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ABSTRACT

Background: Women from a refugee background who resettle in high-income countries experience poorer perinatal outcomes in comparison to women from host countries. There is a paucity of research on how best to improve these outcomes.
Aim: To report on the effectiveness of an Australian Refugee Midwifery Group Practice service on perinatal outcomes.
Methods: We used inverse probability of treatment weighting to balance confounders and calculate treatment effect and compare maternal and neonatal outcomes for women from a refugee background who received Refugee Midwifery Group Practice care (n = 625), to those receiving standard care (n = 634) at a large tertiary hospital (1 January 2016–31 December 2019). Prespecified primary outcomes included: proportion of women attending ≥ 5 antenatal visits, preterm birth (<37 weeks), spontaneous onset of labour, epidural analgesia in the first stage of labour, normal birth (term, spontaneous onset, vertex, spontaneous vaginal birth, no epidural, no episiotomy), and exclusively breast-feeding at discharge.
Findings: Women who received Refugee Midwifery Group Practice care were more likely to have spontaneous onset of labour (adjusted odds ratio 2·20, 95% CI 1·71–2·82; p < 0·0001), normal birth (1·55, 1·23–1·95; p < 0·0001), and less likely to use epidural analgesia (0·67, 0·50–0·89; p = 0·0067) and have a preterm baby (0·60, 0·36–0·99; p = 0·047). There was no difference between groups in women attending ≥ 5 antenatal visits and exclusive breastfeeding at discharge from hospital.
Discussion: A Refugee Midwifery Group Practice is feasible and clinically effective.
Conclusion: Similar services could potentially improve outcomes for women from a refugee background who resettle in high-income countries.

Statement of significance

Problem or issue

Women from a refugee background who resettle in high-income countries have inequitable perinatal outcomes compared to women from host countries.

What is already known

Women from a refugee background have poorer outcomes due to complex unmet medical, psychosocial, and cultural needs, alongside infrequent or no use of Interpreter Services. No research has explored the feasibility and effectiveness of a caseload midwifery group practice service dedicated for women from a refugee background.

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What this paper adds

Evidence that a caseload midwifery group practice, established following consultation with stakeholders, and adapted specifically for women from a refugee background, improved outcomes for women and babies.

Introduction

Humanitarian emergencies have doubled over the last decade and the number of refugees increased from 10.5 million in 2012–21.3 million in 2021 with children and women disproportionately represented. Of the 21.3 million total refugees worldwide, about 41% are children and 48% are women [1]. This means that the number of women from a refugee background seeking maternity care in high-income countries is likely to increase too. Women from a refugee background who resettle in high-income countries have poorer perinatal outcomes when compared to women in host countries [2]. Refugee women are reported to have higher rates of pre-eclampsia, postpartum haemorrhage, gestational diabetes, postnatal depression [2], preterm birth (< 37 weeks), low birthweight (<2500 g) babies, caesarean sections, and neonatal nursery admissions [3–5]. Contributing factors to these inequities include the inability of health services to adequately address women's complex social, medical, psychological needs, alongside communication barriers, racism and social oppression [5]. Other factors impacting pregnancy can be recent experiences of overcrowding, poor nutrition, inadequate sanitation, and low quality medical and reproductive health care in their birth country and/or, refugee camps [6,7]. Witnessing or experiencing gross atrocities, assault, sexual violence, killings, and social upheaval all contribute to women's increased risk of psychological conditions [8]. Poorly managed psychological conditions like depression, anxiety, and post-traumatic stress disorder may result in reduced service use and consequently poorer perinatal outcomes [8,9].

Women from a refugee background often have poorer socioeconomic status due to education and employment inequities [10]. This increases reliance on public transport, impacting access and attendance for antenatal care [6,11,12]. Also, women are often not proficient in the language/s spoken in the new country and might have infrequent or no access to interpreter services. Together, these barriers contribute to poor health literacy [13], which reduces personal agency, leading to absent or misinformed consent for childbirth interventions [3,13,14]. Furthermore, a lack of culturally appropriate care increases women's dissatisfaction with services and experiences of racism are commonly reported [2,5,11,15].

Women from a refugee background often understand childbirth as a culturally normal physiological process compared to the Western medicalisation of childbirth in high-income countries [11,16]. Therefore, conflicting value systems, and/or a preference for physiological birth may cause some women to decline medically indicated procedures like caesarean sections and induction of labour [11,15], and in some instances, this could lead to poor maternal and neonatal outcomes.

Maternity care policy makers in high income countries are trying to address refugee women's perinatal outcomes. For example, Australian Pregnancy Care Guidelines recognise that women from a refugee background are vulnerable populations by summarising their specific pregnancy care needs [17]. However, how best to address the perinatal outcomes is unknown. In one Australian jurisdiction [2], results from two population-based surveys conducted in 2000 and 2008, comparing the impact of changing policy and maternity care experiences for women of non-English speaking background found that approximately 50% of women were dissatisfied with care during pregnancy, birth, and the postnatal period, with less than 5% improvement in satisfaction between the surveys. Therefore, the authors concluded that maternity policy reforms had not translated to improved outcomes for women of non-English speaking background. Australian evidence [7,11,21], alongside growing rates of global refugee displacement, demonstrate an urgent need for maternity service innovation and evaluation; with continuity of midwifery carer models offering a promising approach with strong evidence that it improves maternal and neonatal outcomes for women regardless of pregnancy risk.[18,19]Despite reported benefits of continuity of midwifery care for all-risk women, research examining continuity of midwifery care for women from a refugee background remains scarce. Systematic scoping reviews also highlight a paucity of research examining interventions aiming to provide culturally responsive maternity care for refugee women [4,6,7].

In our Australian urban research setting, a 2010 evaluation of a refugee antenatal clinic was conducted by (Author #3 and #5) [11]. The refugee antenatal clinic service, established in 2008, operated one day a week and provided women with care from a known midwife and obstetrician during pregnancy but not for labour, birth or postnatal care. Despite its popularity with women, some reported feeling disappointed and worried that there were unable to be cared for by their known midwife during and after birth. The evaluation reported women found the hospital location difficult to access, and women often failed to comprehend the need for (urgent) intervention in birth, with a widespread perception that caesarean section was undertaken too frequently and without adequate explanation. The hospital already had significant interest and appetite in maternity service redesign being one site in a large, randomised controlled trial designed to test caseload Midwifery Group Practice for women with identified risk factors in pregnancy [19]. The hospital had also successfully established Midwifery Group Practice services for vulnerable populations, including young women below the age of 21 [20], and First Nations women [21]. The refugee antenatal clinic evaluation recommended the establishment of all-risk community-based Refugee Midwifery Group Practice, though noted stakeholder concerns about the feasibility of doing this with women who needed interpreter services. This paper reports on the effectiveness of this service, established in 2016.

Methods

Study design and setting

This retrospective cohort study examined outcomes for women booked to birth at a tertiary maternity hospital in Brisbane, Australia. The hospital provides care to over 5000 publicly funded women each year, with about 1000 of these receiving caseload midwifery care. The Refugee Midwifery Group Practice service was established to provide care for women from a refugee background, regardless of education level, socioeconomic status, or age. Women who self-identify as having a refugee background self-referred or were referred to the service by general practitioners or hospital midwives. The service provides group antenatal care according to language groups. Women who receive Refugee Midwifery Group Practice care are allocated a primary midwife who receives back up by one other team member within the Refugee Midwifery Group Practice who she has likely met at the group sessions. Approximately 450 women from a refugee background give birth at the hospital each year and about 160 access the Refugee Midwifery Group Practice according to service availability. The main components of the Refugee Midwifery Group Practice service, as compared to standard maternity care, are listed in Table 1.

Participants

Participants were included in the study if they were identified as from a refugee background, received at least two antenatal visits in any model of antenatal care and gave birth to a singleton baby at the hospital from 1 January 2016–31 December 2019. Participants were excluded from analysis if they were transferred in from other hospitals for high-level tertiary care, had pre-existing diabetes and received care through

Table 1
Key components of RMGP and standard care services.

Refugee Midwifery Group Practice (Intervention cohort)	Standard Maternity Care (Reference cohort)
Antenatal care	
Antenatal care is received from a community-based Midwifery Group Practice service. Midwives are employed on an annualised salary and work in a small group (n = 4 Full Time Employment). Each midwife is allocated 4 women per month (adjusted if not working full time). If the woman's primary midwife is on annual leave, sick leave, has more than one woman in labour, or is scheduled off call, the backup midwife, who the woman will know from group sessions, will be available. Women receive continuity of antenatal care and have 24/7 phone access to a known midwife. Antenatal care and education are provided in language groups i.e., Somali, Sudanese, Arabic, Rohingya/Burmese/Tamil/ Dari, Ethiopian/Eritrean, Swahili/ Kirundi, and English every two weeks.	Antenatal care may be received from a General Practitioner, hospital-based midwives or doctors, or the refugee antenatal clinic. Staff are paid based on shifts worked and rotate throughout the service on rosters except in the refugee antenatal clinic where there is a designated midwife. There is no formal continuity of antenatal care except in the refugee antenatal clinic. Women receive care from a rostered care provider and have no 24/7 phone access to a known care provider. Women receive one-one antenatal care with interpreters as required and education according to primary carer or hospital guidelines.
Labour and birth care	
Birth care is provided in a birthing room at the hospital (no home or birth centre service). Women call their midwife when in early labour or during an emergency then seek own transport to the hospital i.e., ambulance, private. Birthing support is provided by a known RMGP midwife.	Birth care is provided in a birthing room at the hospital (no home or birth centre service). Women call the hospital birthing suite in early labour, or during an emergency then seek transport to the hospital i.e., ambulance, private. Birthing support is provided from a large roster of midwives and likely to be by a midwife the woman has never met.
Postnatal care	
Postnatal care is provided in the woman's home, by her primary midwife, or backup if the primary midwife is unavailable, for four-six weeks after birth as required.	Postnatal visit/s or phone call from a rostered community midwife available for women who discharge before 48 h for vaginal birth and 72 h for caesarean section; usually for < 2-weeks.
Interpreting services	
Dedicated onsite interpreters work with midwives and women during group care and education sessions. Face-face or phone interpreters are accessed via the National Interpreting Services as needed. Three-way conversations between the woman, her midwife and an interpreter are available 24/7 during the antenatal, intrapartum, and postnatal period. Often there is continuity of interpreters.	Face-face or phone interpreters are accessed via the National Interpreting Services as needed.
Cultural safety framework	
There are no specific formal cultural training sessions. The Refugee Midwifery Group Practice staff's motto is openness to cross cultural learning. Midwives seek self-cultural knowledge, education, and cultural education from the women and share the knowledge with each other. One of the team (author #3) has been working in the Refugee Midwifery Group Practice since inception and prior to that, worked in the refugee antenatal clinic. She provides support and mentoring to the other midwives. The hospital offers general cultural education and training on how to work with interpreters, but the training is not mandatory. Different organisations in Brisbane sometimes run cultural education sessions but the training is not mandatory.	There are no specific formal cultural training sessions specific to women from a refugee background. Frontline staff may seek out their own cultural training or clinical supervision. There are no cultural mentors for staff. The hospital offers general cultural education and training on how to work with interpreters. Different organisations in Brisbane sometimes run culturally appropriate education sessions but the training is not mandatory.
Holistic wrap around services	
The group education aims to facilitate peer support for women from similar language groups with the aid of an interpreter. There is a social worker on site during antenatal group sessions and she is the main point of referral for any social/emotional supports, referring as required. Other support services (e.g., psychologist) are accessed via the hospital referral system. A physiotherapist from the hospital visits the community venue every 3 months.	Women may be referred to allied health services (e.g., psychologist, social worker, diabetic educator) via the hospital or their General Practitioner. A social worker services the refugee antenatal clinic and is the main point of referral for any social/emotional supports, referring as required.
Coordinated care integrating primary health network with tertiary services	
A Refugee Midwifery Group Practice Manager oversees the resource requirements of the services including eight other Midwifery Group Practice services. There is shared accountability and responsibility among the Refugee Midwifery Group Practice team. The Refugee Midwifery Group Practice team meets weekly to discuss coordination and day to day successes and challenges experienced by each midwife. Troubleshooting is often managed between the Refugee Midwifery Group Practice midwives, the manager, and the hospital. Referrals to community support agencies as required (e.g., family violence support, mental health support, English language support, settlement services, housing support services and child health).	Electronic or postal referrals and discharge summaries are the main source of communication between maternity carers and other support services (hospital, General Practitioners, and Child Health. Referrals to community support agencies as required.

a specialised diabetes in pregnancy clinic, or were cared for by the Maternal Foetal Medicine service. We also excluded women who spoke Farsi or were born in Syria, Yemen, Iran, and Iraq because of their usual location of residence (outside of the geographical intake for Refugee Midwifery Group Practice) and their cultural preference for one-one care (as opposed to group care) and their high rates of requesting medicalised treatments in pregnancy and birth.

Ethical approval

Ethical approval was granted by the hospital's Human Research Ethics Committee and Governance (HREC/MML/46904) and Charles Darwin University Human Research Ethics Committee (H21035).

Procedures

Medical records of all women from a refugee background who gave birth at the hospital between 1 January 2016 and 31 December 2019 were extracted from the hospital's routinely collected obstetric database MatriX and de-identified for analysis. A consent waiver was granted to use routinely collected health data. Maternal and neonatal outcomes were compared between the two groups.

Outcomes

All primary and secondary maternal and neonatal outcomes were defined a-priori. Primary maternal outcomes: $\geq$ 5 antenatal visits, spontaneous onset of labour, epidural analgesia in the first stage of labour, and normal vaginal birth (term, spontaneous onset, vertex, spontaneous vaginal birth, no epidural, no episiotomy). Primary neonatal outcomes: preterm birth (at least 20-weeks' gestation or 400 g birthweight [Australian definition for viability] and <37 completed weeks) and exclusive breastfeeding at discharge from hospital (feeding directly

at the breast, and/or expressed breast milk). Secondary antenatal outcomes: gestation at first antenatal visit, anaemia in pregnancy (haemoglobin level<110 mg/l), and referral to social worker or psychologist. Secondary intrapartum outcomes: spontaneous vaginal birth, vaginal birth after caesarian section, episiotomy, physiological management of the third stage of labour, third-or-fourth degree perineal trauma, and postpartum heamorrhage (blood loss≥500 ml). Secondary neonatal outcomes: skin to skin contact > 60 min, healthy baby (live-born, singleton, term, 2500–4499 g, and, Apgar ≥7 at 5 min), born before arrival at a hospital, low birthweight (<2500 g), neonatal nursery admission, and stillbirth.

Statistical analysis

To explore differences between the two cohorts, we conducted two sample student t-test for normally distributed baseline continuous variables, Wilcoxon rank-sum for non-normally distributed continuous variables and Pearson's chi-squared test for categorical variables. Inverse probability of treatment weighting was used to control for confounders, by constructing a weighted cohort of women who had similar measured characteristics with the only difference being the model of care that they received. A propensity score of each participant is the conditional probability of her receiving Refugee Midwifery Group Practice care after controlling for baseline confounders [22]. We adjusted all baseline variables including maternal age, body mass index, region of birth, female genital cutting history, socioeconomic status (Socio Economic Index for Areas quintile), marriage status, obstetric history (parity, smoking status at booking, previous caesarean section, previous stillbirth, previous preterm birth), and, maternal pre-existing co-morbidities (autoimmune disease, thyroid disease, liver disease, haematological disease, heart disease, renal disease, mental health condition, and hypertension). Standardised differences (see Supplementary Table 1) and summary measures Rubin's B and Rubin's R were calculated to assess the balance of measured baseline variables [22]. We calculated adjusted odds ratios, with significance level (α) of 5% and 95% confidence interval [23]. All analysis was performed in Stata 16·0.

Results

A total of 1519 babies were born from women with a refugee background at the hospital between 1 January 2016 and 31 December 2019. A total of 251 records were excluded: 221 from Standard Care and 30 from Refugee Midwifery Group Practice (see Fig. 1 for cohort participants and exclusions). After exclusions, 634 women received standard care and 625 received Refugee Midwifery Group Practice care.

Women were initially grouped according to the World Health Organization regional classification, then separated and reported within the five countries with the highest population individually (Table 2). There was a statistically significant difference in the region of birth ($p < 0.0001$) with most women born in the African region. The countries with the highest population were Somalia, Sudan, Afghanistan, Ethiopia, and Eritrea. From the above list, the percentage of women from all countries was slightly higher in the Refugee Midwifery Group Practice group except for Afghanistan. There were more women from East Asia, Pacific, and European regions in standard care. See Supplementary Table 2 for a list of participants by country of birth and model of care.

There were six statistically significant differences in maternal and obstetric characteristics between the two groups (Table 2). Compared to standard care, women in the Refugee Midwifery Group Practice were slightly younger (mean age 29 years vs. 31 years), more likely to be socioeconomically disadvantaged ($p < 0·0001$), disclose female genital cutting and less likely to have pre-existing hypertension or mental illness.

The analysis from the unweighted cohort and inverse probability weighted cohort (after balancing for confounders), showed statistically

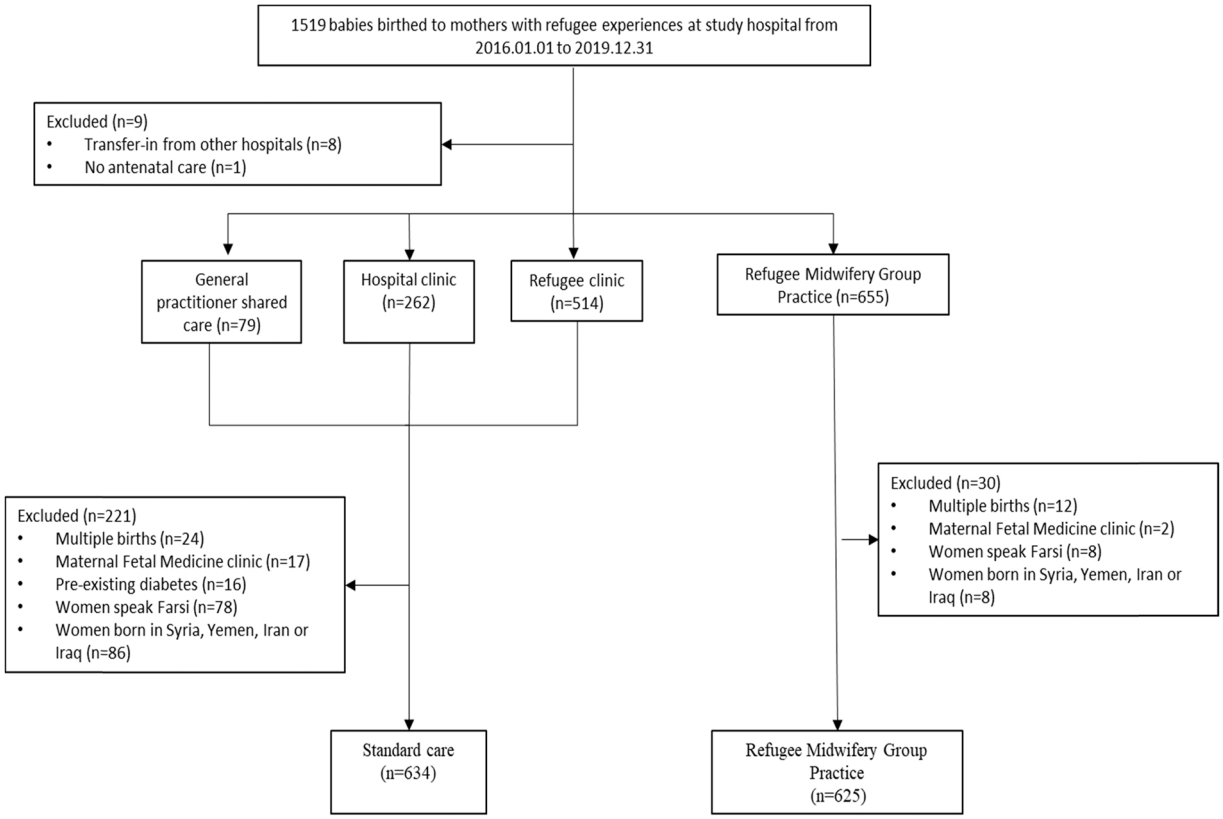

Fig. 1. Cohort participants.

Table 2
Demographic and clinical characteristics of women.

	Standard care	Refugee Midwifery Group Practice	p-value
N	634	625	
Maternal age, mean (SD)	**30·7 (6·1) (n = 634)**	**28·9 (5·7) (n = 625)**	**< 0·0001**
Body mass index Category			0·45
< 18.5	36 (5·7%)	41 (6·6%)	
18.5–24.9	303 (47·8%)	276 (44·2%)	
25.0–29.99	180 (28·4%)	199 (31·8%)	
30 or more	115 (18·1%)	109 (17·4%)	
Region of birth			**< 0·0001**
Africa	165 (26·0%)	173 (27·7%)	
Americas	5 (0·8%)	0 (0·0%)	
East Asia and Pacific	42 (6·6%)	6 (1·0%)	
Europe	24 (3·8%)	9 (1·4%)	
Mediterranean	15 (2·4%)	2 (0·3%)	
South Asia	39 (6·2%)	38 (6·1%)	
Sudan	74 (11·7%)	84 (13·4%)	
Somalia	134 (21·1%)	191 (30·6%)	
Eritrea	29 (4·6%)	51 (8·2%)	
Afghanistan	71 (11·2%)	27 (4·3%)	
Ethiopia	36 (5·7%)	44 (7·0%)	
Socioeconomic status (Socio Economic Index for Areas quintile)			**< 0·0001**
Quintile 1 (most disadvantaged)	219 (34·5%)	353 (56·5%)	
Quintile 2	74 (11·7%)	83 (13·3%)	
Quintile 3	72 (11·4%)	60 (9·6%)	
Quintile 4	151 (23·8%)	76 (12·2%)	
Quintile 5 (most advantaged)	118 (18·6%)	53 (8·5%)	
Marriage status			0·12
Married or de facto	478 (75·4%)	494 (79·0%)	
Not married or de facto	156 (24·6%)	131 (21·0%)	
Parity			**0·010**
Primiparous	162 (25·6%)	116 (18·6%)	
1–3 births	321 (50·6%)	354 (56·6%)	
4–12 births	151 (23·8%)	155 (24·8%)	
Smoking status at booking			0·98
Non-smoker	628 (99·1%)	619 (99·0%)	
Smoker	6 (0·9%)	6 (1·0%)	
Previous caesarean section	126 (19·9%)	141 (22·6%)	0·24
Previous stillbirth	26 (4·1%)	18 (2·9%)	0·24
Previous preterm	59 (9·3%)	45 (7·2%)	0·17
Pre-existing Autoimmune disease	4 (0·6%)	5 (0·8%)	0·72
Pre-existing Haematological disease (excluding anaemia)	29 (4·6%)	39 (6·2%)	0·19
Pre-existing Heart disease	21 (3·3%)	22 (3·5%)	0·84
Pre-existing Hypertension (excluding prior gestational hypertension)	**7 (1·1%)**	**1 (0·2%)**	**0·035**
Pre-existing Liver disease (Hepatitis B, C)	19 (3·0%)	26 (4·2%)	0·27
Pre-existing Kidney renal disease	23 (3·6%)	20 (3·2%)	0·68
Pre-existing Thyroid disease	30 (4·7%)	20 (3·2%)	0·16
Pre-existing - Mental health illness	**44 (6·9%)**	**26 (4·2%)**	**0·031**
Previous Breast surgery	16 (2·5%)	8 (1·3%)	0·11
Female genital cutting	**95 (15·0%)**	**163 (26·1%)**	**< 0·0001**

significant difference on 4/6 of the primary outcomes (Table 3). Women who received Refugee Midwifery Group Practice care were more likely to have spontaneous onset of labour (adjusted odds ratio 2·20, 95% confidence interval 1·71–2·82; p < 0·0001), normal vaginal births (1·55, 1·23–1·95; p < 0·0001), and less likely to use epidural analgesia in the first stage of labour (0·67, 0·50–0·89; p = 0·0067) or have a preterm baby (0·60, 0·36–0·99; p = 0·047). There was no statistically significant difference between groups in women attending ≥ 5 antenatal visits, with both groups being above 90%, or exclusive breastfeeding at discharge from hospital.

There were significant differences in six secondary outcomes from the analysis of both the unweighted cohorts and the inverse probability weighted cohort (Table 4). Women who received Refugee Midwifery Group Practice care were more likely to attend their first antenatal visit before 14 weeks (adjusted odds ratio 2·94, 2·19–3·95; p < 0·0001), have a spontaneous vaginal birth (1·28, 1·02–1·61; p < 0·036), have a successful vaginal birth after caesarean (1·69, 1·03–2·76; p = 0·037), have physiological management of the third stage (4·66, 2·12–10·27; p < 0·0001), have their babies born before arrival to the hospital (2·13, 1·07–4·24; p = 0·032), and less likely to have low birthweight babies (0·54, 0·33–0·89; p = 0·015). There were no significant differences between the two groups in referral to social worker or psychologist, episiotomy, third or fourth-degree tear, postpartum haemorrhage, skin-skin contact > 60 min, healthy baby, neonatal unit admissions, and stillbirths. Women in the Refugee Midwifery Group Practice were likely to have anaemia in the unweighted cohort, but the analysis of the inverse probability weighted cohort showed no statistically significant difference between the two groups. For women who were eligible for a vaginal birth after caesarean (n = 267) 36 achieved one in the standard care group (28.5%) and 61 (43.3%) in the Refugee Midwifery Group Practice group (p = 0.13).

Discussion

To our knowledge, this paper is the first to report on the effectiveness of a caseload Refugee Midwifery Group Practice service on maternal and neonatal outcomes for women from a refugee background reported as a discreet group rather than within a group of Black, Asian and Ethnic Minority women [24,25]. Our study provides compelling evidence that continuity of midwifery care models, are feasible in this setting, and when adapted to meet the needs of women from a refugee background, can improve maternal and neonatal outcomes. While the earlier evaluation of the refugee antenatal clinic found stakeholders to be sceptical about the feasibility of integrating interpreters into a Midwifery Group Practice service that incorporates 24/7 phone availability and group antenatal care, we have demonstrated that it is possible to provide clinical care and interpreting services to small numbers of women speaking different languages.

In relation to preterm birth, our results are comparable to findings from the systematic review of continuity of midwifery care [18] and two studies from the same research setting analysing the impact of caseload midwifery care for 'all risk' women at higher risk of preterm birth and social vulnerability, that is: young women (under 21-years) [20] and First Nations women [21]. They differ however, from two other studies with socio-economically disadvantaged women, one a pilot [26,27]. Our study found similarities between the two groups in ≥ 5 antenatal visits but secondary outcomes highlighted increased first trimester pregnancy care for women who received Refugee Midwifery Group Practice. We hypothesise that women who use the Refugee Midwifery Group Practice service share their positive experiences within their social networks, which increases the number of women who make early direct contact to book into the service [21]. We also suggest that the Refugee Midwifery Group Practice model itself enables synergistic health engagement as described by Allen where women do more than just 'turn up' to antenatal care but also 'buy in' [28]. This together with what Allen describes as optimal caseload midwifery (which includes midwives with specific personal attributes and philosophical commitments, along with appropriate institutional infrastructure and support) could be driving these differences [28].

Women who received Refugee Midwifery Group Practice care were more likely to have a spontaneous vaginal birth, a finding that is consistently associated with continuity of midwifery care [18] and more likely to have a successful vaginal birth after caesarean. Findings from a small, randomised control trial found no difference in the success rate of vaginal birth after caesarean between women who received continuity of midwifery care and women who received standard care [29]. However, in the randomised control trial, women in the continuity of care cohort were seen by up to six midwives during their pregnancy journey, which may have reduced relational continuity, a factor that might have

Table 3
Treatment effect of Refugee Midwifery Group Practice service on primary outcomes among unweighted cohort and inverse probability weighted cohort.

Outcome	Standard Care (n = 634)	Refugee Midwifery Group Practice (n = 625)	Crude Odds Ratio (95% Confidence Interval)	P-value	Adjusted Odds Ratio (95% Confidence Interval)	P-value
Received ≥ 5 antenatal visits	573 (90·4%)	577 (92·3%)	1·28 (0·86, 1·90)	0·222	1·34 (0·88, 2·06)	0·173
Spontaneous onset of labour	**325 (51·3%)**	**469 (75·0%)**	**2·86 (2·25, 3·63**	**<0·0001**	**2·20 (1·71, 2·82)**	**< 0·0001**
Epidural analgesia in the first stage of labour	**170 (26·8%)**	**99 (15·8%)**	**0·51 (0·39, 0·68)**	**< 0·0001**	**0·67 (0·50, 0·89)**	**0·0067**
Normal birth (term, spontaneous onset, vertex, spontaneous vaginal birth, no epidural, no episiotomy)	**187 (29·5%)**	**293 (46·9%)**	**2·11 (1·67, 2·66)**	**< 0·0001**	**1·55 (1·23, 1·95)**	**< 0·0001**
Preterm birth	**42 (6·6%)**	**24 (3·8%)**	**0·56 (0·34, 0·94)**	**0·028**	**0·60 (0·36, 0·99)**	**0·047**
Exclusive breastfeeding at discharge	397 (62·6%)	414 (66·2%)	1·17 (0·93, 1·48)	0·180	1·24 (0·97, 1·58)	0·089

Note: variables adjusted in the propensity score analysis are maternal age, body mass index, region of birth, female genital cutting history, socioeconomic status (Socio Economic Index for Areas quintile), marriage status, parity, smoking status at booking, previous caesarean section, previous stillbirth, birth after previous preterm, pre-existing autoimmune disease, pre-existing thyroid disease, pre-existing liver disease, pre-existing haematological disease, pre-existing heart disease, pre-existing renal disease, pre-existing mental health condition, and pre-existing hypertension.

Table 4
Treatment effect of Refugee Midwifery Group Practice on secondary outcomes among unweighted and inverse probability weighted cohort.

Outcome	Standard Care (n = 634)	Refugee Midwifery Group Practice (n = 625)	Crude Odds Ratio (95% Confidence Interval)	P-value	Adjusted Odds Ratio (95% Confidence Interval)	P-value
Antenatal outcomes						
Booking in visit< 14 weeks	**102 (16·1%)**	**207 (33·1%)**	**2·58 (1·97, 3.38)**	**< 0·0001**	**2·94 (2·19, 3·95)**	**< 0·0001**
Anaemia in pregnancy	283 (44·6%)	316 (50·6%)	1·27 (1·02, 1·58)	0·035	1·05 (0·83, 1·34)	0·684
Referral to social worker or psychologist	176 (27·8%)	156 (25·0%)	0·87 (0·67, 1.11)	0·260	0·90 (0·69, 1·18)	0·456
Intrapartum outcomes						
Spontaneous vaginal births	**397 (62·6%)**	**448 (71·7%)**	**1·51 (1·19, 1·92)**	**0·0006**	**1·28 (1·02, 1·61)**	**0·036**
Vaginal birth after caesarean section	**36 (5·7%)**	**61 (9·8%)**	**1·80 (1·17, 2·76)**	**0·0064**	**1·69 (1·03, 2·76)**	**0·037**
Episiotomy	90 (14·2%)	76 (12·2%)	0·84 (0·60, 1·16)	0·286	0·99 (0·66, 1·48)	0·967
Physiological management of 3rd stage	**9 (1·4%)**	**35 (5·6%)**	**4·10 (1·95, 8·60)**	**< 0·0001**	**4·66 (2·12, 10·27)**	**< 0·0001**
Third- or fourth-degree tear	10 (1·6%)	11 (1·8%)	1·12 (0·47, 2·65)	0·800	2·27 (0·55, 3·32)	0·513
Postpartum haemorrhage	139 (21·9%)	118 (18·9%)	0·83 (0·63, 1·09)	0·181	1·13 (0·82, 1·55)	0·470
Neonatal outcomes						
Skin to skin contact for 60 min or more	227 (35·8%)	235 (37·6%)	1·08 (0·86, 1·36)	0·509	1·14 (0·88, 1·48)	0·327
Healthy baby	548 (86·4%)	533 (85·3%)	0·91 (0·66, 1·25)	0·556	0·82 (0·59, 1·15)	0·253
Born before arrival	**12 (1·9%)**	**33 (5·3%)**	**2·89 (1·48, 5·65)**	**0·0010**	**2·13 (1·07, 4·24)**	**0·032**
Low birthweight	**48 (7·6%)**	**23 (3·7%)**	**0·47 (0·28, 0·78)**	**0·0025**	**0·54 (0·33, 0·89)**	**0·015**
Neonatal unit admission	85 (13·4%)	68 (10·9%)	0·79 (0·56, 1·11)	0·171	0·86 (0·60, 1·23)	0·399
Stillbirth	7 (1·1%)	3 (0·5%)	0·43 (0·11, 1·68)	0·225	0·79 (0·19, 3·35)	0·746

Note: variables adjusted in the propensity score analysis are maternal age, body mass index, region of birth, female genital cutting history, socioeconomic status (Socio Economic Index for Areas quintile), marriage status, parity, smoking status at booking, previous caesarean section, previous stillbirth, birth after previous preterm, pre-existing autoimmune disease, pre-existing thyroid disease, pre-existing liver disease, pre-existing haematological disease, pre-existing heart disease, pre-existing renal disease, pre-existing mental health condition, pre-existing hypertension.

affected fostering the woman-midwife relationship [29]. Interestingly, in our study, women received most care from their primary midwife or one of four known midwives but this was also within a group antenatal care context. Therefore, the small number of midwives in the team might have strengthened relational continuity, which may have promoted successful vaginal birth after caesarean section. Thus, relational continuity might have improved midwives' confidence in supporting women's cultural beliefs and when possible, avoiding birth interventions. The increased likelihood of having physiological management of the third stage is reported elsewhere [30]. The increase of births occurring before arrival at the hospital in the Refugee Midwifery Group Practice group requires further exploration which is underway. Plausible causes for babies in the Refugee Midwifery Group Practice being born before arrival to hospital could be the higher proportion of socio-economic disadvantage in this group leading to lack of private transport, precipitate labour (more multiparous women in Refugee Midwifery Group Practice), communication barriers, the belief that childbirth is a physiological process that can be accomplished at home, delays in contacting ambulance services or ambulance service processes. Of note, the previous refugee antenatal clinic evaluation found 55% of women had difficulty accessing the hospital [11]. Lastly, the reduction in low birth weight is similar to other studies [18].

Many of the improved outcomes for women and babies in our study are likely to be strongly related to the impact of the midwifery continuity of care model that allows time for women and midwives to foster trusting relationships [18]. Standard care is more fragmented due to a regular rotation of midwives caring for women in different areas, and sometimes, in a single episode of care. Trust between a woman and her midwife is fundamental to disclosure of sensitive information, cohesion in the development and delivery of care plans, and translates to better outcomes [18]. The willingness to disclose sensitive information, such as disclosing female genital cutting which was higher in the Refugee Midwifery Group Practice group, as the midwife learns and understands the women's values, aspirations, strengths, and fears [25]. We hypothesise that meaningful consultation with women from a refugee background before the inception of the Refugee Midwifery Group Practice service was fundamental in co-designing a maternity care model that promoted woman-centred care and cultural safety [31,32]. Thus, the service promoted the women and midwives to work synergistically to achieve the women's goals.

Key service adaptations for the Refugee Midwifery Group Practice likely improved accessibility to care, addressed communication and social needs, improved understanding of education, and strengthened woman-midwife relationships, which are fundamental to improving maternity care service use [4,6,7], with consequential improvements to maternal and neonatal outcomes. The impact of peer support and encouragement was also likely to be a beneficial factor and may reduce stress in pregnancy, another factor associated with preterm birth [28].

We acknowledge the limitation of potential selection bias associated with non-randomisation of participants. However, the use of inverse probability of treatment weighting contributed to a robust statistical analysis method to estimate the treatment effect of the Refugee Midwifery Group Practice service [23]. Even though propensity scoring can reduce selection bias, it does not address hidden bias. Therefore, our findings do not provide definitive answers to the treatment effect of the service. Excluding women from other regions and reporting findings from a single site could further affect the generalisability of our findings. The high percentage of women from the Somalia and Sudan in the Refugee Midwifery Group Practice service is also noted and could be due to the cultural acceptability of group antenatal care and the high population of women from these regions in the service's catchment area. Despite these limitations, our findings address the scarcity of research on improving maternal and neonatal outcomes for women from a refugee background.

Conclusion

Our study found that an Australian Refugee Midwifery Group Practice with caseload midwifery care was successfully adapted and significantly improved maternal and neonatal outcomes for women from a refugee background. The findings confirm the benefit of individual health service changes that are aimed at improving "quality and culturally acceptable maternity care" for women from a refugee background [33]. Our findings are helpful in supporting policy recommendations to replicate and adapt similar services across Australia and importantly have international relevance to other high-income countries as they seek to provide refugee women with high quality maternity care. Reducing the global issue of inequitable perinatal outcomes for women from a refugee background through high quality maternity care should be prioritised as a fundamental necessity for promoting thriving contemporary multicultural communities in high-income countries.

Implications for further research

Since our study only focussed on outcomes up to discharge from the hospital, research on the cost effectiveness and long-term impacts of continuity of midwifery models targeting women from a refugee background care will be beneficial. Further qualitative research to understand the women's experiences and meaning of care, and the experiences of midwives who provide continuity of care for women from a refuge background is underway and will provide a better policy direction for improving the quality of maternity care for women from a refugee background. Further research could explore how synergistic health engagement could be monitored and reported.

Ethical statement

We extracted routinely electronically collected maternal and newborn data from the hospital's health information database. We did not seek individual consent to use the data as per conditions stipulated in the Australian National Health and Medical Research Council National Statement for waiver of consent. To protect the participants' confidentiality, we de-identified all collected data before analysis. Ethical approval was granted by the Mater Misericordiae Ltd Human Research Ethics Committee and Governance on 26/11/2018 (HREC/MML/46904) and Charles Darwin University Human Research Ethics Committee on 05/05/2021 (H21035).

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CRediT authorship contribution statement

Mpho Dube: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Yu Gao:** Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Michelle Steel:** Conceptualization, Writing – review & editing. **Angela Bromley:** Writing – review & editing. **Sarah Ireland:** Writing – review & editing the manuscript. **Sue Kildea:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Conflict of interest

MS is a midwife at the Refugee Midwifery Group Practice service. All other authors declare no conflict of interest.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.wombi.2022.10.004.

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