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The opportunity costs of birth in Australia: Hospital resource savings for a post–COVID-19 era

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Abstract

Background: COVID-19 caused significant disruptions to health systems globally; however, restricting the family presence during birth saw an increase in women considering community birth options. This study aimed to quantify the hospital resource savings that could occur if all low-risk women in Australia gave birth at home or in birth centers.

Methods: A whole-of-population linked administrative data set containing all women (n = 44 498) who gave birth in Queensland, Australia, between 01/07/2012 and 30/06/2015 was reweighted to represent all Australian women giving birth in 2017. A static microsimulation model of woman and infant health service resource use was created based on 2017 data. The model was comprised of a base model, representing "current" care, and a counterfactual model, representing hypothetical scenarios where all low-risk Australian women gave birth at home or in birth centers.

Results: If all low-risk women gave birth at home in 2017, cesarean rates would have reduced from 13.4% to 2.7%. Similarly, there would have been 860 fewer inpatient bed days and 10.1 fewer hours of women's intensive care unit time per 1000 births. If all women gave birth in birth centers, cesarean rates would have reduced to 6.7%. In addition, over 760 inpatient bed days would have been saved along with 5.6 hours of women's intensive care unit time per 1000 births.

Conclusions: Significant health resource savings could occur by shifting low-risk births from hospitals to home birth and birth center services. Greater examination of Australian women's preferences for home birth and birth center birth models of care is needed.

KEYWORDS
birth, birth models of care, covid-19, opportunity costs, resource use

1 | INTRODUCTION

The COVID-19 pandemic highlighted the value of hospital resources like never before in recent history. Beds, clinical staff, operating theaters, consumables, and equipment were all of upmost importance.[1,2] In an effort to divert resources to those in the greatest need, many governments suspended nonessential surgeries and departments were prepared for only the most critical surgeries to take place.[3,4] Maternity services similarly underwent rapid restructuring to comply with social distancing requirements, and prepare for the continuance of services in the event of reduced staffing.[5,6]

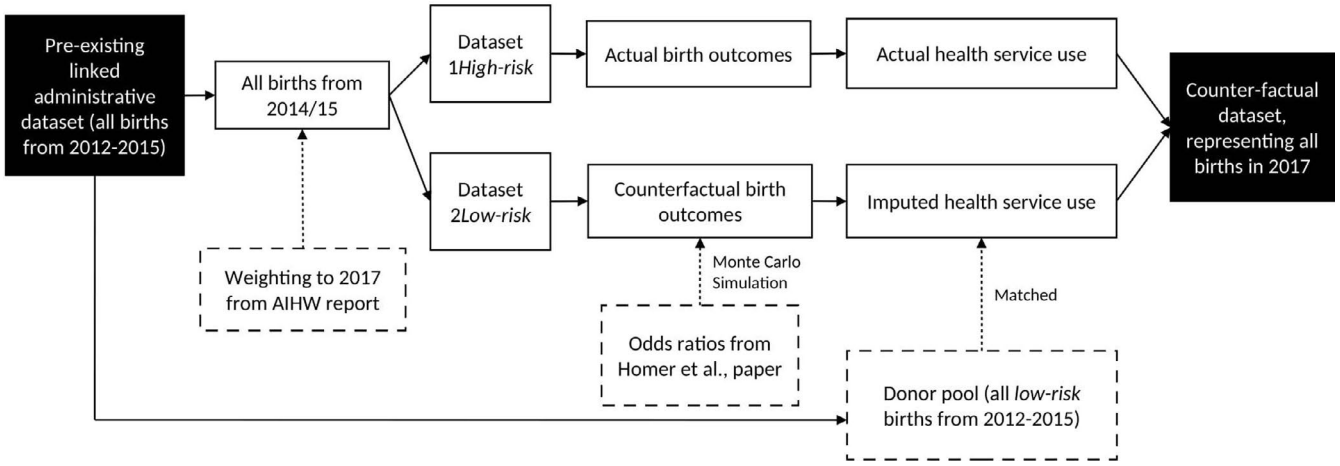

FIGURE 1 Generation of the counterfactual data set using preexisting linked administrative data for all live births occurring between 2012 and 2015 in Queensland, Australia

To some extent, the changes made to maternity services were related to limitations that existed pre–COVID-19. Many countries adopted or strengthened community-based antenatal and postnatal care and/or telehealth services to reduce face-to-face contact for routine care.[7] Before COVID-19, women with additional or complex needs generally attended hospital for antenatal and postnatal care. However, the pandemic saw many of these services devolve out into community settings in combination with telehealth. Birth practices also changed, including the use of additional personal protective equipment, strict protocols about birth room occupation (eg, limiting the presence of partners and other attendants),[8] and even discouraging skin to skin contact at birth.[9] Some services looked to medical intervention to control the timing of births in an attempt to meet resource availability.[5,10] In the early stages of the pandemic, some of the changes to maternity service delivery were driven by women who expressed concern about traveling to and attending hospitals for care during pregnancy and/or for birth. Consequently, giving birth outside the hospital environment gained more consideration as a viable option (particularly for women without identified pregnancy concerns).

Choice of birth setting is at the heart of woman-centered care, and the demand for birth outside the hospital setting was further emphasized during the COVID-19 pandemic. Midwifery-led birth centers (which can be within or alongside hospitals, or separate) are designed for women whose pregnancy is deemed to be "low-risk." They provide a "homely" environment and support birth with minimal medical intervention but with links to referral services if required.[11] Growing evidence suggests that hospitals are not optimized to support low-risk birth,[12] and several studies and reviews have demonstrated the safety of home and birth centers as acceptable places for birth, particularly for low-risk women.[13,14] Notably, research suggests that home births pose no greater mortality or morbidity risks to either the woman or baby than giving birth in a hospital, can reduce the odds of neonatal intensive care unit (NICU) admission, and result in the use of fewer medical interventions during birth (eg, reduced rates of instrumental birth).[15,16] Previously, birth centers and home births were viewed as optional services, advocated to promote women's choice about how and where they would like to birth. However, the post–COVID-19 era might see these services become a necessary component of maternity service delivery to reserve hospital resources for those who truly need them.

The current study sought to quantify health resource savings in the acute inpatient public hospital setting if *all low-risk women* routinely gave birth at home or in a birth center. Although there is some research to suggest that nonhospital birth can be cost-saving,[17-19] this research has been minimal and not considered in the context of the post–COVID-19 era. We sought to quantify the number of inpatient bed days, women's intensive care unit (ICU) bed hours, infant's special care nursery (SCN) days, and infant's neonatal intensive care unit (NICU) days associated with birth.

2 | METHODS

We created a static microsimulation model of woman and infant health service use associated with birth, using a population-based linked administrative data set. Microsimulation models use individual-level data to estimate the impact of change before it occurs, and have traditionally been used to model income and tax policy changes. By drawing on real-world data, microsimulation models can estimate the actual relationships between events that are currently observed within a population (eg, between gestation at birth and an infant's admission to SCN).

TABLE 1 Probability of different birth types applied in the microsimulation models

Birth type[a]	Probability used in counterfactual model, applied to low-risk women—home births	Probability used in counterfactual model, applied to low-risk women—birth centers
Vaginal birth, no forceps or vacuum	0.9308	0.8641
Vaginal birth, vacuum	0.0204	0.0469
Vaginal birth, forceps	0.0076	0.0261
Unplanned cesarean	0.0411	0.0630

[a]The actual percentage of women with different birth types is shown in Table 2.

Our model was designed to represent the Australian population of women giving birth in 2017. This was the most recent year with benchmarking data available. Microsimulation models are comprised of two parts: the *base model* containing details of the status quo and the *counterfactual model* that estimates change under hypothetical scenarios, in this case, low-risk birth occurring at home or in a birth center. The methods we undertook for completing these two parts are outlined below and illustrated in Figure 1.

2.1 | Underlying data set

Our microsimulation model is based on a preexisting data set created from a whole-of-population administrative data linkage. The data set contains all women who gave birth between 01/07/2012 and 30/06/2015 in Queensland (QLD), Australia, and both woman and infant clinical and health service use records from conception to the time the infant was two years of age. The data set contains 186 789 women and 189 809 infants.[20] The preexisting data set was linked with *Perinatal Data Collection* (PDC) data to identify women and their infants for inclusion. The PDC contains the details of all births regardless of location (private hospital, public hospital), information on maternal demographics, maternal clinical characteristics, medical interventions preformed in pregnancy and childbirth, and infant outcomes. It also records length of hospital stay, a woman's time in an ICU, and an infant's time in a SCN or NICU at time of birth.

2.2 | Weighting to produce national estimates for 2017

We reweighted the data of women giving birth between 01/07/2014 and 30/06/2015 (n = 61 801) to reflect the Australian population of women giving birth between 01/01/2017 and 31/12/2017. Reweighting was conducted using GREGWT, a generalized regression reweighting algorithm developed by the Australian Bureau of Statistics (ABS).[21] Weighting was conducted using national benchmarks for a woman's age based on Indigenous identification, a woman's age by parity, remoteness, and sector of birth (public or private) using data from the Australian Institute of Health and Welfare's (AIHW) Mothers and Babies 2017 report.[22]

2.3 | The base model

The base data set was limited to women who gave birth in a public hospital (n = 44 498), as we were interested in public hospital decision-making about location of birth. To quantify the health resources used in current standard care, the number

TABLE 2 Distribution of different birth types in the base data set and counterfactual scenarios where all low-risk women gave birth at home or at a birth center, weighted to the Australian population, 2017

	Current standard care		Home birth counterfactual model		Birth center counterfactual model	
Birth type	N (%) All-risk	N (%) Low-risk	N (%) All-risk	N (%) Low-risk	N (%) All-risk	N (%) Low-risk
Vaginal birth, no forceps or vacuum	124 031 (59.1%)	64 244 (71.2%)	144 119 (68.6%)	84 332 (93.5%)	137 263 (65.4%)	77 476 (85.9%)
Vaginal birth, vacuum	17 581 (8.4%)	9629 (10.7%)	9837 (4.7%)	1885 (2.1%)	12 532 (6.0%)	4580 (5.1%)
Vaginal birth, forceps	8255 (3.9%)	4260 (4.7%)	4618 (2.2%)	623 (0.7%)	6114 (2.9%)	2119 (2.3%)
Unplanned cesarean	60 174 (28.6%)	12 089 (13.4%)	51 468 (24.5%)	3383 (3.7%)	54 132 (25.8%)	6047 (6.7%)

of inpatient bed days, ICU hours, SCN days, and NICU days was summed based on actual health resource use.

2.4 | Estimating the impacts of change (the "counterfactual model")

2.4.1 | Scenario 1—Home births

The first simulation estimated the health resources that would be used in a hypothetical scenario where all low-risk women gave birth at home. Women who had a higher risk of pregnancy complications were defined as having any of the following characteristics at the start of labor: a multiple pregnancy, being more than 41 weeks of gestation, a non-cephalic presentation, were classified as obese (BMI > 30), had a prior cesarean or previous uterine surgery, grand multiparity (≥ five previous births), or any maternal medical condition deemed to affect pregnancy.[23] Women at higher risk will be referred to as "women with risk factors" throughout this paper. Women without any of these characteristics were classified as having a low-risk pregnancy for this study.

Two sub–data sets were created from the base data set: the first contains women with risk factors, whose health resource use remained as it was recorded on the base data set (n = 26 596); and the second contains low-risk women (n = 17 902). Actual rates of unplanned cesarean, vaginal birth with vacuum, vaginal birth with forceps, and unassisted vaginal birth (without vacuum or forceps) were then identified for these low-risk women in our population. The relative risk reduction in each of these events produced by home birth and birth center births was identified from odds ratios reported in a recently published population-based retrospective study of outcomes for women who had planned home births or birth center births.[24] These relative risk reduction values were applied to the observed probability of unplanned cesarean, vaginal birth with forceps, and vaginal birth with vacuum to give a counterfactual probability of each of these birth types occurring (Table 1). Monte Carlo simulation[25] was then used to randomly assign the low-risk women in the second sub–data set to each of these birth types.

Still using the second sub–data set, subsequent health resource use for the records of low-risk women (the "recipient" records) was then imputed by matching to similar "donor" records who had the same demographic and clinical characteristics, and mode of birth. The donor records were drawn from the complete linked data set of low-risk women (covering births from 01/07/2012 and 30/06/2015). Recipient records were then assigned the health resource use trajectories of the donor records, thus representing the counterfactual scenarios. For example, if a recipient record of a woman was assigned in the Monte Carlo simulation step to have a vaginal birth with forceps, that record was given the subsequent health resource use of a similar donor record who actually had a vaginal birth with forceps. This recreates the actual observed dynamics in health states and resource use captured in the real-world data.[26] Radius matching was used because of its performance with real-world data.[27] Matching scores were based on a woman's age, BMI score, if it was the woman's first pregnancy, smoking status before 20 weeks' gestation, Indigenous identification, socioeconomic status, and rurality of residence. These variables were chosen as they have previously been shown to be associated with total health care costs[28]—an outcome of primary importance[29]—but not influenced by mode of birth. Recipient and donor records were matched if their score fell within 0.02 standard deviations of the logit of the matching score, using the greedy matching technique.

For the home birth simulation, it was assumed that where women gave birth vaginally with no forceps or vacuum, there was no inpatient bed use for either the woman or baby at time of birth. However, ICU, SCN, and NICU use was included from the matched donor records. Those with an unplanned cesarean, vaginal birth with vacuum, or vaginal birth with forceps were assumed to be transferred to a public hospital with inpatient, SCN, NICU, and ICU use based on the counterfactual modeling. As this study focused on acute inpatient resource use, we did not consider the ambulance transfer resource use that may be required.

2.4.2 | Scenario 2—Birth centers

The second simulation of the study estimated the health service resources used if all low-risk women gave birth at birth centers. Low risk was defined as above, and the aforementioned counterfactual methodology was repeated. For the birth center simulation, it was also assumed that where women gave birth vaginally with no forceps or vacuum, there was no inpatient bed use for either the woman or baby at time of birth, and both remained in the birth center until they were discharged home. However, ICU, SCN, and NICU use was included. Those with an unplanned cesarean, vaginal birth with vacuum, or vaginal birth with forceps were assumed to be transferred to a public hospital with inpatient, SCN, NICU, and ICU use based on the counterfactual modeling.

2.5 | Generation of results

After the simulation, the two sub–data sets of women with risk factors and low-risk women were recombined, and the number of inpatient bed days, ICU hours, SCN days, and NICU days was compared with that in the base data set (representing current standard care). This was repeated for the two counterfactual simulations representing the home birth and birth center scenarios. The mean number of health resources

used per woman, and the health resource savings that could be made per 1,000 public hospital births were presented.

3 | RESULTS

There were 44 498 records of women in the base data set, which once weighted represented 215 615 women giving birth in Australian public hospitals in 2017. Of these women, 43.9% were considered low-risk and 56.1% were considered higher risk. From our base model (standard care), 58.2% of women had a vaginal birth without forceps or vacuum, and 29.1% had an unplanned cesarean. Of the low-risk women, a higher proportion (70.8%) had a vaginal birth without forceps or vacuum, and 13.6% had an unplanned cesarean (Table 2).

The results of our counterfactual model show that if all low-risk women had a home birth, then 93.5% would have a vaginal birth with no forceps or vacuum, 2.1% would have a vaginal birth with vacuum, 0.7% would have a vaginal birth with forceps, and 3.7% would have an unplanned cesarean (Table 2). This would have increased the population-level percentage of women having a vaginal birth without forceps or vacuum to 68.6%, and the percentage of women having an unplanned cesarean would have reduced to 24.5%.

If all low-risk women had given birth in a birth center, 85.9% would have had a vaginal birth with no forceps or vacuum, 5.1% would have had a vaginal birth with vacuum, 2.3% would have had a vaginal birth with forceps, and 6.7% would have had an unplanned cesarean (Table 2). The population-level percentage of women having a vaginal birth without forceps or vacuum would have increased to 65.4%, and the percentage of women having an unplanned cesarean would reduce to 25.9%.

Under current standard care, the mean number of inpatient bed days per birth is 2.6 (Table 3). The mean number of ICU hours for women is 0.1, and the mean number of days infants spend in SCN and NICU is 1.1 and 0.4, respectively. If all low-risk women gave birth at home, the mean number of inpatient bed days would reduce to 1.7 per birth. The total number of bed days used in 2017 would have reduced from 539 953 to 356 828 if all low-risk women gave birth at home. The total number of hours women spent in the ICU would have reduced from 27 737 to an estimated 24 896 (Table 3). Similarly, if all low-risk women gave birth in a birth center, the mean number of inpatient bed days per birth would be 1.8. The total number of inpatient bed days would have reduced to 374 453, and the total ICU hours for women would have reduced to 25 764.

If home birth was available to all low-risk women, then for every 1000 births, an estimated 860 inpatient bed days, 11.5 infant SCN days, 2.1 NICU days, and 10.1 ICU hours for women would be saved (Table 4). If birth in a birth center was available to all low-risk women, then for every 1,000 births, an estimated 768.2 inpatient bed days, 3.9 SCN days, 1 NICU days, and 5.6 ICU hours for women would be saved (Table 4).

4 | DISCUSSION

Our analysis indicates that enabling all low-risk women to routinely give birth at home or in birth centers would substantially increase the rate of spontaneous vaginal birth (ie, without assistance) and reduce the rates of unplanned cesarean by more than half. Importantly, substantial resource savings would arise from reduced inpatient bed days and hours spent in the ICU by women if all low-risk births moved out of the acute inpatient public hospital setting. This study contributes to the current dearth of literature about resource savings associated with giving birth at home or in birth centers. Furthermore, it is the first study that we are aware of, to consider the discussion of resource savings for childbirth in the post–COVID-19 era. This research is crucial for informing discussions about freeing up acute inpatient hospital

TABLE 3 Mean number of health resources used per birth, and total numbers used for all births, weighted to the Australian population, 2017

	Current standard care		Home birth		Birth center	
Resource type	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total
Inpatient bed days	2.6 (3.7)	539 953	1.7 (4.4)	356 828	1.8 (4.4)	374 453
Infant SCN days	1.1 (10.9)	233 522	1.1 (11.0)	228 165	1.1 (11.0)	230 005
Infant NICU days	0.4 (9.8)	74 670	0.4 (9.8)	74 260	0.4 (9.8)	73 475
Woman ICU hours	0.1 (5.4)	27 737	0.1 (5.2)	24 896	0.1 (5.3)	25 764

Abbreviations: SD, standard deviation; SCN, special care nursery; NICU, neonatal intensive care unit; ICU, intensive care unit.

TABLE 4 Estimated resources saved per 1000 births if all low-risk women gave birth at home or in a birth center

	Resources saved per 1000 births	
Resource type	**Home birth**	**Birth center**
Inpatient bed days	860.0	768.2
Infant SCN days	11.5	3.9
Infant NICU days	2.1	1.0
Woman ICU hours	10.1	5.6

Abbreviations: SCN, special care nursery; NICU, neonatal intensive care unit; ICU, intensive care unit.

resources for those with the greatest need, and preparing for the next, inevitable global pandemic.

The findings of this study depict that rates of unplanned cesarean would have reduced from 13.4% per 1000 women to less than 4% in 2017 if all low-risk women gave birth at home, or less than 7% if they gave birth in a birth center. This has significant implications for the Australian public health care system in terms of resource savings. Rates of cesarean are particularly high in low-risk nulliparous women.[30,31] Among nulliparous women in Australia, the rate of cesarean increased by 4% between 2004 and 2017.[32] Cesarean in nulliparous women can also increase the risk of complications in subsequent births for women and babies, and increases the chances of undergoing additional cesarean, which exacerbates the risks and costs associated with birth.[33,34] Unplanned cesarean in particular are the most costly birth procedure in Australia.[35] Recent research demonstrates that the cost of births by cesarean in Australian public hospitals was AU$31 939 in comparison with AU$18 521 for vaginal births with no instruments, including costs for women and children up to two years postpartum.[36] Though not as disparate, evidence from other countries also indicates that there is a significant difference between the procedural cost of vaginal birth and cesarean.[12,37] Consequently, the results of the current study suggest that shifts toward home and birth center births for low-risk women may result in health care system savings in the tens to hundreds of millions of dollars by reducing the proportion of unplanned cesarean undertaken, and significant improvements in women's and children's health outcomes.

Our findings also depict that although shifting all low-risk women's births to birth centers and home births may only modestly reduce infant NICU and SCN days, we could see major reductions in the number of days women spent as inpatients, and hours spent in the ICU. A 2012 Australian study comparing women giving birth in midwifery-led birth centers and those experiencing usual care (birth in a hospital labor ward) evidenced similar resource savings.[38] The authors concluded that there was a statistically significant difference between the cost of receiving care in the birth center versus the hospital, which equated to roughly AU$1000 saved per birth for the hospital and an additional AU$1000 saved by the government.[38] However, despite these resource savings, few women have access to alternate birth settings.

In 2017, 97% of births in Australia occurred in hospitals, 74% in public hospitals, and 26% in private hospitals.[22] Only 0.3% of births took place in the home.[22] Low rates of home births are underpinned by several contentious issues. First, there are very few publicly funded home birth programs in Australia, with different reports suggesting between 14 and 19 known programs.[39,40] Low rates of home birth are also partly because of professional indemnity insurance restrictions placed on both public and private practicing midwives in the early 2000s.[41] Most available programs cater to women in metropolitan areas, thereby propagating inequity of access for regionally and remotely located women. Moreover, neither Queensland nor Tasmania offer publicly funded home birth programs.[40] Women's access to home birth can also be financially restricted because of a lack of public funding. Women who want to give birth at home with a private midwife can expect to pay between $3500 and $6000 out of pocket.[42] Even women eligible for publicly funded home births can still expect to pay up to $1500 out of pocket depending on the additional tests, scans, and support sought.[42] Thus, both geographical and financial limitations impede Australian women's access to suitable support for home birth.

There are more birth centers than home birth programs in Australia, but only marginally. In 2016, there were at least 10 birth centers in NSW—five colocated on hospital premises or adjacent to hospital labor wards, and five midwifery-led, free-standing birth centers.[43] *Pregnancy Birth and Beyond Pty Ltd* lists 24 birth centers across Australia on their website,[44] catering to the 2.4% of Australian births.[22] By comparison, The Netherlands has a reported 23 birth centers (as of 2017),[45] and a much higher birth center birth rate of 11.4%.[12]

Generally, there is a paucity of literature on Australian women's preferences for place of birth. Stoll and colleagues examined 760 Western Australian (WA) university students' (>75% of whom were female) preferences for place of birth.[46] Close to half of the participants preferred to give birth in a hospital under obstetrician-led care, roughly 36% preferred a hospital birth under midwifery-led care, and 10% and 1.8% respectively preferred to give birth in birth centers or at home.[46] This does not show an overwhelming preference for home birth or birth center births. Instead, this may be a reflection of what participants know to be available, have previously been exposed to, or view as accepted. However, while not extreme, the results do indicate a degree of disparity between current rates of home births and birth center births, and the proportions of women that would prefer these options. An overwhelming majority of the submissions made to the Australian Maternity Services Review in 2009 (a review of maternity services in Australia undertaken by the Government Department for Health and Ageing,

eliciting a range of perspectives on gaps in the system at the time) were from women who wanted to be able to give birth in their home, but were unable to do so because of limited access and exorbitant out-of-pocket fees associated with the available services.[47,48] The recent COVID-19 pandemic has also led some women to reconsider giving birth in hospitals because of perceived high risks of infection,[49] and restrictions on the presence of family or other support persons. Alarmingly, the pandemic may have also seen a rise in free births (home births unattended by any health professional) as a consequence of women's preferences for home birth not being met. Consequently, future research should aim to formally and comprehensively examine Australian women's preferences for birthing at home and in birth centers in order to appropriately inform birthing service-related decision-making. In particular, preference-based methods, such as those that have been used in the United Kingdom,[50] may provide a comprehensive backdrop to inform such decisions.

4.1 | Recommendations

In the wake of COVID-19, there have been calls to make birthing options outside the hospital more accessible to pregnant women. Although there is some evidence to suggest that Australian women would prefer these alternative birthing models of care, current public and private funding arrangements and limited accessibility to nonhospital birthing services pose significant restrictions to women's ability to choose where and how they give birth. Thus, the current study proposes three key recommendations.

First, greater examination of women's preferences for birth center and home births in Australia is crucial to understand the demand for these services. It may also provide us with an indication of the types of funding models that could feasibly support equitable access to these services. Second, few Australian women can access and use home births or birth centers because of the limited number of these services nationally, and their tendency to operate in metropolitan cities. Thus, to promote equity in choice of birthplace—irrespective of geographical location—future research should attempt to understand the cost-effectiveness of providing birth center and home birth models of maternity care in regional and remote Australia. Third, future research should consider modeling at the individual hospital jurisdiction level based on local population characteristics and risk factors to identify the actual proportion of women who could use home birth or birth center birth services.

4.2 | Limitations

A key limitation of the study is that resource savings represent those that could have been made in 2017 instead of the current year (2020), as this is the latest national benchmarking data available. However, this was done so that the sample weighting undertaken was representative of the Australian population. Assumptions in our modeling, which are potential limitations, include the following: transfer into hospital for care such as epidural where a spontaneous vaginal birth was still achieved, other factors that influence suitability for different birth settings such as women's preferences, and additional risk factors not included in our modeling. In addition, the results represent absolute resource savings, either *all* low-risk births occurring in birth centers or *all* low-risk births occurring at home. It may be unreasonable to assume that all women giving birth would choose the same option, or that no low-risk women would prefer to give birth in public or private hospitals.

There are also recognized differences in birth location recommendations for women giving birth for the first time compared with subsequent pregnancies, and differences between maternity practitioner practices. However, the current analysis aimed to illustrate potential resource savings and generate discussion about nonhospital birthing options that are currently inaccessible to many women giving birth in Australia, particularly in light of the COVID-19 global pandemic. Finally, our modeling did not include women's antenatal model of care because this was not available in the data set. It is recognized that the model of antenatal care has significant impacts on birth outcomes,[51] and is worthy of further research.

4.3 | Conclusions

The recent COVID-19 pandemic has highlighted the importance of women's ability to choose to give birth at home and in birth centers, and the availability of these services. The current study demonstrates that if all low-risk women gave birth at home or in birth centers, there would be significant reductions in women's health service resource use, and modest reductions in that of their baby. However, we currently have a limited understanding of Australian women's preferences for these services. Future research should aim to understand women's preferences for, and willingness and ability to pay for these services to inform suitable government funding schemes. This research has the potential to address current inequities underpinning maternity care in Australia, and promote greater capacity in woman-centered maternity care globally.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Research data are not able to be shared.

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