Title:

Is the Birthing Unit Design Spatial Evaluation Tool valid for diverse groups?

Short title:

Validating the BUDSET

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Abstract

Background: Awareness of the impact of the built environment on health care outcomes and experiences has led to efforts to redesign birthing environments. The Birth Unit Design Spatial Evaluation Tool was developed to inform such improvements, but it has only been validated with caseload midwives and women birthing in caseload models of care.

Aim: To assess the content validity of the tool with four new participant groups: Birth unit midwives, Aboriginal or Torres Strait Islander women; women who had anticipated a vaginal birth after a caesarean; and women from refugee or culturally and linguistically diverse backgrounds.

Methods: Participants completed a Likert-scale survey to rate the relevance of the Birth Unit Design Spatial Evaluation Tool's 69 items. Item-level content validity and Survey-level validity indices were calculated, with the achievement of validity set at >0.78 and >0.9 respectively.

Results: Item-level content validity was achieved on 37 items for birth unit midwives (n=10); 35 items for Aboriginal or Torres Strait Islander women (n=6); 33 items for women who had anticipated a vaginal birth after a caesarean (n=6); and 28 items for women from refugee or culturally and linguistically diverse backgrounds (n=20). Survey-level content validity was not demonstrated in any group.

Conclusion: Birth environment design remains significant to women and midwives, but the Birth Unit Design Spatial Evaluation Tool was not validated for these participant groups. Further research is needed, using innovative methodologies to address the subconscious level on which environment may influence experience and to disentangle the influence of confounding factors.

Keywords: environment design; facility design and construction; labour; midwifery; natural childbirth; obstetric.

Introduction

Statement of Significance	
Problem or Issue	The environment in which a woman labours and births impacts on her birth outcomes.
What is already known	The BUDSET was developed to inform improvements in birthing environment design, and it has been validated by caseload midwives and women in their care.
What this paper adds	The BUDSET was not found to be valid for use with birth unit midwives; Indigenous women; women who had anticipated VBAC, and women from refugee/CALD backgrounds. Midwives perceived more relevance in the BUDSET characteristics than women did. Further research is needed, using innovative methodologies, to explore the features of birth environment design that are valued by diverse groups of participants.

There is a significant body of literature linking the built environment with health care outcomes, both generally[1] and in maternity care specifically.[2,3] This knowledge has led to a growing interest in modifying the design of the birthing environment, such as in birth centres, to transform the experience of birth from an impersonal clinical encounter into a celebration of life for women and their families.[4]

The physiological significance of the birth environment was first championed by Michel Odent[5] who argued that the release of oxytocin was highly dependent on environmental factors. Both human and non-human mammal studies[4-10] have highlighted the importance of a dark, warm, private and protected environment, which stands in stark contrast to the environment common in many contemporary hospital birth units. A Cochrane Systematic review of birth settings which

included ten trials and almost 12,000 women[3] concluded that women who labour and birth in conventional settings are more likely to experience interventions including caesarean section.[3] Conversely, alternative birth settings, such as Birth Centres which offer a homelike environment either within or near a hospital maternity service, are associated with higher rates of spontaneous vaginal birth, labour and birth without pain relief, breastfeeding at six to eight weeks postpartum, maternal satisfaction with care, and lower rates of oxytocin augmentation, assisted vaginal birth, caesarean birth, and episiotomy.[3] Thus women's birthing room preferences are not design luxuries, but fundamental environmental aspects which influence birth outcomes.[11]

The Birth Unit Design Spatial Evaluation Tool (BUDSET) was designed to assess and inform improvement plans for birthing environments.[12] It was designed following a literature review and interviews with midwives, childbearing women and architects.[13] The four domains of the BUDSET (Fear Cascade, Facility, Aesthetics, and Support) incorporate 69 characteristics of an ideal birth environment (see Table 1).

In 2011, a study testing the BUDSET's internal validity was undertaken in eight maternity hospitals in New South Wales, Australia.[14] The BUDSET did not always produce similar scores between users, and study authors concluded that the tool required further modification and validation (with clinical midwives and childbearing women) before it could be used to assess birthing environment design more widely.14 That further validation work was undertaken by Sheehy et al with a small group of maternity service users (pregnant and postnatal women, n=5 each) and midwives (midwifery academics, n=2; and caseload midwives, n=10) using a Content Validation Survey.[15] Content validity was established in all four domains of the BUDSET with all participant groups except pregnant women, possibly because the women were primiparous and may not have anticipated the relevance of some characteristics surveyed. However, the participants were atypical of the broader Australian birthing and midwifery populations: The midwives worked in a midwifery group practice, with a philosophy of supporting and promoting normal birth and where they provided continuity of care to

a caseload of women throughout their pregnancy, labour and birth, and the postnatal period. The women's in Sheehy et al's study were all users of that model of care, were all non-Indigenous, and were all relatively socio-economically advantaged. No conclusions could be drawn about the content validity of the BUDSET for use with a broader range of midwives or women.

Participants, Methods and Ethics

Aim

This study therefore aimed to assess the validity of the BUDSET with four new participant groups: Midwives working in the birth unit of a large tertiary hospital, Aboriginal or Torres Strait Islander women; women anticipating a vaginal birth after a caesarean (VBAC); and women from refugee or culturally and linguistically diverse (CALD) backgrounds.

Design

The Content Validity Survey (CVS), developed by Sheehy et al.,[15] was used, with permission, to assess the validity of each item of the BUDSET with the four participant groups. Ethics approval was obtained from both the study site (HREC/13/MHS/181/AM01) and Australian Catholic University (201414Q), where the first author was enrolled as an Honours student.

Setting

This study was conducted in a large, urban tertiary hospital in Queensland, Australia. Approximately 10,000 births per year occur at the study site, evenly divided between women with private health insurance and those accessing public services. The maternity service was located within a large complex which included Adult's and Children's hospitals and research buildings. The birth unit was located on the entry level of the maternity hospital and constituted a traditional labour ward environment. It comprised 16 birth rooms, each with a shower and toilet separated from the bed by a screen, and a domestic bath. Table 1 describes the features of the birth rooms and the surrounding maternity service environment at the study site, which would likely achieve a

low score on the BUDSET. All women who laboured and birthed vaginally at the study site, did so in these birth rooms; there was no birth centre or home-like birth rooms at, or associated with, the hospital.

Eligibility criteria

The participant groups were defined purposefully to expand upon Sheehy et al's study[15] by collecting survey responses from contrasting participant groups.

Whereas Sheehy et al included caseload midwives, midwives were eligible to participate in the current study if they worked regularly in the mainstream model of care in the hospital's public birth unit. That is, these midwives would generally not have met the birthing women they cared for prior to labour and birth. They commenced caring for women on admission to the birth unit, and handed over their care after birth to midwives in the postnatal ward.

The women who participated in Sheehy et al's[15] study were all non-Indigenous, relatively socio-economically advantaged and accessing a caseload model of care; more diverse participant groups were sought in this study. Women were eligible to participate in the current study where they were at least 18 years of age, willing and able to complete the survey in English, and had recently experienced a vaginal birth of a healthy baby at term, in a birth room at the study site, and subsequently been admitted to the public postnatal ward. Additionally, eligible women identified with one of the following groups: Aboriginal and/or Torres Strait Islander women; women who anticipated a vaginal birth after a caesarean (VBAC) and women from refugee or CALD backgrounds. Aboriginal and Torres Strait Islander Women comprise only 3.9% of pregnant women in Australia,[16] but it was anticipated that they might have specific needs for a culturally secure birthing environment.[17] Women who anticipated a VBAC were likely to be demographically similar to the women included in the original BUDSET validation study,[15] and their previous experiences of pregnancy, labour and birth may have given them useful insights into the relevance

Table 1: Description of study site against BUDSET domains and characteristics

BUDSET		Description of study site
Domain	**Characteristics**	
Fear Cascade	Space: Arrival, Outside, Reception	○ Maternity entrance separate to main hospital ○ Gardens, artwork, tables, seating, lawn ○ Short-term car park immediately adjacent ○ Large longer stay car park short distance away ○ Reception, information desks immediately inside ○ Indoor and atrium seating areas with plants and café ○ Birth unit on entrance level
	Space: Birth rooms	○ Birth rooms along corridor, reception half way ○ Windows face outside gardens or inside atrium, transparent. ○ Latest obstetric technology in plain sight ○ Furnished with staff desk, bed, two visitor chairs
	Sense of domesticity	○ One artwork, modern in each birth room ○ All birth rooms thoroughly cleaned between uses ○ Medical gasses, emergency equipment, linen hampers and waste bins in plain sight in birth room
	Privacy	○ Birth room doors not lockable; windowless and curtained ○ "Knock before entering policy" observed ○ Birth room occupants visible through windows unless blinds closed ○ Lockable drawer available in birth rooms
	Noise control	○ Loudspeaker paging system audible within birth room ○ Conversations and birthing sounds partly audible in corridor ○ Music can be selected and controlled by woman
Facility	Physical support	○ Some birth rooms house equipment such as birth balls, mats, stools, bean bags
	Birthing bath	○ No water birth facilities ○ All birth rooms have standard domestic bath
	Ensuite facilities	○ Toilet and shower behind curtain in each birth room
Aesthetics	Light	○ Birth room lighting is dimmable ○ Lamps, natural light via windows, theatre lighting
	Colour	○ Neutral palette, mostly whites, off whites, peach
	Texture	○ Surfaces are smooth and uniform, often metallic. ○ No use of natural textures (eg wood)
	Indoor environs	○ Temperature adjustable, windows not openable
	Femininity	○ Artwork but not related to femininity, birth, or multicultural ○ No rounded corners or edges, or plants
Support	Food and drink for woman	○ Meals at set times; sandwich/toast available on request ○ Ice water/tea available by request ○ Women may bring own food/drink with them
	Accommodation for companions and birth attendants	○ On same floor as birth unit: ○ Café or nearby shops during business hours ○ Vending machines ○ Tables, comfortable chairs & toilets in hospital foyer ○ No play room or provision for additional children

of items on the CVS. Finally, women who identified as refugees or recent immigrants, especially those anticipating their first birth in Australia, were identified as a participant group as they may have been less familiar with Australian birthing environments. An evaluation of maternity services for women from refugee backgrounds at the study site[18] made several recommendations related to birth environment design and facilities, including the provision of free or low cost childcare, appropriate food and drink, and strategies to enable cultural birthing practices and rituals.

Outcomes

Sample size

The sample was limited to a minimum of six and a maximum of 20 participants per group to match the analysis method adopted by Sheehy et al.[15] It also more than meets the group size minimum of three recommended for this method.[19]

Data collection

Data were collected in February and March 2014 using the Content Validity Survey (CVS)[15] which asked participants to rate, using a Likert-scale, how relevant they regarded each BUDSET characteristic to be in the design of an ideal birth environment. The CVS was retained largely in its original form to ensure results could readily be compared to the findings from Sheehy et al's earlier validation study.[15] Four demographic questions were added, given this study's focus on diverse participant groups, and one question (about stage of pregnancy) was omitted as all women were postnatal.

Women were provided with information about the study via posters displayed in the antenatal clinic waiting rooms at the study site. During the study period, the first author liaised with postnatal ward midwives to identify eligible women, and to ascertain the best time to approach the woman, provide the information sheet, verbally explain the study and answer questions. The information sheet and the researcher emphasised the voluntary nature of participation. Interested women were then invited to sign a consent form and provided with a hard copy of the

survey to complete during their postnatal stay. Women who indicated that they were not interested in the study were not approached again. The hospital's Indigenous Liaison Officers and Aboriginal Maternal and Infant Health Care Workers also assisted with recruitment of Indigenous women. Each survey took approximately twenty minutes to complete, and the researcher was on hand to answer questions.

Information sessions for midwives were conducted in the Birth Unit, after which, midwives who met study inclusion criteria were approached and invited to participate. Midwives completed the survey voluntarily and independently during work time.

Data analysis

Completed surveys were scanned into "Remark", a software management package for survey data collection, before being exported to Microsoft Excel for analysis.

Survey results were analysed via an Item-level content validity index (I-CVI) and a Survey-level validity index (S-CVI) and comparisons were made between the four participant groups. Content validity is the degree to which an instrument has an appropriate sample of items for the construct being measured and is an important procedure in scale development.[20] The Content Validity Index (CVI) is the most widely used index for this purpose, due to its ease of computation, comprehension, and provision of both item and scale information.[19] The I-CVI is the proportion of participants who rated each item as relevant, while the S-CVI was determined by the average of the I-CVI scores for all items for each participant group. To achieve excellent content validity, a scale should be composed of items with I-CVIs of at least 0.78 and have S-CVI of at least 0.9.[20]

Results

A total of 42 participants completed the CVS, including 10 midwives (see Table 2), six Aboriginal and/or Torres Strait Islander women, six women who had an anticipated a VBAC and 20 women from refugee or CALD backgrounds (see Table 3).

Table 2: Demographics of participants midwives (n=10)

Characteristic		**n**
Age	18-25	1
	25-35	3
	35+	6
Training	Bachelor of Midwifery	3
	Post Graduate Midwifery	3
	Hospital trained midwife	2
	Other	2
Years of midwifery experience	0 – 5 years	2
	6 – 10 years	4
	20+ years	4
Any homebirth experience?	No	8
	Yes	2
Models of care experience	Birth unit	10
	Antenatal ward	7
	Postnatal ward	7
	Antenatal clinic	7
	Post-graduate rotational program	6
	Community midwifery	5
	High-risk clinic	3
	Midwifery group practice	1

Table 3: Demographic characteristics of participant women (n=32)

Characteristic		Indigenous women (n=6)	VBAC women (n=6)	CALD women (n=20)
Age	18-25	2	0	2
	26-35	3	4	15
	35+	1	2	3
Highest level of education completed	High School	4	3	3
	Vocational training	0	1	5
	University	2	2	12
Relationship status	De facto	2	1	0
	Married	2	3	20
	Single	2	2	0
Country/region of birth	Australia	6	4	0
	Asia/Middle East	0	2	13
	Europe	0	0	1
	Oceania	0	0	3
	South America	0	0	1
	Africa	0	0	2
Length of time since arrival in Australia	Less than 2 years	n/a	0	1
	2-5 years	n/a	0	6
	5-10 years	n/a	1	5
	> 10 years	n/a	1	8
Permanently emigrated to Australia?	Yes	n/a	2	20
Language spoken at home	English	6	4	6
	Other	0	2	14

Table 4 reports the I-CVI scores for each participant group. Shaded boxes indicate survey items which achieved content validity, with an I-CVI score of greater than 0.78.

Across all participant groups, there was agreement that survey items related to 'Space-Arrival' and 'Space: Reception' were relevant in an ideal birth environment design. Domains in which few participants found relevance included 'Physical Support', 'Colour', 'Texture' and 'Femininity'.

In most domains, only some items were likely to be rated as relevant, precluding those domains from achieving content validity overall. Having sufficient space in the birth room was regarded by all participants as relevant in the design of ideal birth environments, but there was not agreement about the relevance of northerly facing windows or a positive outlook. (In the southern hemisphere,

where this study was conducted, northerly facing windows are the preferred orientation for natural light with minimal heat and glare). While 'Privacy' overall was regarded as relevant, this was restricted to a knock before entering policy, and ensuring the birth room was not visible through windows, or from an open doorway. Other elements, such as lockable doors and secure storage of the woman's belongings were not regarded as relevant by participants. Only some of the survey items related to 'Indoor Environment' were regarded as relevant by all groups: adjustable temperature, additional heating for mother and baby and a blanket warming cupboard. Being able to open windows for fresh air or use aromatherapy were not widely regarded to be relevant.

Some domains were also rated differently between different participant groups. Survey items related to 'Space: Outside' and 'Sense of Domesticity' and 'Birthing Baths' were regarded as relevant by midwives, but less so by women participants. Likewise for 'Lighting', where all participant groups agreed that variable lighting was relevant, but only midwives reported that the presence of natural light was relevant, while only women valued the absence of theatre lighting and the capacity to create a cave-like environment. Midwives and Indigenous women found the domain of 'Food and drink for the woman' more relevant than VBAC and CALD women did. In terms of 'Noise control', all participant groups regarded soundproofing as relevant; only midwives regarded facilities to enable the woman to play music of her choice as relevant, and only women regarded the absence of a paging system as relevant. All participant groups supported the relevance of ensuite (attached bathroom) facilities, in terms of their presence and spaciousness, but only midwives regarded the domesticity of the décor as relevant. Ensuring companions were made to feel welcome was rated as relevant by all participant groups, but specific provisions such as vending machines, telephone areas, and access to toilet/shower found most relevance with midwives.

Table 4: Item-level Content (I-CVI) Validity of BUDSET, by participant group

Survey items		I-CVI scores*				% of participants (n=42) rating item as relevant
		Midwives (n=10)	Indigenous women (n=6)	VBAC women (n=6)	CALD women (n=20)	
Space: Arrival	Safe, well-lit	0.95	1	1	1	97.6%
	Directionally labelled and navigable	1	1	1	1	100.0%
	Temporary parking	1	1	1	1	100.0%
	Separate entrance	0.7	1	1	1	92.9%
	Short and logical route to birth room	1	1	1	1	100.0%
Space: Outside	Visible from birth room	0.7	0.6	0.66	0.33	50.0%
	Accessible with places to sit	0.6	0.5	0.33	0.35	42.9%
	View of trees/landscape	0.8	0.5	0.5	0.35	50.0%
	Positive distractions	0.9	0.5	0.83	0.45	61.9%
	Minimises intrusion (eg urban noise)	0.8	0.5	0.83	0.7	71.4%
Space: Reception	Open, inviting	0.7	1	1	0.9	88.1%
	Sense of entering a private space	0.8	1	1	1	95.2%
	Indoor plants/flowers/living things	0.2	1	0.83	0.75	66.7%
	Supporters waiting area	1	1	1	1	100.0%
	Beverages/snacks for supporters	0.9	1	1	0.9	92.9%
Space: Birth room	Sufficient space	0.9	1	1	1	100.0%
	Windows face north	1	0	0	0	2.4%
	Positive outlook	0.1	0.6	0.83	0.4	64.3%
Sense of domesticity	Cleanliness	1	1	1	1	100.0%
	Medical gases available but hidden	0.9	0	0.16	0.2	33.3%
	Emergency equipment hidden	0.8	0	0.16	0.15	33.3%
	Waste and used linen hidden	0.9	0.83	0.83	0.85	85.7%
	Gas outlets flexible to allow movement	1	1	0.5	0.5	66.7%
Privacy	Lockable doors	0.1	0	0	0.15	9.5%
	Knock before entering rule	0.9	1	1	1	97.6%
	Unable to be seen through window	1	1	0.83	0.9	92.9%
	Lockable place for woman's belongings	0.3	0.16	0	0.35	26.2%
	Woman not visible from doorway	1	1	0.83	0.95	95.2%
Noise Control	Absence of paging system	0.7	1	1	1	92.9%
	Sound proof	1	1	1	1	100.0%
	Can choose own music	0.9	0.5	0.56	0.25	50.0%
Physical support	Birth assistance materials	1	0.66	0.33	0.25	50.0%
	Bars on walls at various heights	0.6	0.33	0.33	0.15	31.0%
	Mantelpiece or similar to lean on	0.4	0.33	0.33	0.15	26.2%
	Comfortable chair for breastfeeding	0.6	0.33	0.5	0.2	35.7%
	Comfortable space for supporters	0.8	0.83	0.66	0.65	66.7%
Birthing bath	Bath in birth room	0.7	0.5	0.33	0.3	42.9%
	Access to bath in next room	0.8	0.5	0.33	0.35	47.6%

	Bath is deep and wide	0.8	0.5	0.33	0.25	42.9%
	Bath has rails to pull up on	0.9	0.5	0.33	0.25	45.2%
	Two sided access to bath	0.8	0.5	0.33	0.25	42.9%
Ensuite facilities	Toilet and shower in ensuite	1	1	1	0.95	97.6%
	Adequate space in shower/toilet	1	1	0.83	1	97.6%
	Domestic feel, not institutional	0.9	0.66	0.66	0.7	73.8%
Lighting	Natural light	0.9	0.66	0.66	0.65	66.7%
	Able to see through windows from bed	0.7	0.66	0.66	0.35	52.4%
	Variable lighting	0.9	1	0.83	1	95.2%
	Absence of theatre lighting	0.6	1	1	1	90.5%
	Cave-like	0.7	1	1	0.95	95.2%
Colour	Tonal contrasts	0.3	0	0.5	0.3	31.0%
	Limited palette	0.4	0	0.5	0.3	33.3%
	Minimal white/yellow	0.3	0.16	0.5	0.3	33.3%
	Floor non-shiny	0.3	0	0.16	0.1	14.3%
	Wood-like materials	0.4	0	0.66	0.3	33.3%
Texture	Textural variety in birth room	0.2	0	0.5	0.25	23.8%
	Textural variety on décor	0.1	0	0.5	0.3	35.7%
	Furnishings soft but strong	0.4	0	0.5	0.3	31.0%
	Natural materials, eg timber/tiles	0.2	0	0.66	0.35	31.0%
	Minimal metal materials	0.4	0	0.5	0.15	23.8%
Indoor Environment	Adjustable temperature	1	1	1	0.95	97.6%
	Additional heating for mother/baby	1	1	1	1	100.0%
	Blanket warming cupboard	1	1	1	1	100.0%
	Windows openable	0.7	0.66	0.5	0.4	52.4%
	Aromatherapy	0.8	0.33	0.66	0.25	45.2%
Femininity	Feminine archetypes	0.2	0.5	0.66	0.35	40.5%
	Rounded corners/edges	0.3	0	0.33	0.05	14.3%
	Flowers/plants	0.2	0.5	0.66	0.5	47.6%
	Calm, peacefulness common areas	0.9	0.5	0.66	0.75	73.8%
	Artwork embraces multiple cultures	0.5	0.5	0.66	0.6	57.1%
Food/drink for woman	Available 24 hours	0.9	1	1	1	95.2%
	Microwave available	0.8	1	0.5	0.4	50.0%
	Toaster available	0.8	1	0.5	0.4	50.0%
	Hot water available	1	1	1	0.9	95.2%
	Refrigerator and ice available	1	1	0.83	0.5	73.8%
Accom for companions	Companions made welcome	1	1	1	1	100.0%
	Vending machines	0.9	1	0.66	0.4	64.3%
	Telephone access/area	1	0.16	0.16	0.25	42.9%
	Access to toilet/shower	0.8	0.5	0.5	0.3	47.6%
	Play room/entertainment for children	0.4	0.33	0.5	0.5	45.2%
Items reaching content validity (of 69)		**47**	**35**	**33**	**28**	
Scale Content Validity (S-CVI)		**0.72**	**0.62**	**0.66**	**0.57**	

* Shaded boxes indicate that content validity was achieved (ie I-CVI score >0.78)

Discussion

The study examined the validity of the BUDSET with four new participant groups: traditional/standard birth unit midwives; Indigenous women; women who had anticipated a VBAC, and women from refugee and CALD backgrounds. Overall, the BUDSET was not found to have sufficient Scale-level content validity (S-CVI) with any of these participant groups. Relatively few items reached Item-level content validity (I-CVI), unlike the earlier findings of Sheehy et al (see Table 5).

The low content validity for the BUDSET found in this study raises two important questions: Firstly, can a survey accurately assess the importance of birthing room design and its impact on birthing women, and secondly, if participants indicate that most survey items have low relevance does that necessarily mean that these design characteristics are unimportant?

Design beyond awareness

Good hospital design changes the health service users' experience, possibly outside their own awareness.[21,22] Given the significant evidence base which supports the items included in the BUDSET,[12] the items to which participants gave low relevance may still have value. For example, although participants in this study did not regard the inclusion of plants or views of nature as an important feature in a birthing room, other studies attest to the importance of including the natural environment in hospital design.[23] Such design inclusions may alter women's experiences or reduce stress, or may support wayfinding and navigation in transitional spaces,[24] even where women are not consciously aware of their impact, thus giving them value independent of perceived relevance.

The use of a survey such as the CVS also intersects with the problems associated with the concept of satisfaction with maternity care, especially that health "service users tend to value the status quo over innovations of which they have no experience."[25, p75] For example, whereas midwives regarded the inclusion of a bath as relevant in ideal birth room design, this item did not reach I-CVI in women's responses. Given that waterbirth was not available at the study site at the time of the

Table 5: Validity of BUDSET from the current study and Sheehy et al [15]

BUDSET characteristics	Women					Midwives		
	In this study			In Sheehy et al		In this study	In Sheehy et al	
	Indigenous women	VBAC women	CALD women	Antenatal women	Postnatal women	Birth Unit midwives	Midwifery academics	Caseload midwives
Space: Arrival	Y	Y	Y	Y		Y	Y	Y
Space: Outside							Y	Y
Space: Reception	Y	Y	Y				Y	Y
Space: Birth rooms								
Sense of Domesticity						Y	Y	Y
Privacy				Y			Y	
Noise control				Y	Y	Y	Y	Y
Physical support				Y	Y		Y	Y
Birthing bath				Y	Y	Y	Y	Y
Ensuite facilities				Y	Y	Y	Y	Y
Light								Y
Colour								
Texture								
Indoor environment				Y	Y	Y	Y	Y
Femininity								
Food/drink for woman	Y			Y	Y	Y	Y	Y
Accom for companions				Y	Y	Y	Y	
Number of domains where validity reached (of 17)	3	2	2	9	7	8	12	11

survey, perhaps women's low rating on these items related to an acceptance of the status quo. A similar phenomenon of accepting the status quo may have influenced midwives' responses. Midwives in this study found the BUDSET items more relevant than the groups of women, but not as relevant as the caseload midwives in the original study by Sheehy et al.[15] Although both groups of midwives worked in traditional birth unit environments (not birth centres with 'homelike' environments), mainstream practice is likely to be accompanied by higher levels of medicalisation and perhaps therefore acceptance of medicalised environments. Nonetheless, midwives in the current study appeared keenly aware of the research about the benefits of, for example, water immersion.

It was also beyond the scope of this study to report on participants' clinical outcomes, or use of the birth environment, but this may have influenced their perception of relevance. Such information (such as epidural use and length of stay in Birth Unit) may have provided useful contextual data regarding opportunity to assess and make use of the birth environment. Elements such as physical support and outdoor space, may not have been used by women during their labours for a range of reasons. For example, the use of epidural may have limited their capacity to make use of physical supports, or conversely, it may have allowed them to be more relaxed and able to take in their surroundings. Alternatively, if women are not "introduced" to the space and facilities and supported to use the options available, they may not do so, nor perceive any value in doing so. It may also be participants did not feel they were "allowed" to leave the birthing area to access outdoor spaces, or that the spaces available did not meet their needs (for example, where they are also accessed by the public).

Much of the research about the impact of the built environment on health care experience and outcomes[21,23,26] has not been conducted in a maternity setting and where they have been,[3] they are likely confounded by other factors. The attitude, competence and helpfulness of the staff may be at least as significant as the layout, furnishings, and ambience.[27] The positive effects of home-like birth

environments may be overpowered by routine institutional policies and practices,[28] especially when they are co-located within a larger hospital, rather than being freestanding units with their own governance. This makes it difficult to draw inferences about the independent effects of the physical birth environment.[3] While changing the conventional hospital environment may indeed make it more homelike, this may not be sufficient to change the conventional power dynamics and therefore birth outcomes.[27,29]

It was interesting to note that the only domains in which all groups of women in the current study found relevance were Space: Arrival and Space: Reception. Women interact with both of these domains of the birth environment during the vulnerable transition period, when their strategies for coping with early labour may be disrupted. Perhaps the vulnerability made them more acutely sensitive to the impact of entering a new environment. Attending to the design of these spaces may therefore have significant impact on women's birth experiences, as early labour care can set the tone for the rest of the childbirth experience.[30] Perhaps more importantly however, women interact with these arrival and reception spaces before they are formally admitted to the hospital and thus before they become 'patients.' Once in the role of patient, powerful norms lead women to adopt a docile or submissive stance.[31] The lack of relevance women perceived in many of the design features of an ideal birth environment may therefore have been an expression of this 'docility,' the sense of having very limited control over their environment where most of those features were lacking.

Women's views differ from Midwives'

One similarity between these findings and those of Sheehy et al,[15] is that in both studies, women found less relevance in the BUDSET characteristics than midwives did (although this disparity was greatest in the current study). Different perceptions of the relevance of the BUDSET between women and midwives may reflect midwives being out of touch with women's needs, or may be a result of different or competing priorities. For example, most midwives in this study reported that emergency equipment should be out of sight, but few women agreed with this. This was particularly

so for immigrant and refugee women where all but two participants valued seeing such equipment. There may be several explanations for this. While the physical environment is thought to influence the behaviours and activities that constitute midwifery practice,[32,33] women may not be as aware of the possible negative impact of seeing emergency equipment.[4,34] Alternatively, some women may find the visible presence of such equipment reassuring, part of the technological support in childbirth that has been reported to provide them with a greater sense of control.[35] This may be particularly influenced by prior experience of accessing health care in low resource settings where access to life saving medical intervention cannot be taken for granted.

In other cases, disagreement between midwives and women may be accounted for by different priorities in the birth room. Although seven out of ten midwives felt the absence of a loudspeaker/paging system was relevant, 100% of women agreed with this. Perhaps labouring women are more likely to be disturbed by announcements than midwives who are habituated to the environment and are exposed to the paging system constantly. Likewise for lighting, where all women favoured the absence of bright theatre lighting, but this item was not relevant for midwives. In this case, midwives may be more aware of the need for bright theatre lighting in certain circumstances, whereas this was at odds with the emphasis most women placed on the ability to create a cave-like environment. That is, midwives may have prioritised facilitating work flow (focused on the medical interventions), rather than optimising the environment for physiologic birth.[36]

Using BUDSET with diverse groups

By asking four new groups of participants to evaluate the BUDSET, this study has yielded more information on the appropriateness of the tool for use with diverse groups of women. All groups of women in the current study regarded few of the BUDSET characteristics to be relevant to ideal birth environment design, and overall the CVS was not found to be valid for use with Indigenous women, women anticipating VBACs or women from refugee or CALD backgrounds. It may be that the BUDSET

should only be applied to populations similar to those who deemed it valid in the original study (caseload midwives and women accessing their services). However, particularly for Indigenous women and women from refugee and CALD backgrounds, the items that participants did find relevant may be instructive to health services considering birth space design or redesign.

Aboriginal and Torres Strait Islander Women

Results from this study indicate that Aboriginal and Torres Strait Islander women place particular emphasis on provisions for support people, and may prefer to birth in a room that has provisions for more than two support people. Culturally, it may be very important for some women to have the support of many family members and friends, creating a need for sufficient food and chairs for large family groups. Indeed choice of companionship at birth is recognised in the Universal Rights of Childbearing Women.[37] A review into the study site's Murri clinic established the importance of multiple support people for Aboriginal and/or Torres Strait Islander women,[38] but other studies have concluded that traditional birth unit environments often do not meet the needs of supporters thus limiting the potential benefits of their support role.[39] Creating an environment that welcomes multiple support people. including for male partners, can help overcome the unfamiliar and hostile impression women may have of the hospital. Indeed doing so is part of supporting women's rights to Respectful Maternity Care.[37]

Furthermore, the characteristics of the physical environment are a key consideration for culturally competent maternity care since they "provide powerful first impressions for the service user and signify how and if the institution values Aboriginal and Torres Strait Islander people."[17] Given that women in this study found most relevance in aspects of the environment related to first impressions, these considerations should be paramount. Such first impressions come from visual acknowledgement of Aboriginal and/or Torres Strait Islander culture, including flying Indigenous flags and displaying plaques acknowledging the traditional owners of the land on which the health service is situated. Displaying artwork from local and national Aboriginal and Torres Strait Islander

artists and using traditional local languages on signage can also contribute to a welcoming and respectful environment.[17]

Women from refugee and CALD backgrounds

Results from this study indicate that women from refugee and CALD backgrounds may place particular emphasis on the availability of appropriate food and drink. This may have been because the hospital menu did not accommodate their dietary preferences. For example, they may have been offered ice water, when hot water may be a cultural requirement.[40] Similarly, requests for halal or vegetarian food may have yielded simple salads, which the woman may not have regarded as providing the energy she needed for birth.

Study Limitations

Several limitations of this study should be noted. First, to date studies of BUDSET have been limited to hospital birth environments (either in a birth centre within a hospital, or a traditional birth unit); the findings may not be generalizable to freestanding birth centres or home. Second, although the study recruited culturally and linguistically diverse women, no interpreter services were available; women who could not complete the survey in English were excluded. Third, the phrasing and sequence of survey questions may have introduced bias by encouraging participants to consider ideas that they may not have previously contemplated. Fourth, in a divergence from the research of Sheehy et al.,[15] we used only a survey rather than also interviewing participants. Interviews could have elicited more or different information from participants about the relevance of the BUDSET characteristics. However, women in the current study completed the survey during their postnatal stay, where logistical constraints made interviewing impractical. Finally, it remains unclear whether a survey design can in fact assess midwives' and women's satisfaction with birthing environment design given that evidence suggests environment affects us on a subconscious level.[21,22,41]

Conclusion

In conclusion, further research is needed to explore the features of birth environment design that are valued by diverse groups of participants, and to unpick the apparent disparity between midwives and women's perceptions. However, survey-based methods may not be the most useful approach as they may not be able to address the subconscious level on which birth environment design may influence outcomes, or address confounds such as acceptance of the status quo, model of care and institutional policies and practices. Innovative methodologies need to be explored in the further study of birth environment design. Discrete choice experiments have been used to quantify the value health service users place on different aspects of experience, including in maternity,[42,43] particularly to address limitations with the concept of satisfaction.[44] Immersive virtual reality could also be used to allow participants to experience and interact with different birth environments.

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References

1. Ulrich RS, Zimring C, Zhu X, et al. A review of the research literature on evidence-based healthcare design. *Health Environments Research & Design Journal* 2008; **1**(3): 61-125.

2. Hodnett ED, Stremler R, Weston JA, McKeever P. Re-conceptualising the hospital labor room: The PLACE (pregnant and laboring in an ambient clinical environment) pilot trial. *Birth* 2009; **36**(2): 159-66.

3. Hodnett ED, Downe S, Walsh D, Weston J. Alternative versus conventional institutional settings for birth. *Cochrane Database Syst Rev* 2012; (9).

4. Fahy K, Foureur M, Hastie C, editors. Birth territory and midwifery guardianship: Theory for practice, education and research. Edinburgh: Elsevier; 2008.

5. Odent M. The fetus ejection reflex. *Birth* 1987; **14**(2): 104-5.

6. Newton N, Foshee D, Newton M. Parturient mice: effect of environment on labor. *Science* 1966; **151**(3717): 1560-1.

7. Newton N. The fetus ejection reflex revisited. *Birth* 1987; **14**(2): 106-8.

8. Lothian JA. Do not disturb: the importance of privacy in labor. *The Journal of perinatal education* 2004; **13**(3): 4-6.

9. Gimpl G, Fahrenholz F. The oxytocin receptor system: structure, function, and regulation. *Physiological reviews* 2001; **81**(2): 629-83.

10. Taylor SE, Klein LC, Lewis BP, Gruenewald TL, Gurung RA, Updegraff JA. Biobehavioral responses to stress in females: tend-and-befriend, not fight-or-flight. *Psychological review* 2000; **107**(3): 411.

11. Foureur M, Davis D, Fenwick J, et al. The relationship between birth unit design and safe, satisfying birth: Developing a hypothetical model. *Midwifery* 2010; **26**(5): 520-5.

12. Foureur MJ, Epi GDC, Leap N, Davis DL, Forbes IF, Homer CS. Developing the birth unit design spatial evaluation tool (BUDSET) in Australia: A qualitative study. *Health Environments Research & Design Journal* 2010; **3**(4): 43-57.

13. Forbes I, Homer C, Foureur M, Leap N. Birthing unit design: researching new principles. *Design & Health Scientific Review* 2008; **1**: 47-53.

14. Foureur MJ, Leap N, Davis DL, Forbes IF, Homer CS. Testing the birth unit design spatial evaluation tool (BUDSET) in Australia: a pilot study. *Health Environments Research & Design Journal* 2011; **4**(2): 36-60.

15. Sheehy A, Foureur M, Catling-Paull C, Homer C. Examining the Content Validity of the Birthing Unit Design Spatial Evaluation Tool Within a Woman-Centered Framework. *Journal of Midwifery & Women's Health* 2011; **56**(5): 494-502.

16. AIHW. Australia's mothers and babies 2013—in brief. Canberra, 2015.

17. Kruske S. Culturally Competent Maternity Care for Aboriginal and Torres Strait Women Report September 2012, prepared on behalf of the Maternity Services Inter-Jurisdictional Committee for the Australian Health Ministers' Advisory Council. 2012. http://www.health.gov.au/internet/main/publishing.nsf/Content/77F5B09BC281577ACA257D2A001EE8CD/$File/cultur.pdf (accessed June 20 2018).

18. Stapleton H, Murphy R, Correa-Velez I, Kildea S. Evaluation of the mater Mothers' hospitals Refugee Antenatal Clinic. Brisbane: Mater Mothers Hospital, 2010.

19. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in nursing & health* 2007; **30**(4): 459-67.

20. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health* 2006; **29**(5): 489-97.

21. Johnson J. Designs for Healing. *American Medical News* 1995; **32**(8).

22. Stenglin M, Foureur M. Designing out the Fear Cascade to increase the likelihood of normal birth. *Midwifery* 2013; **29**(8): 819-25.

23. Bowler DE, Buyung-Ali LM, Knight TM, Pullin AS. A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health* 2010; **10**(1): 456.

24. Jiang S, Verderber S. On the Planning and Design of Hospital Circulation Zones: A Review of the Evidence-Based Literature. *Health Environments Research and Design Journal* 2016; **10**(2): 124-46.

25. van Teijlingen ER, Hundley V, Rennie A-M, Graham W, Fitzmaurice A. Maternity satisfaction studies and their limitations: "What is, must still be best". *Birth* 2003; **30**(2): 75-82.

26. Ulrich R, Quan X, Zimring C, Joseph A, Choudhary R. The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity. Concord, CA: : The Center for Health Design, 2004.

27. Rowlands J, Noble S. How does the environment impact on the quality of life of advanced cancer patients? A qualitative study with implications for ward design. *Palliative Medicine* 2008; **22**(6): 768-74.

28. Fannin M. Domesticating birth in the hospital:"Family-centered" birth and the emergence of "homelike" birthing rooms. *Antipode* 2003; **35**(3): 513-35.

29. Hardy S, Wiedmer C, editors. Motherhood and Space: Configurations of the maternal through politics, home, and the body. New York: Palgrave Macmillan; 2005.

30. Janssen P, Nolan M, Spiby H, et al. Roundtable Discussion: Early Labor: What's the Problem? *Birth* 2009; **36**(4): 332-9.

31. Fahy K. Power and the social construction of birth territory. In: Fahy K, Foureur M, Hastie C, eds. Birth Territory and Midwifery Guardianship. Edinburgh: Butterworth Heinemann Elsevier; 2008.

32. Hammond AD, Homer CSE, Foureur M. Messages from Space: An Exploration of the Relationship between Hospital Birth Environments and Midwifery Practice. *HERD: Health Environments Research & Design Journal* 2014; **7**(4): 81-95.

33. Hammond, Athena, Homer CSE, Foureur M. Friendliness, functionality and freedom: Design characteristics that support midwifery practice in the hospital setting. *Midwifery* 2017; **50**: 133-8.

34. Odent M. Preparing the nest. *Midwifery today* 2003; (68): 13.

35. Fenwick J, Staff L, Gamble J, Creedy DK, Bayes S. Why do women request caesarean section in a normal, healthy first pregnancy? *Midwifery* 2010; **26**(4): 394-400.

36. Hall PJ. Keeping it together, falling apart and everything in between: A phenomenology of women's experience of childbirth. Ann Arbor: Emory University; 2015.

37. White Ribbon Alliance. Respectful Maternity Care: The universal rights of childbearing women. 2011. http://whiteribbonalliance.org/wp-content/uploads/2013/10/Final_RMC_Charter.pdf (accessed 23 June 2014).

38. Stapleton H, Murphy R, Gibbons K, Kildea S. Evaluation of the Mater Mothers' Hospitals Murri Antenatal clinic. Brisbane: Mater Health Service, 2011.

39. Harte JD. The childbirth supporter study: Video-ethnographic examination of the physical birth unit environment. Sydney: University of Technology Sydney; 2015.

40. Queensland Health. Cultural Dimensions of pregnancy, birth and post-natal care. nd. https://www.health.qld.gov.au/multicultural/support_tools/mcsr (accessed 24 May 2018).

41. Kahn PH. Technological nature: Adaptation and the future of human life. Cambridge: MIT Press; 2011.

42. Hendrix M, Pavlova M, Nieuwenhuijze MJ, Severens JL, Nijhuis JG. Differences in preferences for obstetric care between nulliparae and their partners in the Netherlands: a discrete-choice experiment. *Journal of Psychosomatic Obstetrics & Gynecology* 2010; **31**(4): 243-51.

43. Scotland G, McNamee P, Cheyne H, Hundley V, Barnett CA. Women's preferences for aspects of labor management: results from a discrete choice experiment. *Birth* 2011; **38**(1): 36-46.

44. Hundley V, Ryan M, Graham W. Assessing Women's Preferences for Intrapartum Care. *Birth* 2001; **28**(4): 254-63.