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Nurse home visiting and maternal mental health: 3-year follow-up of a randomized trial

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1 **Nurse Home Visiting and Maternal Mental Health: 3-Year Follow-Up of a Randomized**
2 **Trial**

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33
34 **Short title:** Nurse Home Visiting and Maternal Mental Health

35
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37 research collaboration between the Australian Research Alliance for Children and Youth
38 (ARACY); the Translational Research and Social Innovation (TReSI) Group at Western
39 Sydney University; and the Centre for Community Child Health (CCCH), which is a
40 department of The Royal Children's Hospital and a research group of Murdoch Children's
41 Research Institute. Ownership of the right@home implementation and support licence, which
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56 or approval of the manuscript; and decision to submit the manuscript for publication.

57

58 **Trial registration number:** ISRCTN89962120

59

60 **Data Sharing Statement:** Upon request to the corresponding author
61 (sharon.goldfeld@rch.org.au), deidentified participant data, study protocols and statistical
62 analysis plans can be made available after publication to researchers who provide a
63 methodologically sound proposal for use of the data.

64

65 **Abbreviations:** CFH - child and family health; DASS – Depression Anxiety and Stress
66 Scales; NHV - nurse home visiting, RCT - randomized controlled trial; SEIFA-
67 Socioeconomic Index for Areas.

68

69 **Article Summary:**

70 The right@home nurse home visiting trial, implemented within existing child and family
71 health services, demonstrated benefits for maternal mental health and wellbeing at one-year
72 post-intervention.

73

74 **What's Known on This Subject:**

75 Maternal mental health is a crucial aspect of optimal health for mothers and their children.
76 Nurse home visiting (NHV) is an established model of healthcare delivery available in
77 multiple countries but with mixed results in relation to maternal mental health.

78

79 **What This Study Adds:**

80 Benefits of the right@home NHV program were evident for maternal mental health and
81 wellbeing at one-year post-intervention completion (child age 3 years). A NHV program that
82 is designed for women experiencing adversity can lead to latent mental health benefits.

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89 **Contributors' Statement Page**

90

91 Prof. Sharon Goldfeld, Dr. Anna Price, Prof. Harriet Hiscock and Prof Lynn Kemp
92 conceptualized and implemented the study design, and contributed to the first draft and
93 subsequent revisions of the manuscript.

94

95 Dr. Hannah Bryson implemented the study design, coordinated and supervised data
96 collection, conducted the data cleaning and statistical analysis, and contributed to the first
97 draft and subsequent revisions of the manuscript.

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99 Dr. Fiona Mensah conceptualized and implemented the study design, provided statistical
100 expertise in the trial design and conduct of the statistical analysis, and contributed to the first
101 draft and subsequent revisions of the manuscript.

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103 Dr. Lisa Gold conceptualized and implemented the study design, provided health economics
104 expertise in the trial design, and contributed to the first draft and subsequent revisions of the
105 manuscript.

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108 cleaning and statistical analysis, and contributed to the first draft and subsequent revisions of
109 the manuscript.

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111 Dr. Susan Perlen implemented the study design, coordinated and supervised data collection,
112 and contributed to the first draft and subsequent revisions of the manuscript.

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114 Dr. Anneke Grobler provided statistical expertise and conducted the statistical analysis and
115 contributed to the first draft of the manuscript.

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117 Ms. Penelope Dakin and Ms. Diana Harris implemented the study design and on behalf of the
118 sponsor ARACY, as the funding holder, and contributed to the first draft and subsequent
119 revisions of the manuscript.

120

121 Ms Diana Harris implemented the study design, and contributed to the first draft and
122 subsequent revisions of the manuscript.

123

124 All authors approved the final manuscript as submitted and agree to be accountable for all
125 aspects of the work.

126

127 **ABSTRACT**

128 **Background:** Poor mental health is recognized as one of the greatest global burdens of
129 disease. Maternal mental health is crucial for the optimal health of mothers and their children.
130 We examined the effects of an Australian Nurse Home Visiting (NHV) program
131 (right@home), offered to pregnant women experiencing adversity, on maternal mental health
132 and wellbeing at child age 3 years.

133 **Methods:** A randomized controlled trial (RCT) of NHV delivered via universal child and
134 family health services (2013 to 2016). Pregnant women experiencing adversity (≥ 2 of 10 risk
135 factors) were recruited from 10 antenatal clinics across two states. Intervention comprised 25
136 home visits until child age 2 years. Outcomes assessed 1-year post intervention completion
137 were maternal self-report of mental health symptoms (Depression, Anxiety and Stress Scales:
138 DASS) and positive aspects of mental health (personal wellbeing and self-efficacy).

139 **Results:** Of the 722 women enrolled in the RCT, 255/363 (70%) intervention and 240/359
140 (67%) control group women provided data at 3 years. Compared with controls, the
141 intervention group reported better mental health (reverse DASS scores): effect sizes of 0.25
142 (depression, 95% confidence interval [CI]: 0.08 to 0.32), 0.20 (anxiety, 95% CI: 0.05 to
143 0.30), 0.17 (stress, 95% CI: 0.09 to 0.37) and 0.23 (total score, 95% CI: 0.12 to 0.38); 0.16
144 (95% CI 0.04 to 0.29) for personal well-being and odds ratio 1.60 (95% CI 1.19 to 2.16) for
145 self-efficacy.

146 **Conclusions:** A NHV designed to support mothers experiencing adversity can lead to later
147 maternal mental health benefits even after the program ends.

148
149 **Trial registration number:** ISRCTN89962120
150

151

152 **INTRODUCTION**

153 Poor mental health is recognized as one of the greatest global burdens of disease.^{1,2} In
154 the United States (US) alone, annual spending on mental illness is estimated at US \$89
155 billion, not including the economic cost of lost earnings and productivity.³ In Australia an
156 estimated 8 million working days are lost annually due to mental illness, and international
157 estimates are similar.^{4,5} For mothers and children, the estimated annual societal cost in the US
158 of maternal mental illness from birth to 5 years is US \$14.2 billion.⁶ In high income countries
159 like the US and Australia, poor mental health is two-to-three times higher for those in the
160 lowest income quintile compared to the highest.^{4,7} Similarly, mothers experiencing social
161 adversities such as relationship difficulties, social isolation, unemployment and low
162 educational attainment are at higher risk of poorer mental health.^{3,4,7,8} The economic and
163 psychosocial stressors of the COVID-19 pandemic (e.g. unemployment, income loss,
164 isolation and strain on family relationships) are likely to put mothers at heightened risk of
165 poor mental health, with greater impact for those experiencing adversity who are already
166 disproportionately at risk.⁹ A national survey of Australian households found almost half of
167 parents (48%) reported that the pandemic had negatively impacted their mental health, and
168 this was more likely amongst those who had experienced financial impacts.¹⁰

169 Maternal mental health and wellbeing are crucial aspects of the optimal health of
170 mothers and for their children's health and wellbeing.^{2,11-13} From conception to preschool
171 age, poor maternal mental health and wellbeing can hinder the provision of optimal care at a
172 time when children are most sensitive to their environments.¹² Global prevalence estimates
173 suggest that 9-16% of women experience depression and 10-15% experience an anxiety
174 disorder in the perinatal period (antenatal to 1-year postpartum)^{14,15} with limited data on
175 prevalence rates for women with older children.^{8,16,17}

176 Nurse home visiting (NHV) is an established model of healthcare delivery with
177 potential to address inequities in maternal mental health, and subsequently children's
178 development. NHV prioritizes women experiencing social adversity and overcomes barriers
179 to health service access through outreach to women's homes. It shows promise for improving
180 early parent care and home learning environments, with some studies showing greater
181 benefits of NHV for women with poorer mental health.^{18,19} However, few NHV studies have
182 reported on these benefits beyond the first year postpartum. For example, only 6 (all from the
183 US) of the 21 high quality²⁰ (i.e. randomized trial level evidence) NHV models that followed
184 cohorts between child ages 2 and 4 years examined the impact of NHV on maternal mental
185 health and wellbeing. Of these, three reported small to modest benefits (effect size (ES) 0.10
186 to 0.56) for maternal depression symptoms and parenting stress,²¹⁻²³ and three reported no
187 evidence of these benefits.^{18,24,25}

188 Given the parallel international policy interest in NHV and preventing inequitable
189 rates of poor mental health, and the mixed results to date, it is timely to examine the potential
190 benefits of NHV for maternal mental health and wellbeing. The right@home randomized
191 controlled trial (RCT) is the largest multi-site trial of NHV in Australia and has demonstrated
192 benefits to the primary outcomes of parent care, parent responsiveness and the home learning
193 environment when children turned two.²⁶ The program was designed for women experiencing
194 adversity who may benefit from additional support beginning in pregnancy, rather than as a
195 specific mental health intervention. However, maternal mental health and wellbeing support
196 (e.g. nurse-led discussion of maternal mood, coping and identification of additional support
197 needs) were offered as components within the program. Fidelity monitoring showed these
198 supports were the most frequently delivered program components, provided in over 88% of
199 nurse visits.^{27,28} As such, in designing the follow-up study we anticipated that the significant
200 parenting-related benefits (more confident parenting e.g. increased parent warmth, parental

201 involvement and parenting efficacy) seen at two years may translate to later benefits in
202 maternal mental health and wellbeing as an important potential latent effect. We
203 hypothesized that, when compared with women who were offered the universal child and
204 family health (CFH) service (usual care), mothers who received the NHV intervention would
205 report better maternal mental health and wellbeing outcomes at child age 3 years.

206 **METHODS**

207 **Design:** A randomized controlled trial (RCT) of NHV from pregnancy to child age 2 years,
208 compared with the existing universal CFH service (usual care). Conducted as a superiority
209 trial with two parallel groups and a primary endpoint at child age 2 years.^{26,29} The current
210 paper reports on mental health and wellbeing from extended follow-up of trial outcomes at
211 child age 3 years. The published protocol describes the RCT methods to child age 2 years.²⁹

212 **Participants:** Researchers recruited pregnant women attending antenatal clinics of 10 public
213 maternity hospitals across the Australian states of Victoria and Tasmania from 30 April 2013
214 to 29 August 2014. Eligible women: (i) had due dates before 1 October 2014, (ii) were less
215 than 37 weeks gestation, (iii) had sufficient English to complete face-to-face interviews, (iv)
216 lived within travel boundaries specified by participating areas; and (v) had ≥ 2 of 10 risk
217 factors identified at screening (young pregnancy; not living with another adult; no support in
218 pregnancy; poor health; a long-term illness, health problem, or disability that limits daily
219 activities; currently smokes; stress, anxiety or difficulty coping; low education; no person in
220 the household currently earning an income; and never having had a job before).^{29,30} Women
221 were excluded if they: (i) were enrolled in an existing Tasmanian NHV program for 15-19-
222 year-olds, (ii) did not comprehend the recruitment invitation (e.g. intellectual disability, or
223 insufficient English), (iii) had no mechanism for contact, or (iv) experienced a critical event
224 (e.g. termination of pregnancy, stillbirth or child death).

225 **Procedures:** Eligible women were identified in antenatal clinics and invited into the RCT.
226 Participants provided informed consent for the RCT (initially to 2 years) and completed a
227 home-based baseline interview assessing maternal demographic, economic and psychosocial
228 factors. Mean gestational age at the baseline assessment was 28.2 weeks. Participants were
229 then randomized to control or intervention arms with a 1:1 allocation following a computer-
230 generated schedule stratified by site and parity (first-time parent vs. those with children)
231 using permuted blocks of sizes 2, 4 or 6. Research managerial staff, participants and
232 intervention teams were aware of allocation. Researchers who conducted follow-up
233 assessments were blinded to randomization. Participants were reminded not to disclose their
234 randomization allocation before each follow-up, and researchers reported any breach to the
235 research managerial staff; four breaches of blinding were reported at the 3-year follow-up.
236 At the 2-year home-based assessment, women were invited to re-enroll in the extended
237 follow-up and informed consent was obtained.

238 The right@home NHV program was structured around the core Miller Early
239 Childhood Sustained Home-visiting framework and training^{19,31} and bolstered by five
240 evidence-based strategies for content (sleep, safety, nutrition, regulation,
241 bonding/relationship) and two for the delivery process (video feedback and motivational
242 interviewing strategies).^{27,28} Program implementation was enabled using program logic that
243 articulated improved long-term (5-year) parent and child outcomes, together with adaptation
244 processes that ensured the program had fidelity to the evidence and worked in the real-world
245 health system.²⁷ The program logic was centered around confident parenting and child
246 developmental outcomes, with anticipated associated maternal mental health benefits.
247 Mothers in the intervention group were offered 25 nurse home visits (mean 23.2 home visits
248 received), commencing antenatally and delivered mostly by the same nurse trained in the
249 right@home NHV model of care.^{28,29} Most intervention group women (75.6%) also received

250 one or more home visits by a social care practitioner (mean 1.7 visits),²⁸ who provided brief
251 counselling interventions and/or case management as needed. In contrast, the usual CFH
252 service includes six (Tasmania) or nine (Victoria) free nurse consultations up to 2 years
253 (mean 7.6 consultations received)²⁶, with some limited program flexibility depending on
254 family need.

255 **Outcomes/measures (Table 1):** All maternal mental health outcomes were collected via self-
256 report at the 3-year home-based follow-up assessment, in interviews with researchers blinded
257 to randomization allocation. Measures were selected to include mental health symptoms and
258 positive aspects of mental health,³²⁻³⁴ rather than mental ill health only. Maternal mental
259 health symptoms were measured using the Depression Anxiety and Stress Scales (DASS)³⁵
260 and positive mental health measures of personal wellbeing³³ and self-efficacy³⁴ were also
261 assessed (see Table 1 for details). The DASS Total Symptom scores and Depression, Anxiety
262 and Stress Subscales were each reverse-scored to aid interpretation, such that higher scores
263 represent better mental health. Reversed DASS subscale scores were also dichotomized to
264 reflect poorest mental health symptom severity (study-defined as lower 15% of scores
265 according to population reference ranges³⁶) versus better mental health (upper 85% of scores)
266 to estimate the impact of NHV on mental health morbidity. The measures are not diagnostic
267 tools and therefore have no agreed minimum clinically important difference.

268 **Statistical analyses:** The initial RCT sample size was calculated to detect a minimum effect
269 size (ES) of 0.3 standard deviations (SD) in the primary parent responsiveness outcome. A
270 target sample size of 714 participants was estimated to provide 80% power, with 5%
271 significance level, accounting for clustering by care provider in the intervention group and
272 site of care provision for usual care. This estimate allowed for 40% attrition to 2-year follow-
273 up. A final sample size of 722 participants was achieved. The sample size achieved at the 3-
274 year follow-up was 495 (68.6%), which retained 80% power to detect a minimum ES of 0.3

275 SD on continuous measures of maternal mental health. For all women retained at 3 years,
276 baseline characteristics of those in the intervention and usual care group were compared
277 using chi-square tests (categorical measures) and t-tests (continuous measures) to assess
278 differences arising due to attrition.

279 In line with the published statistical analysis plan used at age 2 years,²⁶ between-
280 group comparisons of mental health outcomes at 3 years were made following intention to
281 treat linear (continuous outcomes) and logistic (binary outcomes) regression models. Initially,
282 these models included families who had participated in the 3-year follow-up and completed
283 the mental health outcome measures i.e. complete case data. Regression models were
284 adjusted for the stratification factors used during randomization: parity and study site; and
285 additional baseline covariates: family's Socio-Economic Index for Areas (SEIFA) score,³⁷
286 maternal education, maternal age at child's birth, parity, antenatal risk, maternal self-efficacy
287 and maternal mental health, as well as child sex and age at the 3-year assessment. All
288 regression analyses accounted for effects of nurse clustering.²⁹ Adjusted results are presented
289 to ensure treatment effect estimates are corrected for chance imbalances in baseline
290 covariates, appropriate confidence intervals are estimated and statistical power is most
291 efficient.³⁸ Adjusted results are reported as mean differences, standardized effect sizes (ES)
292 or odds ratios (OR) with 95% Confidence Intervals (CI).

293 Multiple imputation techniques were used to evaluate the sensitivity of the findings
294 based on complete cases to sample attrition. Multiple imputation provided estimates of
295 program effects which included all mothers who were initially randomly assigned. Multiple
296 imputation was conducted using multivariate normal regression within each of the two
297 treatment groups to allow for differing mechanisms by which missing data may have arisen
298 across the groups. Imputation models included all outcomes collected at 3 years, stratification

299 factors and baseline covariates; 30 data sets were imputed.³⁹ Data were analyzed using Stata
300 version 15 for Windows (Stata Corp, College Station, TX).

301 **Ethical approval:** right@home was approved by Human Research Ethics Committees:
302 Royal Children’s Hospital (HREC 32296); Peninsula Health (HREC/13/PH/14); Ballarat
303 Health Services (HREC/13/BHSSJOG/9); Southern Health (HREC 13084X); and Northern
304 Health (HREC P03/13) in Victoria, and University of Tasmania (HREC H0013113); all
305 Australian. The ethics-approved study protocol included processes for responding to
306 participant or child safety concerns.

307 **RESULTS**

308 Of 5586 women screened, 1427 (25.5%) were eligible (Figure 1). Of these, 722
309 (50.6%) enrolled in the trial. Of 722 enrolled, 558 (77.3%) re-enrolled in the extended
310 follow-up and 495 (68.6%) provided data at 3-year follow-up. Table 2 presents the baseline
311 characteristics for women who participated at 3 years compared to women lost to follow-up.
312 The women participating in the 3 year follow up, across both the intervention and usual care
313 group, had slightly better mental health at baseline, were more likely to have completed high
314 school, and were less likely to have reported a drug problem or history of family violence.
315 Amongst those retained, comparison of baseline characteristics between the intervention and
316 usual care group showed minimal differences.

317 Table 3 presents the descriptive statistics of the maternal mental health outcomes and
318 the adjusted complete case analyses. Compared to usual care, benefits of the intervention
319 were evident for mental health in the DASS Total Score (ES: 0.25, 95% CI: 0.12 to 0.38),
320 and consistently across the Depression, Anxiety and Stress subscales. These benefits
321 translated to higher odds of better mental health (better 85% of symptom scores relative to
322 norms) for Depression (OR:1.68, 95% CI: 1.08 to 2.60), Anxiety (OR:1.38, 95% CI: 0.92 to
323 2.08) and Stress (OR: 2.09, 95% CI: 1.28 to 3.42). Similarly, program benefits were evident

324 in better personal wellbeing (ES: 0.16, 95% CI: 0.04 to 0.29) and not lacking self-efficacy
325 (OR: 1.60, 95% CI: 1.19 to 2.16).

326 Results of the multiple imputation analyses (Table 4) are similar to the complete case
327 analyses in estimated effects, confirming that the use of complete case analyses had not led to
328 bias due to attrition between the treatment groups. Estimates had slightly wider confidence
329 intervals because the imputation of a large proportion of the study outcomes increased the
330 uncertainty of estimation, thus these analyses using multiple imputation are considered the
331 more conservative.³⁹

332 **DISCUSSION**

333 Benefits of the right@home NHV program were evident for maternal mental health
334 and wellbeing outcomes at 1-year post intervention completion (child age 3 years). Our
335 findings align with results from three previous US NHV studies showing small-to-modest
336 effect sizes for maternal mental health from child age 2 to 4 years (ES: 0.1 to 0.6 for maternal
337 depression symptoms and parenting stress).²¹⁻²³ We found similar-sized benefits for maternal
338 depression, anxiety and stress symptoms (ES: 0.17 to 0.25), but note the additional positive
339 benefits on personal wellbeing (ES 0.16) and self-efficacy (OR: 1.60).

340 These findings also align favorably with programs that directly target maternal mental
341 illness. Psychosocial and psychological interventions delivered by nurses, physicians,
342 psychologists, researchers or lay people have shown similarly modest positive benefits in the
343 antenatal and first year postpartum periods (ES: 0.06 to 0.16).^{40,41} However, these benefits
344 have either not been observed or assessed beyond child age 1-year, nor were they delivered
345 specifically to women experiencing adversity.

346 Despite substantial research and policy attention paid to maternal mental health, and
347 its known importance for children's development, there are comparatively few published data

348 on maternal mental health beyond the first year postpartum.^{8,17} An Australian population
349 cohort of first-time mothers reported depression increasing with child age, with a peak at 4
350 years.¹⁷ Within our study, mothers receiving usual care also reported worse mental health
351 symptoms from 2 to 3 years.²⁶ In contrast, our findings for intervention mothers suggest that
352 the right@home NHV program may have prevented or postponed this decline in mental
353 health. These findings deliver on the initial aspiration of the program as a salutogenic
354 prevention intervention embedded in healthcare for women who may benefit from additional
355 support, rather than an intervention responding to crisis or illness.²⁸

356 The strengths of our findings lie in the trial's rigorous design and research
357 collaboration. Implementation of the NHV program and the research evaluation were led by
358 different institutions. Outcome assessments were completed by researchers who were blinded
359 to intervention status. The trial is also strengthened by the high retention of study participants
360 in both groups (69% over a 4-year study duration), despite the substantial adversity
361 experienced by participants. For context, by 2-year follow-up the UK Building Blocks study
362 retained 71% of their cohort for self-reported outcomes,⁴² ProKind retained less than 50%,⁴³
363 and the French CAPEDP retained only 31% of their original cohort.⁴⁴ Although those lost to
364 follow-up reported slightly more adversities at baseline, participant characteristics at 3 years
365 remained balanced between the trial arms. In addition, multiple imputation methods were
366 implemented to confirm estimates made using complete data. Compared to the results of the
367 complete cases analyses, multiple imputation methods provided a more conservative
368 estimation of program effects in which benefits for maternal mental health were still evident.
369 Given the large, multi-site design of the trial, high participant retention and confirmation
370 using multiple imputation, we believe our findings should generalize to pregnant women
371 experiencing adversity, in similar health care systems.

372 There are several limitations. The multiple self-reported mental health measures are
373 likely to represent overlapping constructs. However, this was to encompass both the positive
374 aspects of mental health and symptoms of mental ill health, i.e. both positively and negatively
375 framed items.³²⁻³⁴ While mental health was examined using both continuous and
376 dichotomized symptom scores across multiple domains of the DASS, this allowed us to
377 estimate the impact of NHV on a scale of mental health symptoms as well as rates of
378 dichotomized mental health morbidity. The DASS is not a diagnostic tool; however, it is one
379 of the only broad-spectrum, self-report mental health measures and is frequently used in
380 research with clinical and population-level cohorts.³⁶ We reported effect sizes to enable
381 comparability with previous NHV programs and psychological interventions which have
382 reported mental health outcomes using different measures. Although participation in the
383 NHV program in general may have influenced how women reported their mental health
384 (aside from the true benefit), we expect any potential response bias would be minimal given
385 the measures were collected 1-year after the intervention ended. A further limitation of the
386 current study is that the exclusion criteria mean findings may not generalize to non-English
387 speaking women or women with severe intellectual disability.

388 Given the crucial role that maternal mental health plays in optimal health of mothers
389 and their children,^{8,11-13} addressing inequities in maternal mental health can generate
390 substantial societal and mental health benefits.^{3,5} To realize this goal the most efficient and
391 equitable approach is to integrate mental health care into existing health services within a
392 prevention and early intervention paradigm.¹ Although economic data are not presented in
393 this paper, we note that self-reported use of health services following the intervention, from
394 child age 2 years, was similar between the intervention and usual care groups. Future
395 research will examine the cost-consequences of the right@home NHV program outcomes,
396 including maternal mental health benefits, identified at 3-years. Our findings provide

397 evidence to support NHV as a potential platform to achieve substantial benefits through
398 maternal mental health.⁶ Interventions for the prevention of postnatal depression have been
399 estimated to save \$23.3 million over 5 years in Australian mental health expenditure.⁵ While
400 these estimates focus predominantly on intervention effects in the antenatal and first year
401 postpartum, the similar benefits identified at 3 years postpartum suggest an additional
402 advantage in focusing policy on maternal mental health beyond the first year.

403 **CONCLUSION**

404 The right@home NHV program lead to emerging benefits for maternal mental health and
405 wellbeing at child age 3-years, a year after the intervention ended. These findings show that a
406 NHV program that is designed for women experiencing adversity can lead to later benefits to
407 mental health, even when implemented within existing CFH services. While vital for
408 addressing the established mental health burden, the benefits of NHV delivered through
409 existing health care infrastructure may be most critical as the economic and psychosocial
410 stressors of the COVID-19 pandemic emerge for families with young children. At scale there
411 may be real potential to reduce inequities in maternal mental health.

412

413

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416 Australian Research Alliance for Children and Youth (ARACY); the Translational Research
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419 and a research group of Murdoch Children’s Research Institute. We thank all families, the
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423
424

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Table 1. Description of maternal mental health outcome measures

Item	Description
Mental health symptoms	<p>Depression, Anxiety and Stress Scales (DASS).³⁵ 21-item measure, rated on a 4-point scale ("not at all" to "most of the time") assessing the negative emotional states of depression, anxiety and stress. Three subscales (7 items each): Depression, Anxiety and Stress, examined as continuous scores of mental health symptoms. DASS scores were reversed so that higher scores indicate better mental health, ranging from 0-21. Reversed DASS subscale scores were also dichotomized to reflect poorest mental health symptom severity (study-defined as lower 15% of scores according to population reference ranges³⁶) versus better mental health (upper 85% of scores).</p> <p>DASS subscales are strongly correlated with other self-report mental health measures in Australian postpartum women, such as the Edinburgh Postnatal Depression Scale (EPDS, Pearson's correlation(r)=0.84), and the anxiety and depression subscales of Beck Depression Inventory (BDI-II; r=0.82 and 0.86, respectively).⁴⁵</p>
Personal wellbeing	<p>Personal Wellbeing Index.³³ 8 items assessing satisfaction with specific life domains, rated using a 10-point scale ("no satisfaction at all" to "completely satisfied"). Higher scores indicate better wellbeing, ranging from 0-80.</p>
Self-efficacy	<p>3 items assessing mother's self-efficacy or locus of control, which aimed to capture how the mother felt about her life in general including the extent to which she felt that she gets what she wants out of life, felt in control and can run her own life, drawn from the UK Millennium Cohort Study.³⁴ Each item reflected the presence versus absence of self-efficacy and were used to form a single dichotomous item reflecting 'any lack of self-</p>

Item	Description
	efficacy' versus 'no lack of self-efficacy'.

Table 2. Baseline characteristics according to follow-up status (i.e. retained or lost in right@home study) at child age 3 years.

Baseline characteristics (pregnancy)	Intervention (N = 363)		Control (N = 359)		p-value ^a
	Retained (N=255)	Lost (N=108)	Retained (N=240)	Lost (N=119)	
<i>Mother</i>					
Age (years), mean (SD)	27.6 (5.9)	27.1 (6.4)	28.3 (6.4)	26.9 (6.2)	0.22
DASS (reversed – higher scores indicate better mental health)					
Total Score, mean (SD)	51.2 (9.7)	49.8 (11.1)	51.5 (8.8)	50.8 (10.4)	0.69
Depression Scale, mean (SD)	18.0 (3.5)	17.7 (4.0)	18.2 (3.1)	17.9 (3.6)	0.42
Anxiety Scale, mean (SD)	17.5 (3.4)	17.1 (3.5)	17.7 (3.1)	17.2 (3.7)	0.49
Stress Scale, mean (SD)	15.7 (4.0)	15.0 (4.8)	15.6 (3.9)	15.7 (4.3)	0.77
DASS (dichotomized - within 85th percentile score of better mental health according to norms)					
Depression Scale	82.7	81.5	86.7	79.0	0.23
Anxiety Scale	59.2	50.9	61.2	52.9	0.64
Stress Scale	80.8	77.8	80.0	83.2	0.83
Education status					
Did not complete high school	21.3	33.7	26.5	22.3	0.43
Completed high school / vocational training	67.0	58.7	63.2	66.0	
Completed a university degree	11.7	7.6	10.3	11.7	
Marital status					
Single / not living with partner	29.0	26.9	22.9	31.1	0.54
Married / living with partner	69.4	70.4	75.4	66.4	

Baseline characteristics (pregnancy)	Intervention (N = 363)		Control (N = 359)		p-value ^a
	Retained (N=255)	Lost (N=108)	Retained (N=240)	Lost (N=119)	
Separated / divorced	1.6	2.8	1.7	3.5	
Currently unemployed	62.8	73.2	62.9	74.0	0.97
Family income from benefit or pension	42.4	47.2	41.3	42.9	0.26
Ever had a drug problem	12.2	18.5	13.0	24.6	0.78
Experienced domestic violence in past year	10.7	15.9	10.6	13.5	0.97
Total adversity risk count (from screening), mean (SD)	3.0 (1.3)	3.5 (1.4)	3.2 (1.2)	3.3 (1.2)	0.10
<i>Child</i>					
First born	38.8	34.3	34.6	40.3	0.33
Female	57.3	46.9	45.8	41.9	0.01
<i>Family</i>					
SEIFA Index of Social Disadvantage Quintile					0.55
1 (most disadvantaged)	44.2	45.2	39.8	40.9	
2	6.8	9.6	8.7	8.7	
3	39.4	32.7	39.0	36.5	
4	6.4	11.5	10.0	7.8	
5 (least disadvantaged)	3.2	1.0	2.6	6.1	
Language other than English	6.8	10.3	7.6	13.0	0.71

^a p-value for chi-square tests (categorical measures) and t-tests (continuous measures) comparing those retained in the intervention and usual care groups.

All values are percentages, except where otherwise stated.

DASS= Depression, Anxiety, Stress Scale; SD=Standard Deviation; SEIFA=Socioeconomic Indexes for Areas Index of Relative Disadvantage
Range of Intervention N =351-363, Control N= 345-359 due to missing data.

Table 3. Adjusted complete case regression analyses comparing the two trial arms on maternal mental health outcomes at child age 3 years.

Outcome	Intervention		Control (Usual care)		Comparative statistic ^b : Intervention compared to Control				
	N	Summary ^a	N	Summary ^a	Statistic ^b	(95% CI)	p-value	ES	(95% CI)
Depression, Anxiety and Stress Scale (DASS) (reversed – higher scores indicate better mental health)									
Total Score	251	54.15 (8.38)	236	51.77 (9.45)	2.23	(1.08, 3.39)	0.001	0.25	(0.12, 0.38)
Depression Scale	252	18.52 (3.22)	236	17.88 (3.45)	0.67	(0.26, 1.09)	0.003	0.20	(0.08, 0.32)
Anxiety Scale	252	18.98 (2.72)	236	18.36 (3.13)	0.51	(0.15, 0.88)	0.008	0.17	(0.05, 0.30)
Stress Scale	253	16.53 (3.67)	236	15.54 (4.10)	0.90	(0.35, 1.46)	0.002	0.23	(0.09, 0.37)
Depression, Anxiety and Stress Scale (DASS) (dichotomized – within 85 th percentile score of better mental health according to norms)									
Depression Scale ^c	252	222 (88.10%)	236	195 (82.63%)	1.68	(1.08, 2.60)	0.020		
Anxiety Scale ^c	252	214 (84.92%)	236	184 (77.97%)	1.38	(0.92, 2.08)	0.12		
Stress Scale ^c	253	229 (90.51%)	236	193 (81.78%)	2.09	(1.28, 3.42)	0.003		
Personal Wellbeing	247	58.77 (12.93)	228	56.07 (12.56)	2.11	(0.47, 3.76)	0.014	0.16	(0.04, 0.29)
Self-efficacy ^{c,d}	249	192 (77.11%)	233	157 (67.38%)	1.60	(1.19, 2.16)	0.002		

Adjusted for baseline characteristics of: child sex, family's Socio-Economic Index for Areas (SEIFA) score, maternal education, maternal age at child's birth, parity, antenatal risk, maternal self-efficacy and maternal mental health; plus child age at the 3-year assessment.

N=Number of participants included in the analysis; CI= Confidence Interval; ES= Effect Size (Cohen's d).

^a Summary statistics are mean (SD) except where specified as dichotomous where n and %; ^b The comparative statistic is mean difference for continuous outcomes (intervention minus control) and odds ratio for dichotomous outcomes (relative odds for intervention compared with receiving usual care); ^c Outcome is dichotomous (%); ^d 'No lack of self-efficacy' vs 'Any lack of self-efficacy'.

Table 4. Adjusted multiple imputed regression analyses comparing the two trial arms on maternal mental health outcomes at child age 3 years.

Outcome	Intervention		Control (Usual care)		Comparative statistic ^b : Intervention compared to Control				
	N	Summary ^a	N	Summary ^a	Statistic ^b	(95% CI)	p-value	ES	(95% CI)
Depression, Anxiety and Stress Scale (DASS) (reversed – higher scores indicate better mental health)									
Total Score	363	53.79	359	51.74	1.85	0.05 ; 3.65	0.045	0.18	0.00 ; 0.36
Depression Scale	363	18.51	359	17.89	0.59	-0.05 ; 1.24	0.069	0.16	-0.01 ; 0.34
Anxiety Scale	363	18.82	359	18.31	0.40	-0.28 ; 1.07	0.23	0.12	-0.08 ; 0.32
Stress Scale	363	16.46	359	15.54	0.86	0.07 ; 1.65	0.035	0.20	0.02 ; 0.38
Depression, Anxiety and Stress Scale (DASS) (dichotomized - within 85th percentile score of better mental health according to norms)									
Depression Scale ^c	363	91.74	359	88.58	1.53	1.05 ; 2.24	0.028		
Anxiety Scale ^c	363	89.53	359	85.52	1.40	1.00 ; 1.94	0.047		
Stress Scale ^c	363	93.39	359	88.02	1.95	1.20 ; 3.16	0.007		
Personal Wellbeing	363	58.95	359	56.23	2.37	-0.59 ; 5.34	0.10	0.17	-0.04 ; 0.37
Self-efficacy ^{c,d}	363	75.68	359	65.44	1.74	1.26 ; 2.40	0.001		

Adjusted for baseline characteristics of: child sex, family's Socio-Economic Index for Areas (SEIFA) score, maternal education, maternal age at child's birth, parity, antenatal risk, maternal self-efficacy and maternal mental health; plus child age at the 3-year assessment.

N=Number of participants included in the analysis; CI= Confidence Interval; ES= Effect Size (Cohen's d).

^a Summary statistics are mean (SD) except where specified as dichotomous where n and %; ^b The comparative statistic is mean difference for continuous outcomes (intervention minus control) and odds ratio for dichotomous outcomes (relative odds for intervention compared with receiving usual care); ^c Outcome is dichotomous (%); ^d 'No lack of self-efficacy' vs 'Any lack of self-efficacy'.

Figure 1. Participant CONSORT diagram



