address to **receive results** from this study (in approx. 1 year). Your details will not be used for any other purpose.

**Email Address**

#### **IN CASE OF DISTRESS**

If you experience any distress caused due to the completion of this survey, please contact your GP or the Principal Investigator of this study, Dr Amanda Henry on 02 91132315 or [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au)

For more information on this topic please visit The Australian Heart Foundation on the following link:

<https://www.heartfoundation.org.au/your-heart/women-and-heart-disease/womens-stories>



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### RISK PROFILE - LONG TERM RISKS AFTER BLOOD PRESSURE PROBLEMS IN PREGNANCY EXPLAINED

**You may like to take a screenshot of the risk profile so you can refer back to it whenever you need to.**

#### **RISK PROFILE**

Although most women will experience good long-term health after having high blood pressure in pregnancy, there are, unfortunately, some long term health risks associated with having had high blood pressure in pregnancy.

Women who have had high blood pressure during pregnancy are about 3 to 4 times more likely to develop chronic hypertension than women who did not have a blood pressure problems in pregnancy. They are also about twice as likely to get diabetes in later life, even if they did not have diabetes during pregnancy.

Blood pressure diseases are also more likely to happen in the next pregnancy to women who have already had a previous blood pressure problems in pregnancy compared to women who have not. Therefore, if they have had a pregnancy with blood pressure problems, it is important to be seen early in their next pregnancy. There are treatments that can decrease the chance of recurring problems.

Women are also more likely to get various forms of cardiovascular disease (heart disease, stroke, vascular disease) if they have had gestational hypertension, preeclampsia and/or chronic hypertension. All of these cardiovascular problems are about twice as likely to eventually happen to a woman who has had blood pressure problems in pregnancy compared to a woman who has not. This still means most women will not have heart disease or diabetes after having high blood pressure in pregnancy, especially if they can avoid risk factors like smoking or excessive weight gain, and maintain a healthy diet and exercise.

Kidney problems are about 5 to 10 times more common after preeclampsia in particular. Although the relative risk of developing kidney problems is substantially higher after preeclampsia, the absolute risk of long-term kidney disease is still low. Unless the woman already had a kidney problem, well over 90% of women after preeclampsia and gestational hypertension will not have a kidney problem.

Fortunately, although seizures may occur as a result of preeclampsia during pregnancy, women have no higher long term risk of seizures compared to women who did not have a complicated pregnancy. There is no increased risk of getting cancer (e.g. breast cancer, leukaemia) after having high blood pressure in pregnancy.

For all the long term health risks, these start to go up within 10 years after an affected pregnancy and are ongoing after that. Therefore, it is recommended that women attend regular blood pressure checks with their GP and discuss any changes they can make to improve their general health. For more general information about heart health and managing health risks, please visit the National Heart Foundation website: <https://www.heartfoundation.org.au/your-heart/know-your-risks>

THANK YOU FOR YOUR PARTICIPATION



STROBE Statement— Assessing Australian women’s knowledge about cardiovascular risk after hypertensive disorders of pregnancy and exploring information content and format preferences

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	2
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	2& 5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2&6
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	5-6
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	-
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-
Bias	9	Describe any efforts to address potential sources of bias	16
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	

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(e) Describe any sensitivity analyses



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60**Results**

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9 Tab1
		(b) Indicate number of participants with missing data for each variable of interest	8
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	

**Discussion**

Key results	18	Summarise key results with reference to study objectives	9-10 Table 3&4
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15- 16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10- 15
Generalisability	21	Discuss the generalisability (external validity) of the study results	17

**Other information**

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19
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\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Assessing Australian women's knowledge and knowledge preferences about long-term health after hypertensive disorders of pregnancy: a survey study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-042920.R1
Article Type:	Original research
Date Submitted by the Author:	02-Nov-2020
Complete List of Authors:	Roth, Heike; University of Technology Sydney, Faculty of Health Homer, Caroline; University of Technology Sydney, Centre for Midwifery, Child and Family Health; Burnet Institute, Maternal and Child Health LeMarquand, Grace; University of New South Wales Roberts, Lynne M.; Saint George Hospital, Women's and Children's Health; University of New South Wales, Medicine Hanley, Lisa; Saint George Hospital, Maternity Consumer Brown, Mark; Saint George Hospital, Renal Medicine; University of New South Wales, St George Clinical School Henry, Amanda ; University of New South Wales Faculty of Medicine, Women's and Children's Health
<b>Primary Subject Heading</b>:	Cardiovascular medicine
Secondary Subject Heading:	Obstetrics and gynaecology
Keywords:	Hypertension < CARDIOLOGY, Maternal medicine < OBSTETRICS, PRIMARY CARE

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# 1 **Assessing Australian women's knowledge and knowledge** 2 **preferences about long-term health after hypertensive** 3 **disorders of pregnancy: a survey study**

4  
5 Heike Roth<sup>1</sup>, Caroline SE Homer<sup>1,3</sup>, Grace LeMarquand<sup>2</sup>, Lynne Roberts<sup>2,7</sup>, Lisa  
6 Hanley<sup>8</sup>, Mark Brown<sup>5,6</sup>, Amanda Henry<sup>1,2,4,7</sup>

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20 Children's Health, Kogarah NSW 2217, Australia.

21  
22 **Word Count:** (excl. title page, abstract, references, figures and tables): 3650

23  
24 **Keywords:** Cardiovascular risk, women, preeclampsia, gestational hypertension,  
25 long-term cardiovascular health, preventive health

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3 **27 ABSTRACT**  
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8 **29 Objective(s):** To (a) assess women's current knowledge regarding long-term  
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10 30 cardiovascular health after hypertensive disorders of pregnancy (b) elicit women's  
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12 31 preferred educational content and format regarding health after hypertensive disorders  
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15 32 of pregnancy.

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17 33 **Design and setting:** A custom-created online survey exploring Australian women's  
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19 34 knowledge about long-term health after hypertensive disorders of pregnancy,  
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22 35 distributed through consumer groups and social media.

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24 36 **Participants:** 266 women with (n=174) or without (n=92) a history of hypertensive  
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26 37 disorders of pregnancy.

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29 38 **Primary and secondary outcome measures:** 1) Proportion of women identifying  
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31 39 long-term health risks after hypertensive disorder of pregnancy using a 10-point risk  
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33 40 knowledge score with 0-4 'low', 4.1-7.0 'moderate' and 7.1-10 'high'. 2) Exploration of  
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35 41 preferred content, format and distribution of educational material post hypertensive  
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37 42 disorder of pregnancy.

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40 43 **Results:** Knowledge scores about health after hypertensive disorder of pregnancy  
41  
42 44 were moderate in groups with and without a history of the disorder. Knowledge was  
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44 45 highest regarding risk of recurrent hypertensive  
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46 46 disorders in a subsequent pregnancy, 'moderate' for chronic hypertension and heart  
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48 47 attack, 'moderate' and 'low' regarding risk of heart disease and 'low' for diabetes and  
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50 48 renal disease. Only 36% of all participants were aware that risks start within 10 years  
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52 49 after the affected pregnancy. The majority of respondents with a history of  
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54 50 hypertensive disorder of pregnancy (76%) preferred receiving information about long-

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3 51 term health 0-6 months postpartum from a healthcare provider (80%), key  
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5 52 organisations (60%), social media (47%) and brochures/flyers (43%).  
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8 53 **Conclusion(s):** Women's knowledge regarding health risks after hypertensive disorder  
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10 54 of pregnancy was 'moderate', although with important disease-specific gaps such as  
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12 55 increased risk of diabetes. Most women wanted to be informed about their long-term  
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14 56 health from a healthcare provider.  
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## 20 58 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

- 23 59 • Consumer co-created survey exploring health knowledge after hypertensive  
24  
25 60 pregnancy.
- 27 61 • For the first time survey results include findings from women with a history of  
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29 62 gestational hypertension as well as from women without a history of hypertensive  
30  
31 63 disorder of pregnancy.
- 34 64 • Recruitment from groups with potentially greater baseline knowledge may bias  
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36 65 results, although substantive knowledge gaps still found.
- 39 66 • Although surveys were available in English, Arabic and Mandarin, there remains  
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41 67 potential sub-optimal coverage of culturally and linguistically diverse groups.  
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## 46 69 **INTRODUCTION**

48 70 Hypertensive disorders of pregnancy (HDP) include chronic hypertension (CH),  
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50 71 preeclampsia (PE) and gestational hypertension (GH) and complicate 5-10% of  
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52 72 pregnancies<sup>1</sup>. PE is a multi-system disorder characterised by new-onset hypertension  
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54 73 after 20 weeks' gestation and involvement of one or more other organ systems and/or  
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56 74 the fetus<sup>2,3</sup>. GH is new-onset hypertension after 20 weeks' gestation without any other  
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58 75 complications. Apart from GH itself being considered an adverse pregnancy outcome  
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3 76 and it carrying an increased risk of progression to PE<sup>2 3</sup>, is not associated with adverse  
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5 77 pregnancy outcomes. However, both conditions are associated with long-term  
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7 78 cardiovascular and other chronic disease sequelae<sup>4 5</sup>. CH is defined as hypertension  
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10 79 that is confirmed before pregnancy or before 20 completed weeks gestation, which  
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12 80 may worsen during pregnancy and/or on which preeclampsia may be superimposed<sup>2</sup> .  
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14 81 Globally, cardiovascular disease (CVD) is one of the leading causes of death in  
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16 82 women,<sup>6</sup> and for women who have experienced an HDP, it is 2-3 times higher  
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18 83 compared with those who did not<sup>4 7 8</sup>. This risk of premature death is present within 10  
19  
20 84 years after the affected pregnancy<sup>7 9 10</sup> and remains after adjusting for the presence of  
21  
22 85 other cardiovascular risk factors. There is also an increasing body of recent research  
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24 86 linking PE and GH with other major chronic diseases including chronic kidney disease,  
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26 87 end-stage kidney disease, and Type 2 diabetes mellitus<sup>11-14</sup>.  
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33 89 Both Australian and international societies, including the Society of Obstetric Medicine  
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35 90 of Australia and New Zealand (SOMANZ) and the International Society for the Study of  
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37 91 Hypertension in Pregnancy (ISSHP), recommend that women and healthcare  
38  
39 92 providers (HCP) are provided with information about HDP and later CVD<sup>2 3</sup>. This  
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41 93 includes recommending that women have a clinical review several months postpartum,  
42  
43 94 and regular general practitioner (GP) follow-up to monitor blood pressure, fasting lipids  
44  
45 95 and blood sugar<sup>2</sup>. Adopting a healthy lifestyle with maintenance of an ideal weight and  
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47 96 regular aerobic exercise is emphasised<sup>2 3</sup>. The aims of this study were to (a) explore  
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49 97 Australian women's current knowledge on the topic of long-term CVD health after any  
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51 98 HDP, not just PE and (b) elicit women's preferred educational content and format  
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53 99 regarding health after HDP, as a basis for creating tailored information and health  
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55 100 advice for women after HDP.  
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67 102 **METHOD**

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9 103 A national survey of women with and without a history of HDP was conducted, using a  
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11 104 custom-created, face-validated online survey. Ethical approval was provided by the  
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13 105 relevant Human Research Ethics Committee (HREC 18/POWH/326, REGIS  
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15 106 2019/PID05668).

17 107

20 108 **Patient and Public involvement**

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23 109 As a validated instrument to assess women's knowledge was unavailable, a survey  
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25 110 was custom designed. Initially, women with a history of HDP, comprising nine  
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27 111 volunteers from the *Postpartum physiology, psychology and paediatric follow up study*  
28  
29 112 (*P4 Study*)<sup>15</sup> and Australian Action on Preeclampsia (AAPEC), were invited to take  
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31 113 part in group interviews which addressed the possible content and design of the  
32  
33 114 survey, tested the survey for face validity and provided feedback for improvement. The  
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35 115 topics discussed during the interviews were sourced from findings from a scoping  
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37 116 literature review<sup>16</sup> and further complemented by questions specifically exploring the  
38  
39 117 Australian context for women experiencing HDP. Nine women participated in the face-  
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41 118 validation process and commented on content, language, flow, survey structure  
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43 119 including length, whether the introduction and the risk profile proposed for the end of  
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45 120 the survey were informative as well as using appropriate language. Following feedback  
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47 121 and integration of suggestions from the women, the survey was modified until  
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49 122 consensus over a final version was achieved among study investigators, including the  
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51 123 consumer representative (LH). The survey was made available in English, Arabic and  
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53 124 Mandarin.  
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## 126 **Data collection**

127 The final survey was targeted at women in Australia, 18 years and older with a history  
128 of pregnancy in the last 3 years. Women who were currently pregnant were requested  
129 to only complete the survey if they had no major issues in their current pregnancy.  
130 Women not currently pregnant with pregnancy in the preceding three years were  
131 eligible either if they had experienced HDP (CH, GH or PE) or a pregnancy without any  
132 serious complications. The online survey, using SurveyMonkey™, was open from July  
133 to August 2019. Survey distribution occurred through the P4 study participants,  
134 organisations such as AAPEC, maternity consumer groups as well as via the project's  
135 consumer representative and social media (Facebook and Twitter) including  
136 multicultural networks in order to reach Arabic and Mandarin speaking communities. A  
137 targeted convenience sample was selected. Prior to acknowledging their voluntary  
138 participation at the commencement of the survey, women were presented with an  
139 introductory letter outlining the details of the study (Appendix 1). Commencement of  
140 the survey was then taken as consent to participate.

141

## 142 **The data collection instrument**

143 The survey for women (Appendix 1) explored demographic details, assessed obstetric  
144 history, history of HDP and other medical history including family history. The survey  
145 was tailored to women's self-reported HDP history (GH, PE, CH with or without  
146 worsening in pregnancy or superimposed PE, no hypertension history), with women  
147 given definitions of HDP conditions early in the survey to aid their self-report.  
148 Questions focused on knowledge of risk after pregnancy, provision of care and  
149 education following birth and what information and education women would like to  
150 receive. Women with a history of GH, PE or CH were asked to classify their perceived

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3 151 risk (based on their own lived HDP sub-type) of experiencing various long-term health  
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5 152 outcomes as greater, less than or equal to that of a woman with a normotensive  
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7 153 pregnancy. Women who experienced a normotensive pregnancy were also asked to  
8  
9 154 classify whether they believed women who had had HDP were at greater, lesser, or  
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11 155 equal risk. The survey included two 'distractor' conditions not known to have an  
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13 156 increased risk after HDP (breast cancer and seizures) to elicit negative answers and  
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15 157 ascertain whether women could identify what they were not at increased risk of after  
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17 158 HDP as well as what they were at risk of. At survey completion, women were provided  
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19 159 with a correct risk profile summary and a link to further information.  
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## 26 161 **Data Analysis**

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28 162 Quantitative survey analysis was undertaken using SPSS Version 25 (SPSS Statistics  
29  
30 163 for Windows, Armonk, NY). Demographic data and responses to individual questions  
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32 164 were analysed descriptively. To examine difference in knowledge levels amongst the  
33  
34 165 targeted subgroups, (GH, PE, CH in pregnancy, no hypertension history) responses  
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36 166 regarding HDP and future health risks were compared using Chi-squared testing or  
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38 167 likelihood ratio for categorical data (as appropriate to subgroup sample size) and one-  
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40 168 way ANOVA testing for continuous data. A  $p$  value of  $<0.05$  was considered  
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43 169 statistically significant.  
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49 171 A knowledge score was created for the risk matrix whereby 1 point was allocated to  
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51 172 the correct answer, 0 for the incorrect answer, 0 for 'I do not know' and 0 for no  
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53 173 answer/left blank. A mean knowledge score for each condition/health outcome was  
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55 174 calculated and a scale of 'low', 'moderate' and 'high' knowledge was established. The  
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57 175 ranking classifications were chosen based on the data distribution and were divided  
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3 176 into three score categories. For each individual condition/health outcome's mean  
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5 177 score, 'low knowledge' equated to a mean of 0.00-0.40, 'moderate knowledge' was  
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7 178 0.41-0.70 and 'high knowledge' a mean of 0.71-1.00. An overall mean score out of 10  
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10 179 (as there were 10 conditions) was calculated for the HDP and non-HDP groups (i.e.  
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12 180 the HDP group's knowledge regarding their long-term health risks and the non-HDP  
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14 181 group's knowledge regarding the long-term health risks of HDP women). This overall  
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17 182 score was classified as 'low' 'moderate' or 'high' using the same mean ranges as were  
18  
19 183 used for the individual conditions. Categorical analysis for proportions of each  
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21 184 knowledge group ('high', 'moderate' and 'low') was also conducted to provide a further  
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24 185 perspective.  
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## 187 **RESULTS**

188 In total, 308 survey responses were received (Figure 1). Forty-two were excluded: 40  
189 for discontinuing the survey and not answering the question asking about their  
190 perception of lower/same/higher risk with regards to 10 health conditions, and two with  
191 'CH only' (no worsening hypertension or superimposed PE in pregnancy) who were  
192 excluded due to small numbers. Of 266 included responses, 174 (65%) women had a  
193 lived experience of any HDP (will be known as HDP for reporting purposes) and 92  
194 (35%) did not (will be known as non-HDP for reporting purposes). The HDP group  
195 consisted of 15 women with GH only (9%), 143 women with PE only (82%) and 16  
196 women with CH plus superimposed pregnancy hypertension or PE (9%; will be known  
197 as CH). Of the HDP group, 123 (71%) had their most recent experience with HDP less  
198 than three years prior (32% <1 year prior and 39% 1-3 years prior).

199

200 Most respondents were in the 26-35 or 36-45 year age groups (91%), 89% were of  
 201 Caucasian ethnicity, 90% pursued education beyond secondary school and 96% were  
 202 in a relationship (Table 1). HDP women were more likely to be Caucasian, to have a  
 203 history of diabetes, renal problems, be overweight and to have at least one additional  
 204 cardiovascular risk factor than non-HDP women (Supplementary Table 1), and less  
 205 likely to be university-educated. Half of all participants were sourced through social  
 206 media (50%), with most of the remainder (45%) recruited via the P4 study (8% of HDP  
 207 women, 46% of non-HDP women) and AAPEC (35% of HDP women).

208

209 Table 1: Respondent demographics

	Total	GH	PE	CH	Total HDP	Total Non HDP	P value HDP vs non HDP
	N(%)	%	%	%	N (%)	N(%)	
<b>Total N</b>	<b>266</b>	<b>15</b>	<b>143</b>	<b>16</b>	<b>174</b>	<b>92</b>	
AGE							
18-25	12 (5)	13	6	-	10 (6)	2 (2)	0.16
26-35	117 (44)	33	48	50	81 (47)	36 (39)	0.25
36-45	126 (47)	53	42	50	76 (44)	50 (54)	0.10
45+	10 (3)	-	5	-	7 (4)	3 (3)	0.75
Prefer not to answer	1 (0)	-	-	-	-	1 (1)	-
ETHNICITY							
Caucasian	236 (89)	93	97	81	165 (95)	71 (77)	<0.001
Asian	23 (9)	7	2	6	5 (3)	18 (20)	<0.001
Other <sup>1</sup>	7 (3)	-	1	13	4 (2)	3 (8)	0.65
HIGHEST EDUCATIONAL ATTAINMENT							
Secondary School	25 (9)	7	14	13	23 (13)	2 (2)	0.003
Diploma/Trade*	69 (26)	33	33	50	60 (35)	9 (10)	<0.001
University Degree	171 (64)	60	52	38	90 (52)	81 (88)	<0.001
Prefer not to answer	1 (0)	-	1	-	1 (1)	-	-
RELATIONSHIP STATUS							
In a relationship	254 (96)	100	93	88	162 (93)	92 (100)	0.001
Not in a relationship	11 (4)	-	6	13	11 (6)	0 (1)	
Prefer not to answer	1 (0)	-	1	-	1 (1)	-	-
RECRUITED TO SURVEY VIA							
P4 Newsletter	56 (21)	13	8	6	14 (8)	42 (46)	<0.001
AAPEC	62 (23)	7	40	19	61 (35)	1 (1)	<0.001
Social Media	134 (50)	80	52	69	97 (56)	37 (40)	0.02
Other <sup>2</sup>	14 (5)	-	1	6	2 (1)	12 (13)	<0.001

210 \* Diploma or Trade certificate

211 <sup>1</sup> Other: Indigenous Australian (n=1), Polynesian or Maori (n=2), mixed ethnicity (n=4).212 <sup>2</sup> Other: Friend (n=11), ACM (n=1), Clinic (n=1), Maternity Consumer group other than AAPEC (n=1).

213 PE = preeclampsia GH = gestational hypertension CH = chronic hypertension, worsening in pregnancy and/or  
 214 superimposed preeclampsia P4= Postpartum Physiology, Psychology, and Paediatric Study AAPEC= Australian  
 215 Action on Preeclampsia ACM= Australian College of Midwives.

217 Table 2: Means of risk factor knowledge of women listed by type of HDP

	GH n=15	PE n=143	CH n=16	HDP n=174	Non HDP n=92	P Value HDP vs non HDP
<i>Chronic Hypertension</i>	0.53	0.78	0.81	0.76	0.62	0.02
<i>Diabetes</i>	0.27	0.24	0.31	0.25	0.35	0.12
<i>Renal Disease</i>	0.27	0.54	0.69	0.53	0.21	<0.001
<i>Heart Attack</i>	0.53	0.69	0.75	0.68	0.52	0.01
<i>Repeat HDP</i>	0.87	0.90	0.94	0.90	0.71	<0.001
<i>Stroke</i>	0.47	0.62	0.81	0.63	0.53	0.14
<i>Heart Disease</i>	0.47	0.69	0.75	0.68	0.50	0.005
<i>PVD</i>	0.33	0.50	0.50	0.32	0.45	<0.001
<i>Breast Cancer*</i>	0.20	0.52	0.31	0.47	0.65	0.004
<i>Seizures*</i>	0.27	0.29	0.13	0.27	0.44	0.01
<b>OVERALL MEAN KNOWLEDGE SCORE (OUT OF 10)</b>	<b>4.2</b>	<b>5.8</b>	<b>6.0</b>	<b>5.6</b>	<b>5.2</b>	0.21

218 PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or  
 219 superimposed preeclampsia, HDP= hypertensive disorder of pregnancy, PVD= Peripheral Vascular Disease  
 220 \* Breast cancer and seizures are distractors within the survey. These were included despite being conditions that  
 221 women after HDP are not at greater risk of.

MEAN SCORE		
	LOW	0-0.40
	MODERATE	0.41-0.70
	HIGH	0.71-1

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 223  
 224  
 225 Average knowledge scores are shown in Table 2 and detailed results on which these  
 226 scores are based are shown in Supplementary Tables 2-11. Overall knowledge of the  
 227 10 conditions in the survey was 'moderate' for both groups (5.6/10 amongst HDP and  
 228 5.2/10 amongst non-HDP, p=0.21), with 33% in both groups having "high" overall  
 229 knowledge and 32% and 40% respectively having "low" overall knowledge  
 230 (Supplementary Table 12). Women with a history of HDP had 'high' knowledge with  
 231 regards to recurrence of HDP in a subsequent pregnancy (0.90) and risk of future CH



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3 232 (0.76). The same group had 'moderate' knowledge regarding increased chance of  
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5 233 conditions such as heart attack (0.68), heart disease (0.68) and stroke (0.63). Women  
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7 234 without HDP history had 'high' knowledge (0.71) for HDP recurrence in a subsequent  
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9 235 pregnancy. The same group of women had moderate knowledge of chronic  
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11 236 hypertension (0.62) and stroke (0.53). Lowest knowledge across both groups was  
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13 237 around the risk of future diabetes (0.25 HDP group and 0.35 for non-HDP group).  
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15 238 Further 'low' scoring conditions were peripheral vascular disease (PVD) and renal  
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17 239 disease. For most conditions HDP women had significantly higher knowledge than the  
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19 240 non-HDP group. However, the non-HDP group were more likely to correctly identify  
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21 241 that the risk of the two 'distractor' conditions, seizures or breast cancer, were equal for  
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23 242 both groups.  
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31 244 Supplementary Table 13 shows knowledge score breakdown by time since pregnancy.  
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33 245 In the subgroup of HDP women who experienced PE (n=143), average knowledge  
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35 246 was similar amongst women who experienced HDP within the last three years (5.8/10),  
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37 247 compared to those who experienced HDP more than three years ago (5.7/10). Of the  
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39 248 HDP women, only 32% were aware that the cardiovascular conditions may start  
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41 249 manifesting within 10 years after an affected pregnancy, compared with 45% of  
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43 250 women in the non-HDP group (p=0.036). About a third in each group (30% HDP, 36%  
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45 251 non-HDP) were unsure about timing of risk rise/when health conditions manifest  
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47 252 (Supplementary Table 14).  
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53 254 Women with HDP history were asked about their personal experience of risk  
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55 255 discussion with healthcare providers (Table 3 represents summary of collective HDP  
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57 256 data, Supplementary Table 15 provides all findings by HDP sub-group). The most  
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257 frequent discussions about future health were regarding HDP in subsequent  
 258 pregnancies (45%), risk of chronic hypertension (43%), and 'No discussion' (37%).  
 259 Risk discussions were no more likely to have occurred in women with HDP less than 3  
 260 years ago or over 3 years ago. There were also no statistically significant differences  
 261 found between HDP subgroups about whether future risks were discussed, or what  
 262 types of risk were discussed.

263

264 Table 3: Proportion of conditions discussed when addressing future risk (multiple  
 265 answers collected) within and over 3 years since last HDP (summary of collective  
 266 HDP data)\*

267

	Total n = 174 N (%)		Overall Total n = 174 N (%)	P value < 3 yrs vs >3 yrs
	<3yrs	>3yrs		
<i>HDP next pregnancy</i>	55 (45)	24 (47)	79 (45)	0.78
<i>Chronic Hypertension</i>	55 (45)	19 (37)	74 (43)	0.37
<b>No discussion</b>	<b>45 (37)</b>	<b>19 (37)</b>	<b>64 (37)</b>	<b>0.93</b>
<i>Lifestyle changes</i>	32 (26)	8 (16)	40 (23)	0.14
<i>Heart Attack</i>	22 (18)	7 (14)	29 (17)	0.50
<i>Renal Disease</i>	23 (19)	4 (8)	27 (16)	0.07
<i>Stroke</i>	20 (16)	6 (12)	26 (15)	0.45
<i>Peripheral vascular disease</i>	16 (13)	5 (10)	21 (12)	0.56
<i>Cannot remember</i>	6 (5)	2 (4)	8 (5)	0.78

268 \*Table represents frequency of each option; percentages add to over 100% as women were asked to select  
 269 any/all that applied. PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in  
 270 pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

271

272 When asked about preferences of the timing of a future risk discussion, the majority  
 273 (76%) of women wanted a discussion 0-6 months postpartum. The topics most women  
 274 with HDP wished to discuss (Table 4) are 'impact on my children from the pregnancy  
 275 affected by HDP' (73%), 'signs and symptoms of the conditions' (67%), 'when does  
 276 risk rise' (54%) and 'risk reduction for subsequent pregnancy' (54%). HDP women's  
 277 preference for receiving information on long-term health after HDP is via a medical  
 278 professional (80%), through key organisations such as The Australian Heart  
 279 Foundation (60%) and social media (47%).

280

281 Table 4: HDP women's preferences for content and distribution of  
 282 information/education on future risk after HDP (multiple answers collected) in order  
 283 of preference  
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	<b>GH</b>	<b>PE</b>	<b>CH</b>	<b>Total HDP</b>
	<b>%</b>	<b>%</b>	<b>%</b>	<b>N (%)</b>
<b>Total N</b>	<b>15</b>	<b>143</b>	<b>16</b>	<b>174</b>
<b>Preference of Discussion Topics*</b>				
<i>Impact on my children from the pregnancy affected by HDP</i>	73	80	63	136 (73)
<i>Signs and Symptoms of the conditions</i>	80	71	69	124 (67)
<i>Risk reduction for subsequent pregnancy</i>	40	62	44	101 (54)
<i>When does the risk rise</i>	40	61	50	101 (54)
<i>Statistics</i>	40	60	38	98 (53)
<i>Reducing risk behaviours (diet, exercise, smoking cessation)</i>	40	56	31	91 (49)
<i>Where to find information</i>	40	51	13	81 (44)
<i>How to discuss the matter with my healthcare provider</i>	27	40	25	65 (35)
<b>Preference of Distribution*</b>				
<i>Medical professionals</i>	73	82	75	140 (80)
<i>Key organisations</i>	53	61	63	105 (60)
<i>Social Media</i>	40	51	19	82 (47)
<i>Brochures/Flyers</i>	40	45	31	75 (43)
<i>Online Videos</i>	20	24	25	42 (24)
<i>Podcast/Media</i>	13	23	25	39 (22)

285 \*Table represents frequency of each option; percentages add to over 100% as women were asked to select  
 286 any/all that applied. PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in  
 287 pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

288

## 289 DISCUSSION

290 This study found overall, 'moderate' knowledge of health conditions after HDP  
 291 amongst both HDP and non-HDP women. Amongst women with a history of HDP,  
 292 highest knowledge was identified with regards to future risk of hypertension and repeat  
 293 HDP in subsequent pregnancies. Conversely, knowledge of future risk of diabetes was  
 294 low, as was knowledge of the "distractor" conditions among HDP women particularly.  
 295 Diabetes as a future risk factor post HDP has previously not been reported on in

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3 296 studies of women's knowledge, and our findings suggest this is an important  
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5 297 knowledge gap to address.  
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10 299 Other novel aspects of our study are inclusion of women who had a history of GH as  
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12 300 well as those with a history of PE, and assessing knowledge of non-HDP women's  
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14 301 knowledge. Women after HDP had somewhat higher knowledge of most health risks  
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16 302 than the non-HDP group, however non-HDP group also had better knowledge of some  
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18 303 aspects such as timing of risk increase. However, both groups' knowledge of the early  
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20 304 increase in risk was low, adding further concern and reason to address the knowledge  
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22 305 gap. When looking at the proportion of participants scoring "high", these were equal  
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24 306 between the HDP (33%) and non-HDP groups (33%), whilst proportions scoring "low"  
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26 307 were similar enough (32% HDP versus 40% non-HDP) to not to show statistical  
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28 308 significance. Our scoping review in 2019<sup>16</sup> identified that post HDP, women have  
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30 309 insufficient knowledge of their long-term risks. By including non-HDP women we  
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32 310 wanted to explore whether knowledge was similar between the groups, which if so  
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34 311 would suggest HDP women are not receiving tailored, targeted information and/or any  
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36 312 information received is not translated into knowledge of personal risk after HDP. Given  
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38 313 women after HDP were not markedly more knowledgeable about their health risks than  
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40 314 unaffected women, the research-to-practice translational gap is further highlighted and  
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42 315 suggests women with a lived experience of HDP remain underinformed about their  
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44 316 increased CVD risk.  
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53 318 A further important finding was that many HDP women were not made aware of future  
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55 319 health risks, with 37% of HDP women reporting to have had 'no discussion' about their  
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57 320 increased long-term risk. Women with more recent HDP were no more likely than  
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3 321 women with HDP>3 years ago to report having risks discussed, which is concerning.  
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5 322 This finding suggests risk discussions may not have improved in recent years despite  
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7 323 updated guidelines emphasising long-term health<sup>2,3</sup>, and that the extensive evidence  
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9 324 regarding long-term implications for women after HDP continues to be lost in the  
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11 325 translation of research to practice. We are exploring reasons for this (e.g. lack of  
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13 326 evidence base in guidelines, lack of provider knowledge of guidelines, siloed  
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15 327 healthcare with insufficient handover from maternity care team to primary care) in our  
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17 328 broader work.  
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24 330 Women's knowledge after GH has not been previously reported as far as we are  
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26 331 aware even though GH has similar frequency and similar future CVD risk as PE<sup>4,17</sup>.  
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28 332 Although only 9% of our sample were GH, this group had somewhat lower knowledge  
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30 333 than the PE and CH groups regarding conditions after HDP (although mostly not  
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32 334 reaching statistical significance). Over half reported receiving no discussion of health  
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34 335 risks after GH. Despite the small number of women with a history of GH (n=15)  
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36 336 contributing to the study, this suggests potential substantive knowledge gaps after GH  
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38 337 to address in both women and healthcare providers.  
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45 339 International studies exploring women's knowledge have predominantly reported  
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47 340 limited or no knowledge about the link between HDP and CVD<sup>16</sup>, though our study  
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49 341 found overall, 'moderate' knowledge of health conditions after HDP. The two  
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51 342 conditions associated with highest knowledge were repeat HDP and risk of future  
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53 343 hypertension. Findings were similar in Traylor et al.'s<sup>18</sup> survey conducted in the United  
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55 344 States of America (USA), where 146 women post HDP were included (PE n=76, PE  
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57 345 with severe features n=41, CH=29). Future hypertension and repeat HDP were  
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3 346 correctly identified by women as risk factors, however this knowledge was mainly  
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5 347 reflected in the group of women who had experienced PE with severe features. In the  
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7 348 United Kingdom (UK), Brown et al.<sup>19</sup> (n=12 women attending postnatal follow-up clinic)  
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10 349 also found that women are aware of repeat HDP risks, however despite postnatal risk  
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12 350 counseling, perception of hypertension and CVD risk was mainly associated with  
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14 351 participants who had a family history of CVD. More recently in Australia, Hutchesson et  
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16 352 al.<sup>20</sup> surveyed 127 women with PE in the two years prior, finding very high knowledge  
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18 353 about future hypertension risk (96%, higher than our post-PE findings) and most were  
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20 354 aware of stroke (67%) and CVD (66%) risks (similar to our findings). Over a third of  
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22 355 women after PE had 'no discussion' about future risk in our study. Hutchesson et. al<sup>20</sup>  
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24 356 reported over one third of their participants remained unaware of increased CVD risks,  
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26 357 which is similar to our findings. Similarities may be explained by the fact that major  
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28 358 source of PE participants for both, the Hutchesson et. al<sup>20</sup> survey and ours was the  
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30 359 patient support/advocacy group AAPEC. Recruitment from this advocacy group may  
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32 360 also explain a higher post-PE knowledge than other studies have reported.  
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41 362 Our study findings resonate with those from similarly targeted women in Canada,  
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43 363 Portugal, UK, the USA and a previous Australian study, all conducted between 2013  
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45 364 and 2017<sup>16</sup>. Therefore, from a global perspective, these findings reinforce a persistent  
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47 365 and concerning, research to consumer gap. With international guidelines, including  
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49 366 ISSHP<sup>2</sup>, specifically targeted to assist HCPs providing care to women on an  
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51 367 international scale to better manage and address health after HDP, this practice gap of  
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53 368 knowledge transmission to women would be expected to narrow.  
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## 58 370 **Education preferences**

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5 372 Women mostly wanted educational materials to address HDP impact on their children,  
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7 373 signs and symptoms of conditions they are at higher risk of, the timing of when their  
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9 374 risks rise, and how to best reduce risk of recurrent HDP. Similar preferences were  
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11 375 expressed by the women included in Seely et al.'s<sup>21</sup> focus group of 20 women after  
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13 376 PE, with the key concern being the impact the PE pregnancy may have had on the  
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15 377 health of their children. More recently, a UK-based study<sup>22</sup>, involving women with a  
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17 378 history of HDP and healthcare providers (HCP), identified research priorities regarding  
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19 379 HDP. The top-ranking priority identified was the long-term physical and mental health  
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21 380 consequences of HDP for the woman, baby and family. Other 'uncertainties'  
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23 381 expressed by participants regarding their lived experience of HDP included topics such  
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25 382 as diagnosis and management in pregnancy, prevention of future complications, short  
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27 383 and long-term consequences of HDP for the woman and the baby, prevention of  
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29 384 recurrent HDP as well as educational needs of HCPs and support for women and their  
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31 385 families. Our study, with focus on women in Australia, suggests that similar  
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33 386 uncertainties may benefit from being addressed, hence validating the importance of  
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35 387 our findings.  
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45 389 Format of education and access

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47 390 Our study identified that women mostly wanted to receive information about long-term  
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49 391 health after HDP from medical professionals. Key organisations who are experts on  
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51 392 the topic, via social media and through information brochures were other acceptable  
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53 393 avenues of access to information. This is in contrast to Skurnik et al's<sup>23</sup> focus group of  
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55 394 14 women after PE, whose preferences for educational materials about the link  
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57 395 between CVD and PE were via pamphlets available in doctor's offices as well as via  
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3 396 online communities and topical blogs. However, Hird et al's<sup>24</sup> participants also  
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5 397 expressed preference for healthcare providers as their information source, including  
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7 398 wanting healthcare providers to guide them towards reliable online/external information  
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10 399 sources rather than encounter irrelevant or potentially inaccurate information due to  
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12 400 their self-initiated search. Hutchesson et al.<sup>20</sup> report that high knowledge amongst  
13  
14 401 participants was mainly due to the women's own research rather than receiving all  
15  
16 402 possible, relevant information from their healthcare provider. Overall, existing studies  
17  
18 403 including ours would suggest that although women are very open to the use of online  
19  
20 404 sources or information packs, their healthcare providers are seen as central to closing  
21  
22 405 their knowledge gaps.  
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28 407 Time of risk discussion

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30 408 An important element to consider when communicating about risk with women who  
31  
32 409 have experienced GH or PE is the timing of these discussions, as situational factors of  
33  
34 410 being a new mother may alter when women are most receptive to follow-up. In our  
35  
36 411 study, three-quarters of the women preferred this to occur in the first six months after  
37  
38 412 birth. As well as being their preference, this also aligns with the potential benefits of  
39  
40 413 early intervention and would allow for addressing knowledge gaps found in this study  
41  
42 414 around how soon the risk rises after HDP. Addressing future risk early but not  
43  
44 415 immediately is also supported by Brown et al.'s study of women after PE, where  
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46 416 participants suggested that six months postpartum was the timeframe where they felt  
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48 417 they had transitioned into a more comfortable stage of parenting and were able to  
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50 418 focus more on themselves again<sup>19</sup>.

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52 41953  
54 420 **Strengths and limitations**  
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3 421 The survey was co-created via a formalised process of seeking input and feedback on  
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5 422 the usability, language and content from women who have previously experienced  
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7 423 HDP. Although face-validation is a subjective process, involving consumers with a  
8  
9 424 history of HDP gives added value to the survey.  
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14 426 Our knowledge score is both a strength, as it allows for a summary of findings across  
15  
16 427 all the conditions and risks, and a limitation, as assigning cut-points for knowledge  
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18 428 ranking is an arbitrary designation. Having included the distractor conditions (breast  
19  
20 429 cancer and seizures) may also have altered the overall score. Whilst women are more  
21  
22 430 likely to experience seizures during a pregnancy complicated by HDP compared to  
23  
24 431 non-HDP women, the long-term risk of seizures is similar for both groups. Similarly,  
25  
26 432 the association of HDP and future increased risk of cancer (including breast cancer)  
27  
28 433 has been examined in a systematic review and meta-analysis, however proven not to  
29  
30 434 be associated with increased future risks after HDP<sup>25</sup>. Distractor inclusion may well  
31  
32 435 have lowered overall knowledge score, for example women believing that after HDP  
33  
34 436 they are at more risk of ongoing seizures since this is a risk during PE-affected  
35  
36 437 pregnancy. However, we believe inclusion of distractors and assessment of women's  
37  
38 438 response to them is valid, as it is important for women to not incorrectly believe they  
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40 439 are at increased risk of more conditions than they are, as well as having knowledge of  
41  
42 440 their increased cardiovascular risk. The addition of women with a history of GH as well  
43  
44 441 as women without any history of HDP, is also a strength to add broader perspective on  
45  
46 442 this topic.  
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51 444 Limitations include demographic make-up of respondents, with HDP participants  
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53 445 predominantly English speaking and Caucasian (95%) despite the survey being  
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3 446 available in Arabic and Mandarin as well as English. The non-HDP group (20% Asian  
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5 447 background) had similar background demographics of Australian reproductive-aged  
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7 448 women<sup>26</sup>, and as HDP is more prevalent amongst the Caucasian population<sup>27</sup>, the  
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9 449 sample in the context of ethnic background actually is proportionally likely close to  
10  
11 450 representative of Australian HDP and non-HDP women. However, it would have been  
12  
13 451 preferable to also gain insight from more culturally and linguistically diverse groups in  
14  
15 452 order to understand their knowledge base and address their needs within this context.  
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17 453  
18  
19 454 In the survey, women were asked to select their HDP history which was then used to  
20  
21 455 group them for analysis. Women's diagnosis of HDP is by self-report is a limitation, as  
22  
23 456 some bias may be introduced through inaccurate self-report of diagnosis. The broad  
24  
25 457 geographical range and anonymous nature of the survey precluded any verification of  
26  
27 458 diagnosis. However, women were provided with definitions of the various HDP  
28  
29 459 conditions at the start of the survey to aid them in their self-report. Another limitation is  
30  
31 460 where participants were recruited from, with close to half either drawn from the P4  
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33 461 study (an Australian post-HDP research study) or consumer group AAPEC. Therefore,  
34  
35 462 there may be knowledge bias in the sample (i.e. a more knowledgeable group of  
36  
37 463 participants than the overall HDP or non-HDP population). The women's level of active  
38  
39 464 engagement in pursuing further information on their long-term risks as well as their  
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41 465 level of motivation to participate in this study, further contributes to knowledge bias.  
42  
43 466 The number of respondents in all included HDP subgroups are a small proportion of  
44  
45 467 the total number of women experiencing HDP, which suggests volunteer bias and this  
46  
47 468 affects generalisability. However, non-representative, specialised samples of women  
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49 469 can be noted within most research addressing women's knowledge on long-term  
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51 470 health after HDP<sup>16</sup>. As even this group with potentially greater baseline knowledge had  
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3 471 substantive knowledge gaps, our study highlights the need for interventions to improve  
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5 472 knowledge of health after HDP.  
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10 474 **Implications**  
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12 475 Close to two decades worth of data have been collected<sup>8</sup> since research on the link  
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14 476 between HDP and increased CVD risk emerged in the early 2000s, with the first  
15  
16 477 systematic review published in 2007<sup>25</sup>. It could be expected that this knowledge, by  
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18 478 now, would have been translated into practice and shared with HDP women, however  
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20 479 our findings suggest that this is still not the case. This study is valuable from the public  
21  
22 480 health perspective, given the wider context of prevalence and importance of  
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24 481 cardiovascular disease in women. Findings from this study and the broader study it is  
25  
26 482 embedded in, will contribute towards the development, application and evaluation of  
27  
28 483 educational materials for women and healthcare providers. These future projects will  
29  
30 484 address persistent knowledge-to-practice-gaps regarding improving women's  
31  
32 485 cardiovascular health after HDP. Given the prevalence and impact of both HDP and  
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34 486 CVD, this is valuable for women's health, and public health more broadly.  
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42 488 Guidelines such as ISSHP<sup>2</sup> and SOMANZ<sup>3</sup> suggest regular follow-up after HDP as  
43  
44 489 well as counselling women with regards to their individual long-term CVD risk.  
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46  
47 490 Although available to the public, these are not designed for women. Compiling suitable  
48  
49 491 information for women would be an important step towards closing the knowledge gap.

50  
51 492 It is important to establish preferred content, presentation and timing of education for  
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53 493 post-HDP health for women as we have in this study, to maximise the chance that  
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55 494 women will engage with and benefit from education.  
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## 496 **CONCLUSION**

497 This Australian survey of women's knowledge of risks after HDP, found varying  
498 knowledge from the targeted groups. Despite 'high' knowledge being demonstrated  
499 regarding some risks, overall significant knowledge gaps were identified for certain  
500 conditions, particularly diabetes, and for knowledge about the relatively early timing of  
501 when health risks increase after HDP. Identifying these gaps are important in planning  
502 tailored education for women, and to improve early intervention for modifiable CVD  
503 risks in women after HDP. Addressing these women's preferences for content and to  
504 have this delivered by their healthcare provider may further lead to enhanced  
505 counselling, management and improved women's health trajectories.

506

## 507 **LIST OF ABBREVIATIONS**

508 AAPEC - Australian Action on Preeclampsia

509 CH - chronic hypertension worsening in pregnancy and/or with superimposed  
510 preeclampsia

511 CVD - cardiovascular disease

512 GH - gestational hypertension

513 GP - general practitioner

514 HCP - healthcare provider

515 HDP - hypertensive disorder of pregnancy

516 ISSHP - International Society for the Study of Hypertension in Pregnancy

517 PE - preeclampsia

518 PVD - peripheral vascular disease

519 SOMANZ - Society of Obstetric Medicine Australia New Zealand

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3 **521 STATEMENTS**

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5 **522 Ethical approval**

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7 Ethical approval has been provided by South-Eastern Sydney Local Health District  
8  
9 Human Research Ethics Committee (Ref: 18/POWH/326). The ratification for the  
10  
11 University of Technology Sydney has also been obtained under ETH18-3061.

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13 526

14 **527 Sources of funding**

15  
16 Amanda Henry is supported by a National Health and Medical Research Council  
17  
18 (Australia) Early Career Fellowship (APP 1141570). Caroline Homer is supported by  
19  
20 a NHMRC Principal Research Fellowship (APP1137745). Heike Roth is supported  
21  
22 by an Australian Government Research Training Program Stipend (RTPS) UTS and  
23  
24 RTP Fees Offset (RTPFO) Scholarship: The stipend is a 'salary' to support Heike  
25  
26 Roth in completing her PhD full time. The Scholarship supports her enrolment fees  
27  
28 for the PhD.

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30 535

31 **536 Transparency statement and competing interests**

32  
33 The article is the authors' original work, has not received prior publication and is not  
34  
35 under consideration for publication elsewhere. All the authors have seen and  
36  
37 approved the manuscript being submitted. The manuscript is an honest, accurate,  
38  
39 and transparent account of the study being reported, no important aspects of the  
40  
41 study have been omitted. We have read and understood BMJ policy on declaration  
42  
43 of interests and declare that we have no competing interests. This manuscript  
44  
45 presents partial results from Heike Roth's PhD research. The project is supervised  
46  
47 by Caroline Homer and Amanda Henry.

48  
49 545

50 **546 Authors contributions**

51  
52 Heike Roth, Amanda Henry and Caroline Homer contributed to the conception and  
53  
54 design of the study as well as the distribution of the survey and writing of the  
55  
56 manuscript. Heike Roth led the analysis of the survey data, drafting and designed  
57  
58 the Tables, Figures and Appendixes and wrote the first draft. Grace LeMarquand  
59  
60 was a medical Honours student assisting with pre-survey interviews as well as initial  
61  
62 data analysis. Lynne Roberts assisted in the survey development, supported the  
63  
64 distribution, the interpretation of the findings and the discussion. Mark Brown  
65  
66 contributed to the design of the survey and supported the interpretation of the

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3 555 findings and the discussion. As a maternity consumer, Lisa Hanley has assisted with  
4  
5 556 the survey design and ensured appropriate use of language and content as well as  
6  
7 557 supported the distribution. All authors contributed to drafts and revising of the paper  
8  
9 558 and all approved the final version.

10 559

## 11 560 **Acknowledgements**

12  
13 561 We thank all women who took the time to respond to the survey. We also thank the  
14  
15 562 organisations and their social media networks who assisted with the distribution of  
16  
17 563 the survey: The *Postpartum physiology, psychology and paediatric follow up study*  
18  
19 564 (*P4 Study*) research team, Australian Action on Preeclampsia, maternity consumer  
20  
21 565 groups, Lisa Hanley who is our volunteer consumer representative and the various  
22  
23 566 shares by consumers via social media (Facebook and Twitter) including multicultural  
24  
25 567 networks.

26 568

## 27 569 **Authors' information (optional)**

28  
29 570 This manuscript presents partial results from Heike Roth's PhD research. The project  
30  
31 571 is supervised by Caroline Homer and Amanda Henry.

32 572

## 33 573 **Data availability**

34 574 Data are available upon reasonable request.

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## TABLES, SUPPLEMENTARY TABLES, APPENDICES AND FIGURES

### Table legend

Table 1: Respondent demographics

Table 2: Means of risk factor knowledge of women listed by type of HDP

Table 3: Proportion of conditions discussed when addressing future risk (multiple answers collected) within and over 3 years since last HDP (summary of collective HDP data)\*

Table 4: HDP women's preferences for content and distribution of information/education on future risk after HDP (multiple answers collected) in order of preference

### Supplementary data

Supplementary Table 1: Current CVD risk factors of HDP and non-HDP women (Multiple answers collected) in order of frequency

Supplementary Table 2: Chronic Hypertension

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 3: Diabetes

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 4: Renal Disease

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 5: Heart Attack

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 6: HDP next pregnancy

a) Women with HDP likelihood of risk compared to non-HDP ("Do you think you have a lower/same/higher chance of getting the following")

b) Women without HDP likelihood of risk compared to HDP ("Do you think you have a lower/same/higher chance of getting the following")

Supplementary Table 7: Stroke



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3 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
4 a lower/same/higher chance of getting the following”)  
5 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
6 a lower/same/higher chance of getting the following”)  
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9 **Supplementary Table 8: Heart Disease**

- 10 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
11 a lower/same/higher chance of getting the following”)  
12 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
13 a lower/same/higher chance of getting the following”)  
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16 **Supplementary Table 9: Peripheral Vascular Disease**

- 17 a) - Women with HDP likelihood of risk compared to non-HDP (“Do you think you a)  
18 Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a  
19 lower/same/higher chance of getting the following”)  
20 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
21 a lower/same/higher chance of getting the following”)  
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24 **Supplementary Table 10: Breast Cancer**

- 25 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
26 a lower/same/higher chance of getting the following”)  
27 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
28 a lower/same/higher chance of getting the following”)  
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31 **Supplementary Table 11: Seizures**

- 32 a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have  
33 a lower/same/higher chance of getting the following”)  
34 b) Women without HDP likelihood of risk compared to HDP (“Do you think you have  
35 a lower/same/higher chance of getting the following”)  
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38 **Supplementary Table 12: Proportion of participants scoring ‘high’, ‘moderate’ and  
39 ‘low’ by type of HDP and non-HDP**  
40

41 **Supplementary Table 13: Means of risk factor knowledge of women with a history of  
42 preeclampsia listed by time elapsed since HDP**  
43

44 **Supplementary Table 14: HDP and non-HDP women’s answers to timing of rise of  
45 risk with signs and symptoms starting to show**  
46  
47

48 **Supplementary Table 15: Proportion of conditions discussed by HDP sub-type when  
49 addressing future risk (multiple answers collected) within and over 3 years since last  
50 HDP (complements Table 3 which illustrates a summary of this data)**  
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52

53 **Appendices**

54 **Appendix 1: Survey for women**  
55

56 **Figure legend**

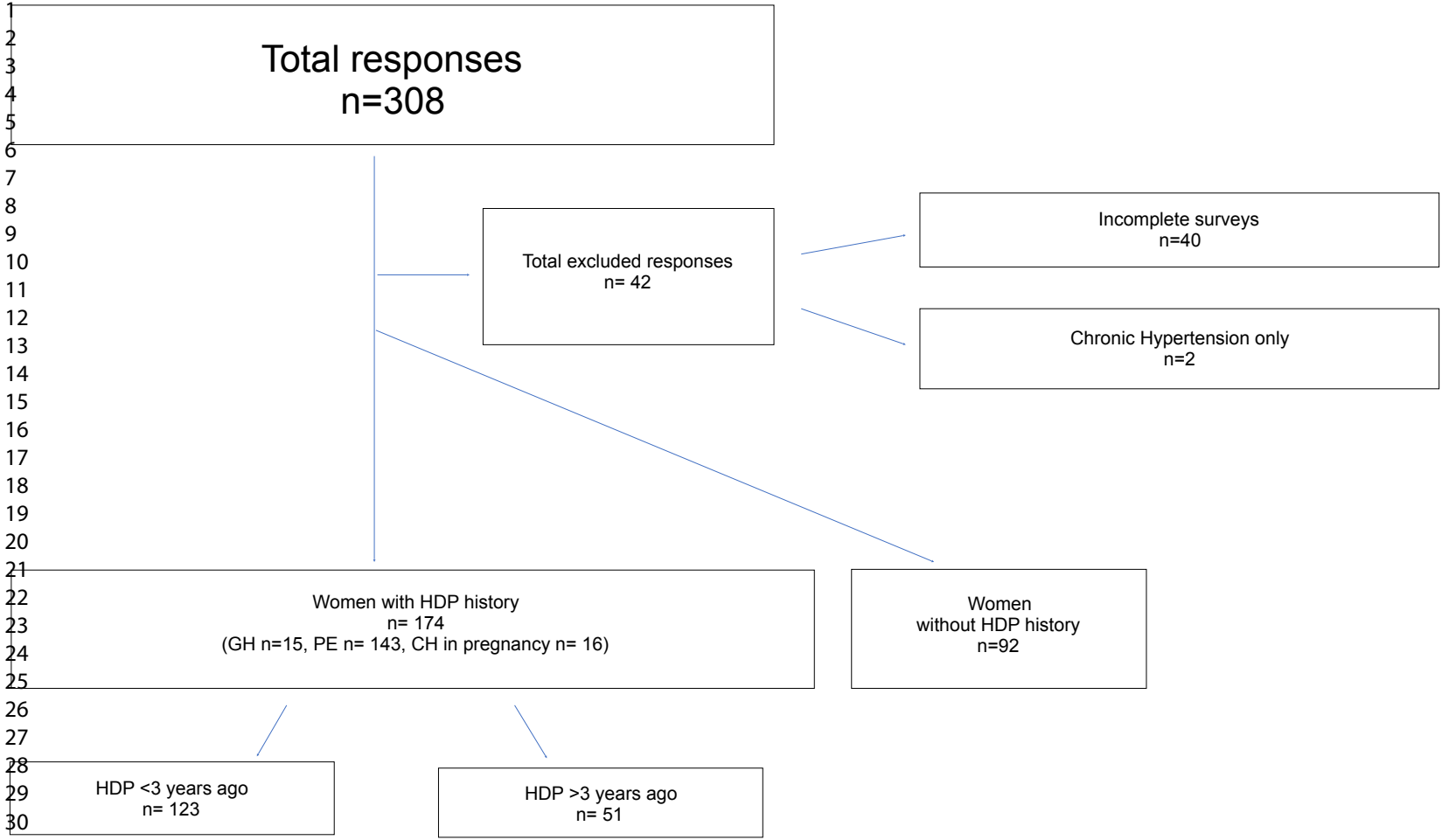
57 **Figure 1: Survey inclusion**  
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For peer review only



HDP- hypertensive disorder of pregnancy, GH - gestational hypertension, PE - preeclampsia, CH in pregnancy - chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia

Supplementary Table 1: Current CVD risk factors of HDP and non-HDP women (Multiple answers collected) in order of frequency

	<b>GH</b>	<b>PE</b>	<b>CH</b>	<b>Total HDP</b>	<b>non-HDP</b>	<b>P HDP vs non HDP</b>
	<b>n=15</b>	<b>n=143</b>	<b>n=16</b>	<b>n=174</b>	<b>n=92</b>	
	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	
None of the options	6 (40)	52 (36)	2 (13)	60 (34)	57 (62)	<0.001
Obesity	5 (33)	38 (27)	7 (44)	50 (29)	10 (11)	0.001
Family History Heart disease	3 (20)	37 (26)	6 (38)	46 (26)	14 (15)	0.037
Hypertension	3 (20)	30 (21)	12 (75)	35 (20)	0 (0)	<0.001
Renal problems	0 (0)	21 (15)	2 (13)	23 (13)	0 (0)	<0.001
Smoking	0 (0)	10 (7)	3 (19)	13 (7)	2 (2)	0.075
History of cardiovascular event**	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	0.356
Diabetes	0 (0)	5 (3)	2 (13)	7 (4)	0 (0)	0.014
Alcohol consumption	0 (0)	0 (0)	1 (6)	1 (1)	0 (0)	0.356
High Cholesterol	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	-

\*Table represents frequency of each option; percentages add to over 100% as women were asked to select any/all that applied.

\*\*angina, stroke or heart attack

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 2: Chronic Hypertension

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	2 (13)	14 (10)	1 (6)	17 (10)
More likely (correct)	8 (53)	111 (78)	13 (81)	132 (76)
I do not know	5 (33)	17 (12)	2 (13)	24 (14)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	57 (62)
Same likelihood	22 (24)
More likely	1 (1)
I do not know	12 (13)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 3: Diabetes

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	3 (20)	61 (43)	5 (31)	69 (40)
More likely (correct)	4 (27)	35 (25)	5 (31)	44 (25)
I do not know	8 (53)	44 (31)	6 (38)	58 (33)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n= 92</b>
	<b>n (%)</b>
Less likely (correct)	32 (35)
Same likelihood	39 (42)
More likely	4 (4)
I do not know	17 (19)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 4: Renal Disease

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	2 (1)	0 (0)	2 (1)
Same likelihood	2 (14)	30 (21)	1 (7)	33 (19)
More likely (correct)	4 (29)	77 (55)	11 (73)	92 (54)
I do not know	8 (57)	32 (23)	3 (20)	43 (25)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	39 (42)
Same likelihood	31 (34)
More likely	0 (0)
I do not know	22 (24)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy



Supplementary Table 5: Heart Attack

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	1 (7)	20 (14)	1 (7)	22 (13)
More likely (correct)	8 (53)	98 (69)	12 (80)	118 (69)
I do not know	6 (40)	23 (16)	2 (13)	31 (18)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	48 (53)
Same likelihood	23 (25)
More likely	0 (0)
I do not know	20 (22)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 6: HDP next pregnancy

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	2 (1)	0 (0)	2 (1)
Same likelihood	0 (0)	9 (6)	0 (0)	9 (5)
More likely (correct)	13 (87)	128 (89)	15 (100)	156 (90)
I do not know	2 (13)	4 (3)	0 (0)	6 (4)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	65 (71)
Same likelihood	19 (21)
More likely	0 (0)
I do not know	8 (9)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 7: Stroke

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	1 (7)	18 (13)	1 (7)	20 (12)
More likely (correct)	7 (47)	89 (63)	13 (87)	109 (64)
I do not know	7 (47)	33 (23)	1 (7)	41 (24)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	49 (53)
Same likelihood	24 (26)
More likely	0 (0)
I do not know	19 (21)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 8: Heart Disease

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	1 (1)	0 (0)	1 (1)
Same likelihood	2 (13)	18 (13)	1 (7)	21 (12)
More likely (correct)	7 (47)	99 (70)	12 (80)	118 (67)
I do not know	6 (40)	24 (17)	2 (13)	32 (19)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	46 (50)
Same likelihood	27 (29)
More likely	0 (0)
I do not know	19 (21)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 9: Peripheral Vascular Disease

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	0 (0)	0 (0)	0 (0)
Same likelihood	2 (13)	20 (14)	1 (7)	23 (13)
More likely (correct)	5 (33)	72 (51)	8 (53)	85 (50)
I do not know	8 (53)	50 (35)	6 (40)	64 (37)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely (correct)	41 (45)
Same likelihood	29 (32)
More likely	0 (0)
I do not know	22 (24)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

## Supplementary Table 10: Breast Cancer

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	0 (0)	0 (0)	0 (0)
Same likelihood (correct)	3 (20)	74 (53)	5 (36)	82 (48)
More likely	1 (7)	1 (1)	1 (7)	3 (2)
I do not know	11 (73)	66 (47)	8 (57)	85 (50)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely	6 (7)
Same likelihood (correct)	60 (65)
More likely	1 (1)
I do not know	25 (27)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 11: Seizures

a) Women with HDP likelihood of risk compared to non-HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>GH pregnancy n=15</b>	<b>PE pregnancy n=143</b>	<b>CH pregnancy n=16</b>	<b>Total n=174</b>
	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>	<b>n (%)</b>
Less likely	0 (0)	0 (0)	0 (0)	0 (0)
Same likelihood (correct)	4 (27)	41 (29)	2 (13)	47 (27)
More likely	1 (7)	41 (29)	4 (27)	46 (27)
I do not know	10 (67)	60 (42)	9 (60)	79 (46)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

b) Women without HDP likelihood of risk compared to HDP (“Do you think you have a lower/same/higher chance of getting the following”)

	<b>non-HDP n=92</b>
	<b>n (%)</b>
Less likely	25 (27)
Same likelihood (correct)	40 (44)
More likely	0 (0)
I do not know	27 (29)

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 12: Proportion of participants scoring 'high', 'moderate' and 'low' by type of HDP and non-HDP

	<b>GH</b> n=15 n(%)	<b>PE</b> n=143 n(%)	<b>CH</b> n=16 n(%)	<b>P</b> GH vs PE	<b>P</b> GH vs CH	<b>P</b> PE vs CH	<b>HDP</b> n=174 n(%)	<b>non-HDP</b> n=92 n(%)	<b>P</b> HDP vs non- HDP
High (score 8-10)	4 (27)	48 (34)	5 (31)	0.59	0.78	0.67	57 (33)	30 (33)	0.98
Moderate (score 5-7)	3 (20)	52 (36)	7 (44)	0.21	0.16	0.56	62 (36)	25 (27)	0.16
Low (score 0-4)	8 (53)	43 (30)	4 (25)	0.67	0.11	0.85	55 (32)	37 (40)	0.16
Total	15 (100)	143 (100)	16 (100)	-	-	-	174 (101)	92 (100)	-

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy.

The colour coding in addition to the mean scores aims to highlight the areas of 'low' (red), 'moderate' (orange) and 'high' (green) knowledge.

	LOW
	MODERATE
	HIGH



Supplementary Table 13: Means of risk factor knowledge of women with a history of preeclampsia listed by time elapsed since HDP

	PE n=143	PE n=143					P	PE n=143		P
	ALL	0 - 6 month	6 - 12 month	1-2 years	2-3 years	>3 years		< 3	> 3	
		n=26	n=19	n=32	n=20	n=46		n=97	n=46	
Chronic Hypertension	0.78	0.77	0.89	0.78	0.80	0.72	0.65	0.80	0.72	0.27
Diabetes	0.24	0.23	0.42	0.31	0.10	0.20	0.14	0.27	0.20	0.35
Renal Disease	0.54	0.50	0.74	0.41	0.65	0.52	0.17	0.55	0.52	0.78
Heart Attack	0.69	0.58	0.89	0.66	0.70	0.67	0.25	0.69	0.67	0.84
Repeat HDP	0.90	0.88	0.89	0.94	0.95	0.85	0.68	0.92	0.85	0.25
Stroke	0.62	0.65	0.68	0.50	0.65	0.65	0.62	0.61	0.65	0.62
Heart Disease	0.69	0.62	0.79	0.63	0.65	0.76	0.50	0.66	0.76	0.21
PVD	0.50	0.54	0.53	0.53	0.40	0.50	0.90	0.51	0.50	0.95
Breast Cancer*	0.52	0.46	0.37	0.63	0.40	0.59	0.25	0.48	0.59	0.26
Seizures*	0.29	0.15	0.16	0.41	0.45	0.26	0.07	0.30	0.26	0.64
<b>OVERALL MEAN KNOWLEDGE SCORE OUT OF 10</b>	<b>5.8</b>	<b>5.4</b>	<b>6.4</b>	<b>5.8</b>	<b>5.8</b>	<b>5.7</b>	0.83	<b>5.8</b>	<b>5.7</b>	0.89

The colour coding in addition to the mean scores aims to highlight the areas of 'low' (red), 'moderate' (orange) and 'high' (green) knowledge.

MEAN SCORE	
LOW	0-0.40
MODERATE	0.41-0.70
HIGH	0.71-1

Supplementary Table 14: HDP and non-HDP women's answers to timing of rise of risk with signs and symptoms starting to show

	<b>GH</b>	<b>PE</b>	<b>CH</b>	<b>HDP</b>	<b>Non HDP</b>	<b>P</b>
	<b>n=15</b>	<b>n=143</b>	<b>n=16</b>	<b>n=174</b>	<b>n=92</b>	<b>HDP vs non-HDP</b>
	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	<b>n (%)*</b>	
<10 years	4 (27)	42 (29)	9 (56)	55 (32)	41 (45)	0.036
10-15 years	3 (20)	28 (20)	2 (13)	33 (19)	15 (16)	0.591
16-20 years	0 (0)	13 (9)	0 (0)	13 (8)	1 (1)	0.013
>20 years	3 (20)	5 (4)	0 (0)	8 (5)	2 (2)	0.302
Not sure/don't know	1 (7)	48 (34)	1 (6)	52 (30)	33 (36)	0.319
I don't think I will get any of these as I maintain a healthy lifestyle	4 (27)	7 (5)	2 (13)	13 (8)	N/A	-
<b>TOTAL</b>	<b>15 (101)</b>	<b>143 (101)</b>	<b>16 (101)</b>	<b>174 (102)</b>	<b>92 (100)</b>	

\* Percentages may not add to 100% as figures are rounded to whole numbers only

PE = preeclampsia GH = gestational hypertension CH= chronic hypertension worsening in pregnancy and/or with superimposed preeclampsia, HDP= hypertensive disorder of pregnancy

Supplementary Table 15: Proportion of conditions discussed by HDP sub-type when addressing future risk (multiple answers collected) within and over 3 years since last HDP (complements Table 3 which illustrates a summary of this data)

	GH n=15 N (%)		PE n = 143 N (%)		CH n = 16 N (%)		Total n = 174 N (%)		Overall Total n = 174 N (%)	P value < 3 yrs vs >3 yrs
	<3yrs	>3yrs	<3yrs	>3yrs	<3yrs	>3yrs	<3yrs	>3yrs		
<i>HDP next pregnancy</i>	3 (23)	1 (50)	47 (48)	21 (46)	5 (38)	2 (67)	55 (45)	24 (47)	79 (45)	0.78
<i>Chronic Hypertension</i>	4 (31)	1 (50)	47 (48)	16 (35)	4 (31)	2 (67)	55 (45)	19 (37)	74 (43)	0.37
<b>No discussion</b>	<b>7 (54)</b>	<b>1 (50)</b>	<b>33 (34)</b>	<b>17 (37)</b>	<b>5 (38)</b>	<b>1 (33)</b>	<b>45 (37)</b>	<b>19 (37)</b>	<b>64 (37)</b>	<b>0.93</b>
<i>Lifestyle changes</i>	4 (31)	-	26 (27)	6 (13)	2 (15)	2 (67)	32 (26)	8 (16)	40 (23)	0.14
<i>Heart Attack</i>	1 (8)	-	20 (21)	6 (13)	1 (8)	1 (33)	22 (18)	7 (14)	29 (17)	0.50
<i>Renal Disease</i>	1 (8)	-	20 (21)	3 (7)	2 (15)	1 (33)	23 (19)	4 (8)	27 (16)	0.07
<i>Stroke</i>	1 (8)	1 (50)	18 (19)	4 (9)	1 (8)	1 (33)	20 (16)	6 (12)	26 (15)	0.45
<i>Peripheral vascular disease</i>	-	-	15 (15)	5 (11)	1 (8)	-	16 (13)	5 (10)	21 (12)	0.56
<i>Cannot remember</i>	1 (8)	-	4 (4)	2 (4)	1 (8)	-	6 (5)	2 (4)	8 (5)	0.78

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### LONG TERM HEALTH AFTER BLOOD PRESSURE PROBLEMS IN PREGNANCY

You are invited to take part in a survey to gain insight into what women like yourself who have been pregnant before know about women's heart health. We are interested in the views of all women especially women who had high blood pressure (hypertension) or preeclampsia in pregnancy.

You can complete the survey if you are currently pregnant (with no major issues so far this pregnancy) or have been pregnant in the last three (3) years. You may have experienced high blood pressure in pregnancy OR you may have experienced a pregnancy without any serious complications.

The study is being conducted by the University of NSW, University of Technology Sydney and the Sydney Partnership for Health, Education, Research and Enterprise (SPHERE). The study is being undertaken by:

- Dr. Amanda Henry - Obstetrician at St George and Royal Hospital for Women, Randwick, Senior Lecturer UNSW and SPHERE member
- Distinguished Professor Caroline Homer - UTS, Midwifery Faculty of Health and SPHERE member
- Dr. Clare Arnott - Cardiologist, Royal Price Alfred Hospital
- Mrs. Heike Roth - PhD Candidate at University of Technology, Sydney
- Mrs. Lynne Roberts - Research Midwife at St George Hospital, SESLHD.

This work is occurring as part of Mrs Heike Roth's PhD studies and the NHMRC Fellowship of Dr. Henry. Apart from salary support for Dr. Henry, the study is otherwise unfunded.

If you agree to take part in this survey, it should only take about 15 minutes to complete and will involve answering questions about you, your pregnancy and your understanding of long term health in women who have been diagnosed with blood pressure problems in pregnancy.

Participation in this study is entirely voluntary and if you do not wish to take part it will have no effect on the care you are currently receiving. If you decide to participate, and throughout the survey think you would like to withdraw/not complete the survey, you can simply stop and not submit your answers. If you have already submitted your survey, it will not be possible to withdraw the data you have provided as the surveys are anonymous.

The information you provide will not be identifiable and will be kept securely until destroyed as per the South East Sydney Local Health District's requirements.

The study results will be published in a research thesis, in peer reviewed journals and presented at conferences and other professional forums. No one will be able to identify you from this information.

1 **If you would like to personally receive results, you will have the option to leave your email details.**  
2 **The results will be available one (1) year after conclusion of the survey and your email will not be**  
3 **used for any other purpose.**  
4

5  
6 **If you would like any further information about the study or you experience any distress or concern**  
7 **as a result of completing this survey, please contact the Principal Investigator, Dr Amanda Henry on**  
8 **02 91132315 or via email [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au). For medical assistance you can**  
9 **consult your General Practitioner. If you would like further information about the topic addressed in**  
10 **this study, you can visit the Australian Heart Foundation on the following link:**  
11 **<https://www.heartfoundation.org.au/your-heart/women-and-heart-disease/womens-stories>.**  
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15 **If you have any concerns or complaints about the conduct of this study, you should contact the**  
16 **Research Support Office of the South Eastern Sydney Local Health District Human Research Ethics**  
17 **Committee which is nominated to receive complaints from research participants. You should**  
18 **contact them on 02 9382 3587, or email [SESLHD-RSO@health.nsw.gov.au](mailto:SESLHD-RSO@health.nsw.gov.au) and quote HREC 18/156.**  
19

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21 \* 1. I acknowledge that participation in the survey is voluntary

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# LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## ABOUT YOU

These first few questions are to find out about you, your background, and occupation. Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 2. What age group are you in?

- 18-25  46-55  
 26-35  56+  
 36-45  Prefer not to answer

\* 3. What ethnic group do you identify with? (Please select one answer)

- Caucasian  Aboriginal or Torres Strait Islander  
 Asian  European  
 Polynesian or Maori  Prefer not to answer  
 Other (please specify)

\* 4. What is your highest level of formal education?

- Secondary school  University degree  
 Trade Certificate/Diploma  Prefer not to answer  
 Other (please specify)

5. What is your usual occupation/profession?

\* 6. Are you currently in a relationship?

- Yes  Prefer not to answer  
 No

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\* 7. Where did you hear about this survey?

- P4 Newsletter
- Australian Action on Preeclampsia (AAPEC)
- Tresillian
- Maternity Choices Australia
- Other (please specify)
- Maternity Consumer Network
- Maternity Clinics
- Social media (Facebook, Twitter)
- Australian College of Midwives

For peer review only

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for  
women

ABOUT YOUR HEALTH

These next questions are about your general health.

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 8. Are you currently pregnant?

Yes

Prefer not to answer

No

For peer review only



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### ABOUT YOUR HEALTH

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

9. How many weeks pregnant are you? (provide whole numbers only, for example: 24)

10. How many children have you given birth to (20 weeks gestation and over)?

\* 11. Have you ever had any of the following, whilst pregnant or before or after pregnancy? (select all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> High blood pressure    | <input type="checkbox"/> Stroke   |
| <input type="checkbox"/> High BMI (overweight)  | <input type="checkbox"/> Significant illness  |
| <input type="checkbox"/> Angina                 | <input type="checkbox"/> Heart attack   |
| <input type="checkbox"/> Diabetes               | <input type="checkbox"/> None of the above/ no significant other medical complication |
| <input type="checkbox"/> Kidney problems        |   |
| <input type="checkbox"/> Other (please specify) |   |

\* 12. From the list below, which currently apply to you? (select all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> Smoking                         | <input type="checkbox"/> High cholesterol    |
| <input type="checkbox"/> Obesity                         | <input type="checkbox"/> High blood pressure |
| <input type="checkbox"/> Alcohol consumption             | <input type="checkbox"/> Diabetes            |
| <input type="checkbox"/> Family history of heart disease | <input type="checkbox"/> None of the above   |

Other (please specify)

13. Please provide the details of any prescribed medications you are taking

- I do not take any prescribed medication
- I take prescribed medication (please list the medications or leave blank if you prefer not to answer)

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For peer review only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### PREGNANCY

**This section is about your pregnancy history.**

**Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.**

#### DEFINITIONS OF BLOOD PRESSURE PROBLEMS

Here are some definitions of certain types of blood pressure problems in pregnancy. You may find these useful in order to more easily understand and answer the next questions.

**Chronic hypertension:** is if you had high blood pressure before falling pregnant, have high blood pressure outside of pregnancy, or were found to already have high blood pressure in the first half of your pregnancy. Chronic hypertension may have no known underlying cause (this is sometimes called "essential" hypertension), or it may be as a result of another underlying condition, such as kidney disease.

**Gestational hypertension:** is when you might have had high blood pressure for the first time in your pregnancy (after 20 weeks of pregnancy) but were otherwise well (that is, high blood pressure only but no effect on your baby's growth or on your health otherwise).

**Preeclampsia:** is when you have had high blood pressure in pregnancy (after 20 weeks of pregnancy) and some additional signs or issues in you and/or your baby. For example, you might have had protein in your urine, liver or kidney problems that showed up on blood tests, or there may have been concerns about the growth of your baby while you were pregnant.

view only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### PREGNANCY

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

We understand that you may find some of the questions difficult to answer as they might remind you of a challenging time in your life. We are grateful for your participation and contribution to improving knowledge on future health for women who had blood pressure problems in pregnancy. You will find some explanations at the end of the survey and a contact, in case you would like to seek further clarification and/or assistance.

\* 14. Choose the situation which best describes your pregnancy history

- |  |  |
|--|--|
| <input type="radio"/> At least one pregnancy is/was affected by gestational hypertension | <input type="radio"/> I had chronic hypertension before pregnancy and had/have pregnancies that were complicated further by higher than usual blood pressure |
| <input type="radio"/> At least one pregnancy is/was affected by preeclampsia             | <input type="radio"/> I had chronic hypertension before pregnancy and had/have pregnancies that were complicated further by preeclampsia                     |
| <input type="radio"/> I have only been diagnosed with chronic hypertension               | <input type="radio"/> No pregnancy is/was affected   |

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## YOUR HEALTH DURING YOUR PREGNANCY

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 15. As someone who has chronic hypertension are you aware of any long term health issues that you are at risk of? (select all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> Diabetes   | <input type="checkbox"/> Leukaemia  |
| <input type="checkbox"/> Kidney disease   | <input type="checkbox"/> Seizures   |
| <input type="checkbox"/> Breast cancer  | <input type="checkbox"/> Overall mortality risk is higher   |
| <input type="checkbox"/> Cardiac death  | <input type="checkbox"/> Ischaemic heart disease/heart attack   |
| <input type="checkbox"/> High blood pressure complications in another pregnancy | <input type="checkbox"/> I think there are health risks but unsure which conditions I may be at risk of |
| <input type="checkbox"/> Stroke   | <input type="checkbox"/> I do not think that there are increased risks                                  |
| <input type="checkbox"/> Peripheral vascular disease                            |   |
| <input type="checkbox"/> Other (please specify)                                 |   |

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LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

\* 16. How many years after blood pressure problems in pregnancy do you think the various signs and symptoms of the potential risks may start to appear?

- < 10 years after pregnancy
- > 20 years after pregnancy
- 10-15 years after pregnancy
- Not sure/do not know
- 16-20 years after pregnancy
- Other (please specify)

peer review only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## Chronic Hypertension only -TYPE OF CARE RECEIVED DURING PREGNANCY

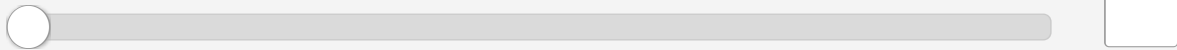
Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

17. If a healthcare provider did speak to you about your future health risks, when did this occur?

- |  |   |
|--|---|
| <input type="checkbox"/> Before birth            | <input type="checkbox"/> 6 months to 1 year |
| <input type="checkbox"/> Immediately after birth | <input type="checkbox"/> 1 year and over    |
| <input type="checkbox"/> Within first 6 weeks    | <input type="checkbox"/> I cannot remember  |
| <input type="checkbox"/> 6 weeks to 6 months     |   |

\* 18. When would be a good time to receive information about long term health risks in your gestational hypertension or preeclampsia experience?

During pregnancy/at birth      12 months after birth      24 months after birth



\* 19. As a result of your pregnancy affected by blood pressure problems, were you referred to any of the below after your baby was born? (tick all that apply)

- |   |  |
|---|--|
| <input type="checkbox"/> Cardiologist             | <input type="checkbox"/> Fitness centre for exercise         |
| <input type="checkbox"/> Renal (kidney) Physician | <input type="checkbox"/> Nutritionist for dietary adjustment |
| <input type="checkbox"/> General Practitioner     | <input type="checkbox"/> I cannot remember                   |
| <input type="checkbox"/> Other (please specify)   |  |

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

20. During your pregnancies over the last 3 years (20 weeks pregnancy and over), which blood pressure problem were you diagnosed with?

	Gestational Hypertension	Preeclampsia	No blood pressure problem diagnosed this pregnancy	I cannot remember	Not applicable
First Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Second Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any comments?

\* 21. How long ago was your most recent pregnancy that was affected by a blood pressure problem?

- 0-6 months
- 6-12 months
- 1-2 years
- 2-3 years
- more than 3 years ago

\* 22. At what point in time were you diagnosed? (Choose a most accurate time frame)

	20-28 weeks	28-34 weeks	34-37 weeks	37-40 weeks	40-42 weeks	During or after giving birth	No diagnosis of blood pressure problem this pregnancy	I cannot remember	Not applicable
First Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Second Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any comments?



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### PREGNANCY

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 23. Did you have a *planned* induction of labour or *planned* caesarean section due to your blood pressure problems?

	Yes, planned induction of labour because of blood pressure issues in pregnancy	Yes, planned caesarean section because of blood pressure issues	Yes, planned caesarean for other reasons than blood pressure	No planned induction and no planned caesarean section	I cannot remember	Not applicable
First Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Second Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third Pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any Comments?

view only

LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

LONG TERM HEALTH RISKS

**This section is about some long term health risks that some women may experience after having had blood pressure problems in pregnancy.**

For this section we would like you to think about the long-term health risks of a woman who has been diagnosed with high blood pressure in pregnancy.

**Not everyone who experienced blood pressure problems in pregnancy will necessarily have health issues in the future. We would not want you to unnecessarily worry about any of these risks, therefore we will provide you with further information about long-term health after high blood pressure in pregnancy at the end of the survey.**

\* 24. FOR WOMEN WITH HISTORY OF BLOOD PRESSURE PROBLEMS IN PREGNANCY:

Compare yourself to a woman who has NOT had blood pressure problems in pregnancy.

Do you think you have a lower/same/higher chance of getting the following:

	Less chance than a woman without blood pressure in pregnancy	Same chance as a woman without blood pressure in pregnancy	Higher chance than a woman without blood pressure in pregnancy	Not sure/I do not know
High blood pressure later in life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kidney disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breast cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart attack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High blood pressure in another pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stroke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seizures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vascular Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**If you are concerned by any of the above potentially affecting you, information is available at the end of the survey where risks are explained.**

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

For this section we would like you to think about the long term health risks of a woman who has been diagnosed with high blood pressure in pregnancy.

\* 25. FOR WOMEN WITHOUT HISTORY OF BLOOD PRESSURE PROBLEMS IN PREGNANCY:

Compare yourself to a woman who HAS had blood pressure problems in pregnancy.

Do you think you have a lower/same/higher chance of getting the following:

	Less chance than a woman with blood pressure in pregnancy	Same chance as a woman with blood pressure in pregnancy	Higher chance than a woman with blood pressure in pregnancy	Not sure/I do not know
High blood pressure later in life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kidney disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breast cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart attack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High blood pressure in another pregnancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stroke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seizures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vascular Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 26. How many years after blood pressure problems in pregnancy do you think the various signs and symptoms of the potential risks may start to appear?

- < 10 years after pregnancy
  > 20 years after pregnancy  
 10-15 years after pregnancy
  Not sure/do not know  
 16-20 years after pregnancy  
 Other (please specify)

If you are concerned by any of the above potentially affecting you, information is available at the end of the survey where risks are explained.

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For peer review only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

\* 27. How many years after blood pressure problems in pregnancy do you think the various signs and symptoms of the potential risks may start to appear?

- < 10 years after pregnancy
- > 20 years after pregnancy
- 10-15 years after pregnancy
- Not sure/do not know
- 16-20 years after pregnancy
- I don't think I will get any of these as I maintain a healthy lifestyle
- Other (please specify)

### IN CASE OF DISTRESS

If you experience any distress caused due to the completion of this survey, please contact your GP or the Principal Investigator of this study, Dr Amanda Henry on 02 91132315 or [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au)

For more information on this topic please visit The Australian Heart Foundation on the following link:  
<https://www.heartfoundation.org.au/your-heart/women-and-heart-disease/womens-stories>

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## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### TYPE OF CARE RECEIVED DURING PREGNANCY WHERE A BLOOD PRESSURE PROBLEM WAS DIAGNOSED

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

It is quite likely that some of the following questions may bring back some memories or bring rise to emotions that you find difficult to deal with. Please contact the Principal Investigator, Dr Amanda Henry on 02 91132315 or via email [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au) if you would like to discuss these concerns. For medical assistance you can consult your General Practitioner.

\* 28. Have you ever been admitted to a 'High Dependency Unit' or 'Intensive Care Unit' as a result of your blood pressure problem in pregnancy?

- Yes
- No
- I am not sure
- I cannot remember

\* 29. Have any of your babies been admitted to 'Neonatal Intensive Care', 'High Dependency Unit' or 'Special Care Nursery' as a result of your blood pressure problem in pregnancy?

- Yes
- No
- I am not sure

30. After your baby was born have you had any of the following? (select all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> Blood pressure measurement in hospital | <input type="checkbox"/> Consultation with a renal (kidney) specialist  |
| <input type="checkbox"/> Blood pressure measurement with my GP  | <input type="checkbox"/> Consultation with an obstetric medicine specialist (doctor who specialises in complications of pregnancy like high blood pressure) |
| <input type="checkbox"/> Consultation with an obstetrician      | <input type="checkbox"/> I cannot remember  |
| <input type="checkbox"/> Other (please specify)                 |   |

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\* 31. After your baby was born, did someone speak to you about any of the below future health risks? (select all that apply)

- Increased risk of high blood pressure
- Risk of hypertensive disease in your next pregnancy
- Increased risk of kidney problems
- I was told to eat a healthy diet, do some exercise and live normally
- Increased risk of stroke
- No risks were discussed
- Increased risk of heart attack
- I cannot remember
- Increased risk of vascular disease
- Other (please specify)

For peer review only

## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

## TYPE OF CARE RECEIVED DURING PREGNANCY WHEN A BLOOD PRESSURE PROBLEM WAS DIAGNOSED

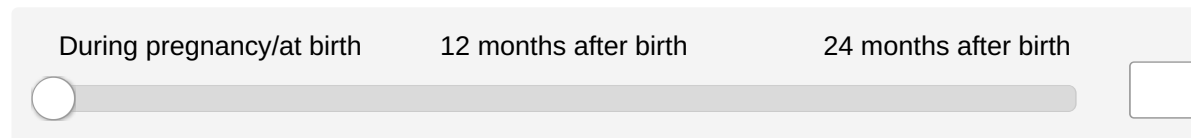
Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

32. If a healthcare provider did speak to you about your future health risks, when did this occur?

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|--|---|
| <input type="checkbox"/> Before birth            | <input type="checkbox"/> 6 months to 1 year |
| <input type="checkbox"/> Immediately after birth | <input type="checkbox"/> 1 year and over    |
| <input type="checkbox"/> Within first 6 weeks    | <input type="checkbox"/> I cannot remember  |
| <input type="checkbox"/> 6 weeks to 6 months     |   |

\* 33. When would be a good time to receive information about long term health risks in your gestational hypertension or preeclampsia experience?

During pregnancy/at birth      12 months after birth      24 months after birth     



\* 34. As a result of your pregnancy affected by blood pressure problems, were you referred to any of the below after your baby was born? (tick all that apply)

- |   |  |
|---|--|
| <input type="checkbox"/> Cardiologist             | <input type="checkbox"/> Fitness centre for exercise         |
| <input type="checkbox"/> Renal (kidney) Physician | <input type="checkbox"/> Nutritionist for dietary adjustment |
| <input type="checkbox"/> General Practitioner     | <input type="checkbox"/> I cannot remember                   |
| <input type="checkbox"/> Other (please specify)   |  |



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### EDUCATION

In this section we would like to find out about your preferred ways of getting information about long term health after gestational hypertension and preeclampsia.

Questions marked with a green asterisk (\*) simply mean that they must be answered in order to continue.

\* 35. After experiencing gestational hypertension or preeclampsia what do you want to know about your long term health? (select all that apply)

- Risk reduction for subsequent pregnancies
- Reducing risk behaviours (eg. diet, exercise, smoking cessation)
- Statistics (eg. increased risk)
- At what point does the risk increase
- Signs and Symptoms
- Where to find information
- How to discuss the matter with my healthcare provider
- Impact on my children from the pregnancy affected by blood pressure problems
- Other (please specify)

\* 36. How do you want to receive the information? (select all that apply).

- Key organisations addressing heart health (e.g. The Australian Heart Foundation or Her Heart)
- Social Media channels (e.g. Instagram, Facebook, Twitter)
- Brochures/Flyers
- Medical Professionals
- Podcasts/Media
- Online videos
- Other (please specify)

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## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### POST-SURVEY OPTIONS AND SUMMARY OF RISK PROFILE

Some further things we would like you to consider:

38. We would like to have your opinion on what you think would be appropriate education material to improve women's knowledge. We would also like to know how the education could best be distributed to women. Would you like to participate in a **focus group** (one off - 2hrs max at St George Hospital, Sydney) or a **telephone interview** (one off 30 mins max)? By involving 'consumers', meaning women like you, the education package will have added value.

If you are interested in participate in either, you can leave your details here.

Name

Email Address

Phone Number

39. Please leave your email address to **receive results** from this study (in approx. 1 year). Your details will not be used for any other purpose.

Email Address

#### IN CASE OF DISTRESS

If you experience any distress caused due to the completion of this survey, please contact your GP or the Principal Investigator of this study, Dr Amanda Henry on 02 91132315 or [Amanda.henry1@health.nsw.gov.au](mailto:Amanda.henry1@health.nsw.gov.au)

For more information on this topic please visit The Australian Heart Foundation on the following link:

<https://www.heartfoundation.org.au/your-heart/women-and-heart-disease/womens-stories>



## LONG TERM HEALTH RISKS AFTER HIGH BLOOD PRESSURE IN PREGNANCY - Survey for women

### RISK PROFILE - LONG TERM RISKS AFTER BLOOD PRESSURE PROBLEMS IN PREGNANCY EXPLAINED

**You may like to take a screenshot of the risk profile so you can refer back to it whenever you need to.**

#### **RISK PROFILE**

Although most women will experience good long-term health after having high blood pressure in pregnancy, there are, unfortunately, some long term health risks associated with having had high blood pressure in pregnancy.

Women who have had high blood pressure during pregnancy are about 3 to 4 times more likely to develop chronic hypertension than women who did not have a blood pressure problems in pregnancy. They are also about twice as likely to get diabetes in later life, even if they did not have diabetes during pregnancy.

Blood pressure diseases are also more likely to happen in the next pregnancy to women who have already had a previous blood pressure problems in pregnancy compared to women who have not. Therefore, if they have had a pregnancy with blood pressure problems, it is important to be seen early in their next pregnancy. There are treatments that can decrease the chance of recurring problems.

Women are also more likely to get various forms of cardiovascular disease (heart disease, stroke, vascular disease) if they have had gestational hypertension, preeclampsia and/or chronic hypertension. All of these cardiovascular problems are about twice as likely to eventually happen to a woman who has had blood pressure problems in pregnancy compared to a woman who has not. This still means most women will not have heart disease or diabetes after having high blood pressure in pregnancy, especially if they can avoid risk factors like smoking or excessive weight gain, and maintain a healthy diet and exercise.

Kidney problems are about 5 to 10 times more common after preeclampsia in particular. Although the relative risk of developing kidney problems is substantially higher after preeclampsia, the absolute risk of long-term kidney disease is still low. Unless the woman already had a kidney problem, well over 90% of women after preeclampsia and gestational hypertension will not have a kidney problem.

Fortunately, although seizures may occur as a result of preeclampsia during pregnancy, women have no higher long term risk of seizures compared to women who did not have a complicated pregnancy. There is no increased risk of getting cancer (e.g. breast cancer, leukaemia) after having high blood pressure in pregnancy.

For all the long term health risks, these start to go up within 10 years after an affected pregnancy and are ongoing after that. Therefore, it is recommended that women attend regular blood pressure checks with their GP and discuss any changes they can make to improve their general health. For more general information about heart health and managing health risks, please visit the National Heart Foundation website: <https://www.heartfoundation.org.au/your-heart/know-your-risks>

THANK YOU FOR YOUR PARTICIPATION

## STROBE Statement—

**Assessing Australian women's knowledge and knowledge preferences about long-term health after hypertensive disorders of pregnancy: a survey study**

	<b>Item No</b>	<b>Recommendation</b>	<b>Page No</b>
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	2
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	2& 5-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2&6
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	5-6
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	-
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-
Bias	9	Describe any efforts to address potential sources of bias	2& 21- 22
Study size	10	Explain how the study size was arrived at	5-6 &Fig1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-8
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	

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3 *Case-control study*—If applicable, explain how matching of cases and  
4 controls was addressed

5 *Cross-sectional study*—If applicable, describe analytical methods  
6 taking account of sampling strategy

7 (e) Describe any sensitivity analyses

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60**Results**

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5&6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	Fig 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9 Tab1
		(b) Indicate number of participants with missing data for each variable of interest	8
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	

**Discussion**

Key results	18	Summarise key results with reference to study objectives	8-14 Tables 2-4
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20-22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-19
Generalisability	21	Discuss the generalisability (external validity) of the study results	22

**Other information**

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	24
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\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).