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POPULATION STUDY

Variations in sustained home visiting care for mothers and children experiencing adversity

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Abstract

Objective: This study aimed to examine the variations in care received by mothers and families within a sustained home visiting program. We sought to identify the extent to which there were variations in home visiting care in response to the program schedule and families' risk factors.

Design and sample: Data collected within the right@home program, a randomized controlled trial (RCT) for a sustained nurse home visiting intervention in Australia, were analyzed. A total of 352 women comprised the intervention arm of the trial.

Measurements: Visit content in the home visiting program, sociodemographic data, and families' risk factors were used for analysis.

Results: Our results confirmed that the majority of women received scheduled content on time or within an acceptable timeframe, except for the sleeping program. Women with identified risks were significantly more likely to receive content related to those risks than women without those risks (smoking: Odds Ratio [OR] = 15.39 [95%CI 3.7–64.7], mental health: OR = 15.04 [1.8–124.0], domestic violence: OR = 4.07 [2.0–8.3], and drugs and alcohol: OR = 1.81 [1.1–3.0]).

Conclusions: The right@home program had high compliance with the scheduled content. Capacity development in responding to mothers with the risk of domestic violence and drugs and alcohol is recommended. Further research is required to explore the relationship between variations in care and critical outcomes.

KEYWORDS
child health services, home visiting, maternal-child health services, maternal health services, public health nursing, risk factors, variations in care

1 | BACKGROUND

Evidence from previous research in early human development demonstrates the importance of the first 1000 days from conception to positive and life-long child outcomes (Britto et al., 2017; Cusick & Georgieff, 2016; Kraemer et al., 2018). This body of research calls for evidence-based early intervention services within this sensitive window of time, targeting parents, caregivers, and children who have been identified as at risk of poor outcomes (Daelmans et al., 2017). Home visiting has been considered a promising strategy for addressing multiple needs

of families, especially those who are experiencing adversity (Avellar & Supplee, 2013; Filene et al., 2013; D. McNaughton, 1994; Molloy et al., 2021; Peacock et al., 2013).

The Maternal Early Childhood Sustained Home-visiting (MECSH) program is a structured nurse facilitated program designed to address health inequities by catering for families experiencing adversity (Kemp et al., 2011, 2017). The MECSH program is delivered to families with significant risk factors by university-trained registered nurses (baccalaureate) with postgraduate training in child and family health nursing. The nurses were also provided additional online and face-to-face training in the MECSH program as well as reflective practice supervision. The program commences in pregnancy and continues until the child is 2 years old. The program's goals are to: improve the transition to parenting by supporting mothers through pregnancy; improve maternal health and well-being by helping mothers to care for themselves; improve child health and development by helping parents to interact with their children in developmentally supportive ways; develop and promote parents' aspirations for themselves and their children; and improve family and social relationships and networks by helping parents to foster supportive relationships within the family and with other families and services (Kemp et al., 2011).

Previous research evidence has shown MECSH-based programs to be effective, reporting significant improvements in maternal confidence in care, knowledge and experience, positive child health and development outcomes, and creating positive home environments to support healthy child development (Goldfeld et al., 2018, 2019; Kemp et al., 2011, 2018). However, there is limited knowledge in relation to the specific mechanisms of effective practice that achieve high quality of care in home visiting interventions. It has been previously noted by Kemp (2016, p. 429) that "quality is achieved by identifying and measuring the core ingredients and variations." However, adaptations and variations in the practices of home visiting programs have not been investigated (Roggman et al., 2001, 2016). Variations in the care provided by home visiting nurses to families, how interventions are structured, and the quality of interactions during the visits may determine how effective a home visiting program is for a particular family (Filene et al., 2013; Nygren et al., 2018; Roggman et al., 2001).

Little research has considered which practices and processes of home visiting contribute to positive outcomes and for whom. The quality of implementation is often poorly reported and, when reported, describes what happens on home visits in very general ways (Kemp et al., 2019; Roggman et al., 2016). Researchers have concluded that what specifically occurs during a home visit is largely unknown and remains a "black box" (Goldfeld et al., 2018; D. B. McNaughton, 2004).

Variations in care occur for a range of different reasons (Australian Commission on Safety & Quality in Health Care, 2015). When a variation is desirable and warranted to customize or tailor programs to meet the client's unique needs and preferences (Kreuter & Skinner, 2000), the variation can be considered "purposeful" variability. Home visiting care services provide opportunities for nurses to observe the environment in which families live, which can help them identify a family's unique needs and provide a greater level of individual attention than usual facility-based care (Goldfeld et al., 2018). This variation is purposefully and intuitively created by nurses based on their knowledge, skills, observations, communications, and relationships with clients. This kind of practice variation is compatible with concepts such as individualized care (Suhonen et al., 2002, 2005, 2007, 2008, 2012; Wright & McCormack, 2001), tailored-care (Pasick, 1997), client-centered care (Brown et al., 2006), and people-centered care (Lydahl, 2021; World Health Organization, 2007). Bespoke care models are largely preferred by clients and thus result in better outcomes and higher rates of client satisfaction (Bertakis & Azari, 2011; Ekman et al., 2012; Jo Delaney, 2018).

On the other hand, if a variation in the care delivery model is unwarranted, it may signal that clients are not receiving appropriate care (Australian Commission on Safety & Quality in Health Care, 2015). Lack of compliance with evidence-based program elements can result in serious consequences, including drift and dilution (Kalisch et al., 2011; Kemp, 2020). Drift is defined as "a misapplication or mistaken application of the model, often involving either technical error, abandonment of core and requisite components, or introduction of counterproductive elements" (Aarons et al., 2012). Dilution is the failure to deliver the intensity or duration of the program as intended (Goldfeld et al., 2018). Non-purposeful variability can threaten the fidelity of the program and the quality of the care provided, while purposeful variability may enhance it.

Achieving the appropriate balance between program compliance and purposeful variation to meet individual needs underpins the theoretical concept of precision home visiting. Precision home visiting is home visiting that differentiates what works, for whom, and in what contexts to achieve specific outcomes (Home Visiting Applied Research, Collaborative; Supplee & Duggan, 2019). It focuses on the components of home visiting services that are most likely to be effective in light of mothers' and families' characteristics and social and cultural context (Haroz et al., 2019). Mothers participating in home visiting programs are, in general, provided with the same program content, dose and duration regardless of their needs or circumstances. However, mothers and children may not need the same program content or dose. Furthermore, without clear guidance on how to customize service delivery, home visiting nurses' judgement may compromise program fidelity. Thus, there is an emerging demand for new home-visiting strategies to address the diverse and critical needs of mothers and families while maintaining fidelity to the core ingredients of evidence-based home visiting programs (Haroz et al., 2019).

This study builds upon and extends the existing home visiting research literature by exploring variations in care. It aimed to examine the variations in care for mothers and children in the delivery of the right@home MECSH-based program by answering four research questions: What are the variations in care as per the program schedule and requirements in the delivery of the program? (Compliance); How did care vary over the duration of the program? Which variations in care in the delivery of the program are made in response to the families' individual risks? (Customization according to families' risk factors:

purposeful variability); and How precisely did the program content vary in response to families' risk?

2 | METHODS

2.1 | Study design

This study draws on data collected in a randomized controlled trial (RCT) of right@home, a sustained nurse home visiting program from pregnancy to child age 2 years (Goldfeld et al., 2017). It was a MECSH-based program which was trialed in seven localities in the Australian states of Victoria and Tasmania (Goldfeld et al., 2017).

2.2 | Participants

Eligibility criteria for the right@home trial included pregnant women attending the antenatal clinics in Victoria and Tasmania from May 2013 to August 2014, who were less than 37 weeks gestation, had sufficient English proficiency to verbally answer interview questions, resided within the study travel boundaries, and reported two or more of ten sociodemographic risk factors for adverse parent and/or child outcomes in risk factor screening conducted verbally by trained research assistants working in antenatal clinics: young pregnancy (age <23 years); not living with another adult; no support in pregnancy; smoking; poor/fair/good health; long-term illness; anxious mood; not completed Year 12 secondary level education; no income; and never worked (Goldfeld et al., 2017; A. Price et al., 2019; A. M. Price et al., 2017). The right@home trial recruited 722 pregnant women, including 363 women in the intervention group and 359 women in the control group. The control group received usual care (Goldfeld et al., 2017).

2.3 | Measures

2.3.1 | Participants sociodemographic and risk factors

Data collected at women's commencement in the program, including sociodemographic and risk factor screening data, and children's dates of birth were extracted from the trial enrolment data.

2.3.2 | Visit content provided for mothers and families

As part of the study, visit content was recorded by the nurses at the completion of each visit to the woman and her family (Goldfeld et al., 2018; Kemp et al., 2019). The nurse completed an online checklist designed explicitly for use in the program quality monitoring. The checklist included the unique client identifier, date of the visit and the activities undertaken. The electronic checklist was located on the nurse's mobile device (tablet) with a simple touch entry. It was used to record activities and content provided in the visit. The checklist identified activities or topics discussed with the family across nine headings: infant well-being; maternal well-being; maternal mental health; family well-being; preventive health care; environment/resources; planning and goal setting; referrals; and tools and focus modules. There were 48 items in the antenatal checklist and 56 items in the postnatal checklist (Goldfeld et al., 2018; Kemp et al., 2019).

2.4 | Ethics approval

The right@home trial was approved by the Human Research Ethics Committees in Australia of the Royal Children's Hospital, Victoria (HREC 32296), Peninsula Health, Victoria (HREC/13/PH/14), Ballarat Health Services, Victoria (HREC/13/BHSSJOG/9), and The University of Tasmania (HREC H0013113). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethics standards. Written consent was obtained from all participants.

2.5 | Analytic strategy

Data analyses were performed using R (4.0.5) and RStudio (Version 1.4.1106). Descriptive statistics, including numbers and percentages, were computed for the variables involved in this study. Odds ratios (OR), accuracy, precision, sensitivity, F1-score, and Matthews Correlation Coefficient (MCC) were calculated to analyze the risk-related variability in care. The F1-score is the harmonic mean of the precision and sensitivity, where the score reaches its best value at 1 (perfect precision and sensitivity) and its worst value at 0 (Choi et al., 2020). Several studies show that MCC produces a more informative and truthful score than accuracy and F1-score in evaluating binary classifications (Boughorbel et al., 2017; Chicco & Jurman, 2020; Chicco et al., 2021). MCC ranges from −1 and 1, with −1 indicating perfect negative correlation, 0 random distribution, and 1 perfect correlation (Boughorbel et al., 2017; Vihinen, 2012).

There were six focus modules (required curriculum) for the right@home program, scheduled to be delivered at specific times related to the developmental needs of the child (Goldfeld et al., 2018, 2019): Get Up & Grow; Sleep program; Safety audit; Promoting First Relationship; Video feedback; and Learning to Communicate. For the analyses on the variations in care content provision, the required visit contents for each of five focus modules were identified according to the right@home intervention manual (Table 1). The module of Video feedback was not included in the analysis as it was part of the Promoting First Relationship and Learning to Communicate modules.

TABLE 1 Visit content applicable to the five focus modules

Focus module	Visit content
Get up & grow	Infant health and growth, infant development, infant feeding, personal health record complete, get up and grow healthy eating guide
Sleep program	Infant crying, infant sleeping and settling, SIDS prevention
Safety audit	Infant bathing, SIDS, household safety, car safety
Promoting first relationships	Infant development, interaction between parent and infant, Promoting First Relationship tools, video feedback
Learning to communicate	Infant health and growth, infant development, infant crying, infant feeding, infant bathing, video feedback, Learning to Communicate and small talk tools

The visit content that could be used to identify the delivery of each focus module was mapped out according to the right@home implementation manual. Using this content mapping, the complete set of home visit activity records were scanned to identify if the visit content was delivered either at the scheduled time or within an acceptable time frame as per the home visit schedule. The time period between each visit of interest and the scheduled age of delivery was calculated, and the visit closest to the target child age was determined and marked. Content provision was assessed for each of these marked home visits. The service was considered to have been provided if any of the selected content was completed during the home visit, and the home visit occurred within the "on time" frame. We considered that the content was provided "within an acceptable time frame," if the service was provided at least once between one scheduled visit before and two scheduled visits after the target visit. The service was considered to have been provided at a time appropriate to meet the child's developmental needs with the recognition that variation in child development may have required the nurse to deliver content somewhat earlier or later than scheduled. If these conditions were not met, the home visit was considered as "content not provided."

3 | RESULTS

Of 363 women randomized to the intervention group, 352 women (97.0%) commenced the intervention, and 304 of these women (86.4%) completed the right@home program when the child reached 2 years of age.

3.1 | Variations against the planned/scheduled content

Variations in care were analyzed from the viewpoint of compliance with the scheduled content. For almost all five focus modules, the majority of the mothers were provided with scheduled content on time or within an acceptable time range, except for the sleep program module. Only 58.4% of women received at least one content of the sleep program module at the scheduled point of the antenatal period.

According to the program schedule, content for the Get Up and Grow module was required to be provided during the antenatal period, and child age 2, 4, 19, 52, and 104 weeks. More than 90% of women received scheduled content on time at almost all the required visits scheduled, except for the antenatal visit (60.1%). The sleep program module was provided at child age 26 weeks on time for 89.7% of participants, and within an acceptable time range for 98.1%. For the safety audit module, 79.2% of the participants received the content on time at the point of child age 3 weeks. However, the proportion increased to 97.3% when the provision of scheduled content within an acceptable time range was calculated. At least 98% of the participants received the scheduled content of the Promoting First Relationships and Learn to Communicate module within an acceptable time range, as presented in Table 2.

3.2 | Variability in content delivery by different time frames

The proportion of the participants who received each visit content once or more was calculated by the different time frames: antenatal to child age 6 months, child age 7–12 months, and child age 13 months to 2 years. The most frequently provided visit content for three different time frames were "mental health" (99.7%) for antenatal to child age 6 months, "infant health and growth" and "infant development" (100% and 99.7%, respectively) for the period of child age 7–12 months as well as the period of child age 13 months to 2 years. The least provided visit contents were "family law" (24.7%) for antenatal to child age 6 months, "Edinburgh Depression Scale" (12.4%) for child age 7–12 months, and "sterilisation for feeding" (6.7%) for child age 13 months to 2 years.

The content for which provision varied by different timeframe (more than 40% difference) were: "sterilization"; "infant bathing"; "parent craft"; "pregnancy and childbirth"; "maternal smoking"; "expectations and reality of having a baby"; "drugs and alcohol"; "car safety"; "Edinburgh depression scale tool"; and "Learning to Communicate tool" (See Additional table).

TABLE 2 Provision of scheduled visit content for five focus modules ($N = 352$)

Required schedule for each module	Total number of families	Provision of scheduled content "on time"		Provision of scheduled content "within an acceptable time range"	
		Number of families provided content	%	Number of families provided content	%
"Get Up and Grow"					
Antenatal	296	178	60.1	246	83.1
2 weeks	339	316	93.2	338	99.7
4 weeks	339	314	93.2	339	100.0
19 weeks	328	297	90.5	326	99.4
52 weeks	305	290	95.1	305	100.0
104 weeks	275	266	96.7	275	100.0
Sleep program					
Antenatal	296	112	37.8	173	58.4
26 weeks	314	287	89.7	314	98.1
Safety audit					
Antenatal	296	222	75.0	275	92.9
3 weeks	336	266	79.2	327	97.3
38 weeks	312	267	85.6	305	97.4
Promoting first relationships					
2 weeks	339	310	91.4	335	98.1
4 weeks	339	306	90.3	336	99.1
5 weeks	338	307	90.8	337	99.7
10 weeks	331	307	92.7	330	99.7
15 weeks	330	307	93.0	329	99.7
45 weeks	310	290	93.5	310	99.7
61 weeks	301	278	92.4	299	99.3
70 weeks	294	274	93.2	293	99.7
87 weeks	282	276	97.9	282	100.0
96 weeks	277	252	91.0	278	100.0
104 weeks	275	265	96.4	275	100.0
Learning to communicate					
3 weeks	336	317	94.3	336	100.0
6 weeks	337	304	90.2	337	100.0
10 weeks	331	318	96.1	330	99.7
15 weeks	330	314	95.2	328	99.4
19 weeks	328	298	90.9	327	99.7
22 weeks	322	297	92.2	322	100.0
26 weeks	320	306	95.6	319	99.7
32 weeks	316	303	95.9	314	99.4
38 weeks	312	297	95.2	313	100.0
45 weeks	310	297	95.8	311	100.0
52 weeks	305	291	95.4	305	100.0

Additional table. Number and percentage of mothers who received the visit content at least once during the indicated timeframe

	Antenatal to child 6 months ($n = 352$)		Child 7–12 months ($n = 314$)		1–2 years ($n = 300$)	
Content	***n***	**%**	***n***	**%**	***n***	**%**
Parent craft/Infant well-being						
Infant health and growth	343	97.4	314	100.0	299	99.7
Infant development	343	97.4	314	100.0	299	99.7
Interaction between parent and infant	343	97.4	311	99.0	298	99.3
Infant crying	340	96.6	224	71.3	193	64.3
Infant sleeping/settling	347	98.6	312	99.4	295	98.3
Infant feeding	349	99.1	313	99.7	297	99.0
Sterilization	228	64.8	61	19.4	20	6.7
Infant bathing	252	71.6	87	27.7	71	23.7
Parent craft (clothing/nappies, etc)	297	84.4	116	36.9	114	38.0
Maternal well-being						
Maternal Health	351	99.7	313	99.7	298	99.3
Physical activity	339	96.3	256	81.5	277	92.3
Maternal nutrition	342	97.2	239	76.1	256	85.3
Dental care	152	43.2	64	20.4	104	34.7
Sexual activity	180	51.1	83	26.4	85	28.3
Pregnancy Childbirth	221	62.8	0	0.0	0	0.0
Contraception/conception	292	83.0	144	45.9	146	48.7
Maternal smoking	281	79.8	96	30.6	115	38.3
Expectations/reality of having a baby	334	94.9	140	44.6	161	53.7
Drugs and alcohol	236	67.0	59	18.8	78	26.0
Maternal Mental Health						
Maternal Mood	349	99.1	312	99.4	298	99.3
Coping	347	98.6	312	99.4	295	98.3
Anxiety	289	82.1	197	62.7	207	69.0
Depression	271	77.0	156	49.7	167	55.7
Mental health issues	240	68.2	108	34.4	138	46.0
Partnership issues	318	90.3	229	72.9	268	89.3
Domestic violence	217	61.6	102	32.5	144	48.0
Family Well-being						
Partner coping	314	89.2	229	72.9	239	79.7
Relationships with other children	240	68.2	196	62.4	213	71.0
Families social support network	349	99.1	289	92.0	291	97.0
Relationships with extended family	338	96.0	258	82.2	285	95.0
Care/management of partner health	170	48.3	85	27.1	112	37.3
Care/management of other child's health	191	54.3	138	43.9	162	54.0
Cultural issues	99	28.1	58	18.5	71	23.7
Preventive health care						
SIDS Prevention	339	96.3	206	65.6	131	43.7
Household safety (e.g., Water, fire, steps)	318	90.3	279	88.9	277	92.3
Car safety	287	81.5	108	34.4	121	40.3
Environment/Resources						
Housing/physical environment	333	94.6	273	86.9	273	91.0
Family Law	87	24.7	56	17.8	93	31.0

(Continues)

Content	Antenatal to child 6 months ($n = 352$)		Child 7–12 months ($n = 314$)		1–2 years ($n = 300$)	
	n	%	*n*	%	*n*	%
Finance/budget	282	80.1	181	57.6	225	75.0
Community services	215	61.1	136	43.3	192	64.0
Childcare issues	217	61.6	183	58.3	244	81.3
Planning						
Care planning	320	90.9	274	87.3	266	88.7
Caregiver's aims and goals for the forthcoming week/s	341	96.9	297	94.6	285	95.0
Caregiver aspirations for the baby	295	83.8	229	72.9	274	91.3
Caregiver aspirations for themself(education/job)	312	88.6	264	84.1	281	93.7
Referral						
Referral to agencies/professionals	247	70.2	156	49.7	147	49.0
Health/other professional involved with family	234	66.5	127	40.4	142	47.3
Referral need not taken up by family	88	25.0	47	15.0	61	20.3
Ongoing management of issues by the team	180	51.1	131	41.7	138	46.0
Tools						
Personal health record complete	342	97.2	300	95.5	289	96.3
Edinburgh depression scale	212	60.2	39	12.4	30	10.0
KidSafe home safety checklist	279	79.3	217	69.1	124	41.3
Get up and grow healthy eating guide	318	90.3	242	77.1	247	82.3
Infant sleep diary and intervention	114	32.4	129	41.1	81	27.0
Promoting first relationships	341	96.9	266	84.7	290	96.7
Video/digital feedback	300	85.2	198	63.1	245	81.7
Learning to Communicate/Small Talk	340	96.6	309	98.4	160	53.3

3.3 | Variability in relation to mothers' risks

This study assessed whether content was delivered that related to four risks identified by participant's self-report at program commencement or during the intervention: smoking, mental health, domestic violence, and drug and alcohol issues. Of all participants who completed the program ($n = 304$), 98 women reported smoking. Of them, 96 women (98.0%) received smoking management content. There were 203 women who identified a mental health risk. Of them, 202 women (99.5%) were provided with at least one visit that addressed maternal mental health care content.

As presented in Table 3, the ORs of risk-related service provision were, for smoking 15.4 (95% CI 3.7–64.7), mental health 15.0 (1.8–124.0), domestic violence 4.1 (2.0–8.3), and drugs and alcohol 1.8 (1.1–3.0). These results indicate that women who identified risks such as smoking, mental health, domestic violence, and drugs and alcohol were significantly more likely to be provided with risk-related services in the home visiting intervention when compared with mothers who did not have the risk.

The accuracy, precision, sensitivity, F1-score, and MCC were calculated for each risk factor as presented in Table 4. The high precision ratios indicated that the mothers with four selected identified risks were more likely to receive the risk-related visit content than those who did not identify with these risks. Risks and provision of specific visit content were correlated for smoking (F1-score = 0.549, MCC = 0.276), mental health (F1-score = 0.810, MCC = 0.189), domestic violence (F1-score = 0.507, MCC = 0.232), and drugs and alcohol (F1-score = 0.661, MCC = 0.133).

4 | DISCUSSION

This study explored the variations in care for mothers and children delivered in a sustained nurse home visiting program, the right@home program, for families experiencing adversity. The right@home program had content scheduled at specific visits over the program duration. There was also an expectation that the program would deliver additional content in each visit in response to the child's age and needs, and the families' circumstances, challenges, needs, and risks.

4.1 | Variability as per the scheduled content and by different time frames

The study results showed that most of the mothers who participated in the program were provided with scheduled content on time or within

TABLE 3 Risk-related visit content provision ($N = 304$)

Risk identified	Number of families provided with risk-related content			% content provided	Odds Ratio	95% CI
Smoking	Yes	No	Total			
Yes	96	2	98	98.0	15.4	3.7–64.7
No	156	50	206	75.7		
Mental health						
Yes	202	1	203	99.5	15.0	1.8–124.0
No	94	7	101	93.1		
Domestic violence						
Yes	78	10	88	88.6	4.1	2.0–8.3
No	142	74	216	65.7		
Drugs and alcohol						
Yes	126	37	163	77.3	1.8	1.1–3.0
No	92	49	141	65.2		

Abbreviation: CI, confidence interval.

TABLE 4 Accuracy, precision, sensitivity, and F1-score for identified risks (N = 304)

	Accuracy (%)	Precision (%)	Sensitivity (%)	F1-score	MCC
Smoking	48.0	98.0	38.1	0.549	0.276
Mental health	68.8	99.5	68.2	0.810	0.189
Domestic violence	50.0	88.6	35.5	0.507	0.232
Drugs and alcohol	57.6	77.3	57.8	0.661	0.133

Abbreviation: MCC, matthews correlation coefficient.

an acceptable time range, except for the sleep program module in the period of the antenatal visits. This may be due to other priorities that needed to be looked after during the antenatal period, such as maternal health. Another reason may be, because unlike other content which has specific intervention tools and materials for distribution, the sleep content was discussion based, prevention strategy without accompanying printed materials. Thus, it might be less prioritized than the other content which has particular tools for intervention. Primary content in provision was varied over the visit time period. The content provided for almost all mothers during the antenatal to child age 6 months period were maternal health, maternal mood, infant feeding, and families' social support network. During the period of child age 7–12 months, primary visit content shifted to infant well-being. Then, specific issues such as household safety and childcare issue were discussed after child age 13 months to 2 years. Nurses seem to have provided timely care in line with expectations according to child age as well as families' circumstances and needs, in addition to the scheduled content.

This study confirmed that the right@home program had high compliance with the scheduled content at the level of individual care. This might be because the quality of the program, including service content, dose, client retention, and implementation processes, was systematically and continuously monitored by the program support service, and feedback on performance was regularly provided to the participating sites (Goldfeld et al., 2018). This quality monitoring and evaluation system is essential to achieving high compliance and fidelity, and eventually the desired outcomes.

4.2 | Risk-related variability in care and implication for public health nursing

The results of this study showed that mothers who identified with the risk factors of smoking, mental health, domestic violence, and drugs and alcohol were much more likely to have specific content delivered related to those risks than the mothers who did not identify with these risks. This suggests that the visit content was provided to the families based on their identified risks in addition to the scheduled content.

However, the mothers with smoking and mental health risks were more likely to have received specific content than those who had domestic violence and drug and alcohol risks. This may be because the risks of domestic violence and drugs and alcohol are more sensitive issues for nurses to address and intervene in compared to smoking and mental health. Several studies found that health care providers felt relative comfort and confidence about assessing smoking and coun-

selling to reduce smoking for pregnant women. However, they experienced discomfort and pessimism when it came to addressing domestic violence (Hanks & Smith, 1999; Herzig et al., 2006). Other studies have noted gaps in provider knowledge and lack of education regarding domestic violence, as well as lack of effective interventions to address domestic violence. Provider self-efficacy, fear of offending clients, providers' personal experience with abuse, and fears of being involved with the judicial system are all factors that have been identified as forming barriers for health care professionals who encounter domestic violence in their practice (Alhusen et al., 2015; O'Doherty et al., 2015). Similarly, previous research confirmed that health care providers are more likely to intervene when pregnant women smoke than when they use drugs and alcohol (Chang et al., 2008; Herzig et al., 2006; Seib et al., 2012). Despite the significance of drugs and alcohol in pregnant women's and their babies' lives, most health care providers receive little education and training about the nature of drugs and alcohol addiction and intervention techniques. Providers may also have negative attitudes about drugs and alcohol addiction (Goodman & Wolff, 2013).

Addressing challenging topics with clients, particularly those with critical risks, requires considerable nurse skill and experience, alongside a well-established nurse-client relationship (Hanks & Smith, 1999; Hebbeler & Gerlach-Downie, 2002). Home visiting nurses are required to continuously reassess the family's ability and desire to learn and grow, and adapt the standard protocol to a specific family's culture, interests, and pace of change (Hanks & Smith, 1999). The results suggest that public nurses are able to personalize services to meet the needs of clients and intervention models should continue to have sufficient flexibility to support the purposeful variation in care. However, they may need further training and support in providing care for families experiencing domestic violence and drugs and alcohol issues. The development of nurse confidence and competencies for identifying these risks and providing appropriate and timely care, intervention and referral is critical to providing high quality interventions and services for these families experiencing significant adversity.

We recommend specific and targeted sleep content with tangible resources such as handouts which may serve as a prompt and encourage home visiting nurses to address the content. Then, we need to identify further if those resources are effective to improve the delivery of the sleep content.

4.3 | Future research

While our study suggests ways to assess the variations in the care provided at home for mothers and children, future research is needed to extend our understanding of the impact of these variations in care on critical outcomes of care delivery in the setting of home visiting services. Additionally, more knowledge on provider characteristics related to variations, and families' and practitioners' perceptions of these variations is required to explore how and why these variations are made.

4.4 | Limitations

Firstly, this study was conducted within the right@home program in two states in Australia. Thus, these findings are considered within the context of the limitations of the study results for the home visiting program. Furthermore, the participant mothers were only those who indicated an initial interest in participating in the study. Therefore, it is possible that some mothers, for example, those in families with significant levels of adversity, may have chosen not to participate in the study. In addition, possible risk factors may vary by geographical, socio-economic, and cultural circumstances. Thus, when the program is scaled up to other geographical locations, it is important to assess alongside local nurses and social workers whether there are particular risks within the local area, and to ensure that the local adaptation of the program includes those modules that are designed to prevent the identified risk profile.

Secondly, the measure of provision of visit content was assessed by using the records made by home visiting nurses and not direct, objectively observed practice during home visits. Therefore, data on the visit content may be biased by the nurse-reported nature of the record. Future research is needed to validate the tools, such as random objective observations of home visits by supervisors and family feedback on the provision of contents during home visits.

5 | CONCLUSION

Our results confirmed that visit content had high compliance with the expected schedule, and also, the additional visit content was carefully chosen by home visiting nurses based on family risks and needs. The systematic and continuous quality monitoring and feedback system of the right@home program may have contributed to ensuring this high compliance. The professional capacity development of nurses in how to respond to domestic violence and drugs and alcohol issues needs to be further supported to provide better quality of care for families experiencing adversity.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Data cannot be shared publicly because of ethics and program licencing requirements to maintain the confidentiality of participants and participating health services. Data are available from the Murdoch Children's Research Institute Institutional Ethics Committee (contact via Dr. Susan Perlen at susan.perlen@mcri.edu.au) for researchers who meet the criteria for access to confidential data.

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REFERENCES

Aarons, G. A., Green, A. E., Palinkas, L. A., Self-Brown, S., Whitaker, D. J., Lutzker, J. R., Silovsky, J. F., Hecht, D. B., & Chaffin, M. J. (2012). Dynamic adaptation process to implement an evidence-based child maltreatment intervention. *Implementation Science*, *7*(1), 1–9. https://doi.org/10.1186/1748-5908-7-32

Alhusen, J. L., Ray, E., Sharps, P., & Bullock, L. (2015). Intimate partner violence during pregnancy: Maternal and neonatal outcomes. *Journal of Women's Health*, *24*(1), 100–106. https://doi.org/10.1089/jwh.2014.4872

Australian Commission on Safety and Quality in Health Care. (2015). Australian Atlas of Healthcare Variation 2015.

Avellar, S. A., & Supplee, L. H. (2013). Effectiveness of home visiting in improving child health and reducing child maltreatment. *Pediatrics*, *132*, S90–S99. https://doi.org/10.1542/peds.2013-1021G

Bertakis, K. D., & Azari, R. (2011). Patient-centered care is associated with decreased health care utilization. *The Journal of the American Board of Family Medicine*, *24*(3), 229–239. https://doi.org/10.3122/jabfm.2011.03.100170

Boughorbel, S., Jarray, F., & El-Anbari, M. (2017). Optimal classifier for imbalanced data using matthews correlation coefficient metric. *Plos One*, *12*(6), e0177678. https://doi.org/10.1371/journal.pone.0177678

Britto, P. R., Lye, S. J., Proulx, K., Yousafzai, A. K., Matthews, S. G., Vaivada, T., Perez-Escamilla, R., Rao, N., Ip, P., Fernald, L. C. H., MacMillan, H., Hanson, M., Wachs, T. D., Yao, H., Yoshikawa, H., Cerezo, A., Leckman, J. F., & Bhutta, Z. A. (2017). Nurturing care: Promoting early childhood development. *The Lancet*, *389*(10064), 91–102. https://doi.org/10.1016/s0140-6736(16)31390-3

Brown, D., McWilliam, C., & Ward-Griffin, C. (2006). Client-centred empowering partnering in nursing. *Journal of Advanced Nursing*, *53*(2), 160–168. https://doi.org/10.1111/j.1365-2648.2006.03711.x

Chang, J. C., Dado, D., Frankel, R. M., Rodriguez, K. L., Zickmund, S., Ling, B. S., & Arnold, R. M. (2008). When pregnant patients disclose substance use: Missed opportunities for behavioral change counseling. *Patient Education and Counseling*, *72*(3), 394–401. https://doi.org/10.1016/j.pec.2008.06.001

Chicco, D., & Jurman, G. (2020). The advantages of the Matthews correlation coefficient (MCC) over F1 score and accuracy in binary classification evaluation. *Bmc Genomics [Electronic Resource]*, *21*(1), 6. https://doi.org/10.1186/s12864-019-6413-7

Chicco, D., Tötsch, N., & Jurman, G. (2021). The Matthews correlation coefficient (MCC) is more reliable than balanced accuracy, bookmaker informedness, and markedness in two-class confusion matrix evaluation. *BioData Mining*, *14*(1), 1–22. https://doi.org/10.1186/s13040-021-00244-z

Choi, B. K., Kim, M. S., & Kim, S. H. (2020). Risk prediction models for the development of oral-mucosal pressure injuries in intubated patients in intensive care units: A prospective observational study. *Journal of Tissue Viability*, *29*(4), 252–257. https://doi.org/10.1016/j.jtv.2020.06.002

Cusick, S & Georgieff, M. K. (2016). The Role of Nutrition in Brain Development: The Golden Opportunity of the "First 1000 Days" The Journal of Pediatrics, 175, 16–21. https://doi.org/10.1016/j.jpeds.2016.05.013

Daelmans, B., Darmstadt, G. L., Lombardi, J., Black, M. M., Britto, P. R., Lye, S., Dua, T., Bhutta, Z. A., & Richter, L. M. (2017). Early childhood development: The foundation of sustainable development. *The Lancet*, *389*(10064), 9–11. https://doi.org/10.1016/s0140-6736(16)31659-2

Ekman, I., Wolf, A., Olsson, L.-E., Taft, C., Dudas, K., Schaufelberger, M., & Swedberg, K. (2012). Effects of person-centred care in patients with chronic heart failure: The PCC-HF study. *European Heart Journal*, *33*(9), 1112–1119. https://doi.org/10.1093/eurheartj/ehr306

Filene, J. H., Kaminski, J. W., Valle, L. A., & Cachat, P. (2013). Components associated with home visiting program outcomes: A meta-analysis. *Pediatrics*, *132*(2), S100-S109. https://doi.org/10.1542/peds.2013-1021H

Goldfeld, S., Price, A., Bryson, H., Bruce, T., Mensah, F., Orsini, F., Gold, L., Hiscock, H., Smith, C., Bishop, L., Jackson, D., & Kemp, L. (2017). 'right@home': A randomised controlled trial of sustained nurse home visiting from pregnancy to child age 2 years, versus usual care, to improve parent care, parent responsivity and the home learning environment at 2 years. *BMJ Open*, *7*(3), e013307. https://doi.org/10.1136/bmjopen-2016-013307

Goldfeld, S., Price, A., & Kemp, L. (2018). Designing, testing, and implementing a sustainable nurse home visiting program: Right@ home. *Annals of the New York Academy of Sciences*, *1419*(1), 141–159. https://doi.org/10.1111/nyas.13688

Goldfeld, S., Price, A., Smith, C., Bruce, T., Bryson, H., Mensah, F., Orsini, F., Gold, L., Hiscock, H., & Bishop, L. (2019). Nurse home visiting for families experiencing adversity: A randomized trial. *Pediatrics*, *143*(1), e20181206. https://doi.org/10.1542/peds.2018-1206

Goodman, D. J., & Wolff, K. B. (2013). Screening for substance abuse in women's health: A public health imperative. *Journal of Midwifery & Women's Health*, *58*(3), 278–287.

Hanks, C. A., & Smith, J. (1999). Implementing nurse home visitation programs. *Public Health Nursing*, *16*(4), 235–245. https://doi.org/10.1046/j.1525-1446.1999.00235.x

Haroz, E. E., Ingalls, A., Kee, C., Goklish, N., Neault, N., Begay, M., & Barlow, A. (2019). Informing precision home visiting: Identifying meaningful subgroups of families who benefit most from family spirit. *Prevention Science*, *20*(8), 1244–1254. https://doi.org/10.1007/s11121-019-01039-9

Hebbeler, K. M., & Gerlach-Downie, S. G. (2002). Inside the black box of home visiting: A qualitative analysis of why intended outcomes were not achieved. *Early Childhood Research Quarterly*, *17*(1), 28–51. https://doi.org/10.1016/S0885-2006(02)00128-X

Herzig, K., Huynh, D., Gilbert, P., Danley, D. W., Jackson, R., & Gerbert, B. (2006). Comparing prenatal providers' approaches to four different risks: Alcohol, tobacco, drugs, and domestic violence. *Women & Health*, *43*(3), 83–101.

Home Visiting Applied Research Collaborative. *Precision home visiting*. Retrieved 2017, November 7 from https://www.hvresearch.org/precision-home-visiting/

Jo Delaney, L. (2018). Patient-centred care as an approach to improving health care in Australia. *Collegian*, *25*(1), 119–123. https://doi.org/10.1016/j.colegn.2017.02.005

Kalisch, B. J., Tschannen, D., Lee, H., & Friese, C. R. (2011). Hospital variation in missed nursing care. *American Journal of Medical Quality*, *26*(4), 291–299. https://doi.org/10.1177/1062860610395929

Kemp, L. (2016). Adaptation and fidelity: A recipe analogy for achieving both in population scale implementation. *Prevention Science*, *17*(4), 429–438. https://doi.org/10.1007/s11121-016-0642-7

Kemp, L. (2020). Health programme decision making and implementation science. Community Public Health in Policy and Practice E-Book: A Sourcebook. C. Whittaker. GB, Elsevier. 199.

Kemp, L., Bruce, T., Elcombe, E. L., Anderson, T., Vimpani, G., Price, A., Smith, C., & Goldfeld, S. (2019). Quality of delivery of "right@home": Implementation evaluation of an Australian sustained nurse home visiting intervention to improve parenting and the home learning environment. *Plos One*, *14*(5), e0215371–e0215371. https://doi.org/10.1371/journal.pone.0215371

Kemp, L., Cowley, S., & Byrne, F. (2017). Maternal early childhood sustained home-visiting (MECSH): A UK update. *Journal of Health Visiting*, *5*(8), 392–397. https://doi.org/10.12968/johv.2017.5.8.392

Kemp, L., Grace, R., Comino, E., Jackson Pulver, L., McMahon, C., Harris, E., Harris, M., George, A., & Mack, H. A. (2018). The effectiveness of a sustained nurse home visiting intervention for Aboriginal infants compared with non-Aboriginal infants and with Aboriginal infants receiving usual child health care: A quasi-experimental trial - the Bulundidi Gudaga study. *BMC Health Services Research*, *18*(1), 599. https://doi.org/10.1186/s12913-018-3394-1

Kemp, L., Harris, E., McMahon, C., Matthey, S., Vimpani, G., Anderson, T., Schmied, V., Aslam, H., & Zapart, S. (2011). Child and family outcomes of a long-term nurse home visitation programme: A randomised controlled trial. *Archives of Disease in Childhood*, *96*(6), 533–540. https://doi.org/10.1136/adc.2010.196279

Kraemer, K., Green, T. J., Karakochuk, C. D., & Whitfield, K. C. (2018). *The biology of the first 1000 days*. London: Taylor & Francis.

Kreuter, M. W., & Skinner, C. S. (2000). Tailoring: What's in a name? *Health Education Research*, *15*(1), 1–4. https://doi.org/10.1093/her/15.1.1

Lydahl, D. (2021). Standard tools for non-standard care: The values and scripts of a person-centred assessment protocol. *Health*, 1363459319851541. *25*(1), 103–120. https://doi.org/10.1177/1363459319851541

McNaughton, D. (1994). Measuring parent satisfaction with early childhood intervention programs. *Topics in Early Childhood Special Education*, *14*(1), 26–48. https://doi.org/10.1177/027112149401400106

McNaughton, D. B. (2004). Nurse home visits to maternal–child clients: A review of intervention research. *Public Health Nursing*, *21*(3), 207–219. https://doi.org/10.1111/j.0737-1209.2004.021303.x

Molloy, C., Beatson, R., Harrop, C., Perini, N., & Goldfeld, S. (2021). Systematic review: Effects of sustained nurse home visiting programs for disadvantaged mothers and children. *Journal of Advanced Nursing*, *77*(1), 147–161. https://doi.org/10.1111/jan.14576

Nygren, P., Green, B., Winters, K., & Rockhill, A. (2018). What's happening during home visits? Exploring the relationship of home visiting content and dosage to parenting outcomes. *Maternal and Child Health Journal*, *22*(1), 52–61. https://doi.org/10.1007/s10995-018-2547-5

O'Doherty, L., Hegarty, K., Ramsay, J., Davidson, L. L., Feder, G., & Taft, A. (2015). Screening women for intimate partner violence in healthcare settings. *Cochrane Database of Systematic Reviews*, *2015*(7), CD007007.

Pasick, R. J. (1997). Socio-economic and cultural factors in the development and use of theory. *Health Behavior and Health Education: Theory, Research, and Practice*, 425–440. San Francisco: Jossey-Bass.

Peacock, S., Konrad, S., Watson, E., Nickel, D., & Muhajarine, N. (2013). Effectiveness of home visiting programs on child outcomes: A systematic review. *Bmc Public Health [Electronic Resource]*, *13*(1), 17. https://doi.org/10.1186/1471-2458-13-17

Price, A., Bryson, H., Mensah, F., Kemp, L., Smith, C., Orsini, F., Hiscock, H., Gold, L., Smith, A., Bishop, L., & Goldfeld, S. (2019). A brief survey to identify pregnant women experiencing increased psychosocial and socio-economic risk. *Women and Birth*, *32*, e351–e358. https://doi.org/10.1016/j.wombi.2018.08.162

Price, A. M., Bryson, H. E., Mensah, F., Kemp, L., Bishop, L., & Goldfeld, S. (2017). The feasibility and acceptability of a population-level antenatal risk factor survey: Cross-sectional pilot study. *Journal of Paediatrics and Child Health*, *53*(6), 572–577. https://doi.org/10.1111/jpc.13510

Roggman, L. A., Boyce, L. K., Cook, G. A., & Jump, V. K. (2001). Inside home visits: A collaborative look at process and quality. *Early Childhood Research Quarterly*, *16*(1), 53–71. https://doi.org/10.1016/S0885-2006(01)00085-0

Roggman, L. A., Cook, G. A., Innocenti, M. S., Jump Norman, V., Boyce, L. K., Christiansen, K., & Peterson, C. A. (2016). Home visit quality variations in two early head start programs in relation to parenting and child vocabulary outcomes. *Infant Mental Health Journal*, *37*(3), 193–207. https://doi.org/10.1002/imhj.21565

Seib, C. A., Daglish, M., Heath, R., Booker, C., Reid, C., & Fraser, J. (2012). Screening for alcohol and drug use in pregnancy. *Midwifery*, *28*(6), 760–764. https://doi.org/10.1016/j.midw.2011.08.003

Suhonen, R., Berg, A., Idvall, E., Kalafati, M., Katajisto, J., Land, L., Lemonidou, C., Välimäki, M., & Leino-Kilpi, H. (2008). Individualised care from the orthopaedic and trauma patients' perspective: An international comparative survey. *International Journal of Nursing Studies*, *45*(11), 1586–1597. https://doi.org/10.1016/j.ijnurstu.2007.12.005

Suhonen, R., Papastavrou, E., Efstathiou, G., Tsangari, H., Jarosova, D., Leino-Kilpi, H., Patiraki, E., Karlou, C., Balogh, Z., & Merkouris, A. (2012). Patient satisfaction as an outcome of individualised nursing care. *Scandinavian Journal of Caring Sciences*, *26*(2), 372–380. https://doi.org/10.1111/j.1471-6712.2011.00943.x

Suhonen, R., Välimäki, M., Katajisto, J., & Leino-Kilpi, H. (2007). Provision of individualised care improves hospital patient outcomes: An explanatory model using LISREL. *International Journal of Nursing Studies*, *44*(2), 197–207. https://doi.org/10.1016/j.ijnurstu.2005.11.030

Suhonen, R., Välimäki, M., & Leino-Kilpi, H. (2002). "Individualised care" from patients', nurses' and relatives' perspective—a review of the literature. *International Journal of Nursing Studies*, *39*(6), 645–654. https://doi.org/10.1016/S0020-7489(02)00004-4

Suhonen, R., Välimäki, M., & Leino-Kilpi, H. (2005). Individualized care, quality of life and satisfaction with nursing care. *Journal of Advanced Nursing*, *50*(3), 283–292. https://doi.org/10.1111/j.1365-2648.2005.03391.x

Supplee, L. H., & Duggan, A. (2019). Innovative research methods to advance precision in home visiting for more efficient and effective programs. *Child Development Perspectives*, *13*(3), 173–179. https://doi.org/10.1111/cdep.12334

Vihinen, M. (2012). How to evaluate performance of prediction methods? Measures and their interpretation in variation effect analysis. *Bmc Genomics [Electronic Resource]*, *13*(4), S2. https://doi.org/10.1186/1471-2164-13-S4-S2

World Health Organization. (2007). *People-centred health care. A policy framework*.

Wright, J., & McCormack, B. (2001). Practice development: Individualised care. *Nursing Standard*, *15*(36), 37–42. https://doi.org/10.7748/ns2001.05.15.36.37.c3032

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