Associations Between Dental Care Approachability and Dental Attendance Among Women Pregnant With an Indigenous Child: A Cross-Sectional Study

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Abstract

Background Oral health during pregnancy is vital for both mother and child. Indigenous Australians face many barriers in accessing dental care. Service approachability is one of the key domains in accessing health services. There is little empirical evidence of the association between service approachability and dental care attendance or oral health outcome. The aim of this study is to examine the relationship between dental service approachability on dental care attendance and self-reported gum disease among South Australian women pregnant with an Aboriginal child.

Methods Four hundred and twenty-seven women pregnant with an Aboriginal child completed questionnaires in both metropolitan and regional health settings in South Australia in 2011. Four variables related to approachability of dental services: (1) perception of need; (2) service-related health literacy; (3) oral health beliefs and; (4) trust and expectation of dental service. The association between service approachability-related factors, dental utilisation and self-reported gum disease during pregnancy were assessed using Generalised Poisson regression models, after adjusting for age, remoteness, employment status and education. Estimates were presented as adjusted prevalence ratios (APR).

Results Most participants (85.8%) reported a need for dental care, had positive oral health beliefs (88.3%) and had expectations towards dental care (86.2%). Dental service utilisation during pregnancy was low (35.7%). Many participants (78.0%) expressed knowing what to do if they needed dental care, while most (39.8%) doubted that dental care would be available the next day. Poor health service literacy was identified as a risk factor for non-optimal dental attendance (APR=0.86, 95%CI: 0.74-0.99). Perceived need for dental care was positively associated with self-reported gum disease (APR= 1.24 95%CI 1.06-1.45).

Conclusion Inability to navigate the dental care system was a risk factor for poor dental attendance among South Australian women pregnant with an Aboriginal child. Perceived need for dental care was associated with gum disease.

Background

Indigenous Australians are those who identify as Aboriginal and/or Torres Strait Lander[1]. Indigenous Australians are the first residents of Australia, and have unique traditions, cultures, and languages[1]. However, Indigenous Australians have poorer oral health, and experience more oral health conditions compared with non-Indigenous Australians[2]. In the National survey of Adult Oral Health, Indigenous adults had higher levels of untreated caries and missing teeth, and a lower prevalence of filled teeth, compared with non-Indigenous Australian[3].

Pregnant women are more affected by oral conditions due to hormonal and immunologic changes during pregnancy[4, 5]. Oral conditions during pregnancy may have adverse effects on both maternal and child health outcomes. Approximately 30~47%[6, 7] of pregnant women have experienced gingivitis during pregnancy, which leads to pain, uncontrollable bleeding, and difficulties eating[8]. Periodontal disease, which stems from gingivitis, may increase risk of adverse maternal outcomes, such as systemic
inflammation\textsuperscript{[9, 10]} and preeclampsia\textsuperscript{[11, 12]}. Maternal experience of dental caries during pregnancy is a contributing factor of early childhood caries (ECC) among children\textsuperscript{[13]}. ECC affects children's eating, speech and self-confidence\textsuperscript{[13]}. Experience of dental disease in childhood increases the risk of experiencing dental disease in later life\textsuperscript{[14, 15]}.

To maintain good oral health, annual dental check-ups are essential\textsuperscript{[16]}. A higher proportion of non-Indigenous Australians attend a dentist once or more a year (60.3\%)\textsuperscript{[17]} compared with non-Indigenous Australians (15-38\%)\textsuperscript{[18, 19]} . The low utilisation of dental care among Indigenous Australians may arise from a range of barriers Indigenous Australians face in regard to accessing timely, culturally appropriate and affordable dental care. Specifically, factors affecting dental care uptake of Indigenous Australians include cultural appropriateness of service\textsuperscript{[20, 21]}, remoteness of residency\textsuperscript{[22]}, cost\textsuperscript{[23]} and experience of discrimination in previous receipt of health services\textsuperscript{[24]}.

Levesque and colleagues\textsuperscript{[25]} (Figure 1) developed a model that summaries the key determinants in accessing health service through a multi-level perspective. The five dimensions that may be used to evaluate accessibility of a given health service include service: (1) approachability; (2) acceptability; (3) availability and accommodation; (4) affordability and; (5) appropriateness. The five dimensions reflect linear stages of a patient's journey from to the initial perception of requiring health care to the final accomplishment of receiving the required treatment. These five dimensions simultaneously correspond with five abilities for consumers: (1) ability to perceive; (2) ability to seek; (3) ability to reach; (4) ability to pay and; (5) ability to engage\textsuperscript{[25]}. This study is especially interested in the effect of service approachability (ability to perceive), which is the first stage of accessing dental care, and the impact of this to have on utilisation of dental care.

According to Levesque\textsuperscript{[25]}, approachability of a health service should enable people who need the service can identify that the service exists, can be reached, and will have an impact on their health. On the demand side\textsuperscript{[25]}, service approachability is related to one's ability to perceive the need of a service, which is constructed by one's health literacy, health belief and expectation and trust of the service. Individual health literacy is related to one's ability to access, understand and apply health information\textsuperscript{[26]}. In this model, health literacy was referred to service-related health literacy, including knowledge of system navigation. Having health service-related knowledge is essential because it is the first step in interacting with the health care environment\textsuperscript{[27]}. In the context of oral health, a belief in good oral health is important to ensure dental services are utilised; such beliefs in oral health can lead to behaviour changes, for example, leading one to seek health care in the first instance. Broadbent and colleagues\textsuperscript{[28]} reported that children's oral health belief, which was associated with their parents' oral health belief, predicted the uptake of dental care when the children grew older. In the Indigenous Australian context, trust and expectation of the health service play indispensable roles in accessing health care. Due to long lasting legacy of colonial practises and laws, including cultural discrimination, lack of trust is one of the primary causes of poor uptake of health services among Indigenous Australians \textsuperscript{[29]}.
Other researchers have, in recent years, applied the model developed by Levesque[25] when working with marginalised populations, such as refugees[30] and Indigenous people[27]. However, all prior research used the model to structure reviews, not to examine the inherent associations of each of the domains with a given service utilisation and its health outcome. Our research is innovative in applying the Levesque model to examine the relationship between dental service approachability on the demand side with dental care attendance and reported gum disease among women pregnant with an Aboriginal child in South Australia.

**Methods**

**Study design**

Data for this study were collected during 2011 to 2012 as part of the baseline data collection of an early childhood caries intervention among Indigenous children in South Australian[31].

**Setting and Recruitment**

Participants were recruited through the antenatal clinic of hospitals and Aboriginal Community Controlled Health Organisations in South Australia in both metropolitan and regional locations. During data collection, researchers and staff members in health settings would approach potential participants and to provide information about the study, before obtaining written, informed consent. The questionnaire included items used in the Australia national dental survey[32], and had been pilot tested and discussed by members in Indigenous communities and Aboriginal Maternal Infant Care workers. Recruitment commenced February 1, 2011 and ended on May 30, 2012.

**Ethics and consent**

Ethical approval was received from the University of Adelaide Human Research Ethics Committee, the Aboriginal Health Council of South Australia, the Government of South Australia, the Human Research Ethics Committee of Child, Youth and Women’s Health Service, and the Human Research Ethics Committees of participating Adelaide hospitals. The study was guided by an Indigenous reference group, World Health Organisation guidelines on ethical conduct in health research on Indigenous people[33], and local Indigenous South Australia principles. The study additionally used the Ethical Conduct in Aboriginal and Torres Strait Islander Health Research guidelines to obtain consent[34]. Participants received a $50 voucher for reimbursement of time after completing the questionnaires.

**Development of service-oriented model of accessing dental care**

To better fit the oral health context, we modified the model developed by Levesque(Figure 2)[25]. Each factor was replaced by oral health-related, and dental service-oriented determinates. These included oral health service-related health literacy, which included literacy about dental system navigation, oral health beliefs of visiting a dentist, trust and expectations of a dental service, and perceived need for dental care.
According to the modified model, different stages were linear from the perception of needing care to the accomplishment of the dental patient journey.

Variables

According to the modified model, there were three factors impacting ability to perceive: dental service health literacy, oral health beliefs, and trust and expectations of the dental provider. With the addition of perceived need for dental care, there were thus four dimensions measured in this study.

Dental service-related health literacy was measured by patient’s ability to navigate to the dental health system. Dental service-related health literacy was measured by “If you needed to visit to the dentist tomorrow, would you know what to do?” and “Do you think there would be a dentist able to see you tomorrow?” (response options ‘yes’ or ‘no’). Dental health belief was measured by the question: “How important do you rate the visiting dentist in relation to health?”; with responses categorised as ‘important’ and ‘doesn't matter much/not important’. Trust and expectation toward dental care was measured by the question “I believe going to the dentist would help my teeth”, and responses were dichotomised as ‘strongly agree’ and ‘not strongly agree/somewhat agree or doesn't much’. The oral health outcome was measured by self-reported gum disease during pregnancy. The dental care utilisation outcome was measured by time of the last dental visit (≤ 1 year or 12+ months). Participant’s perception of need was measured by asking: “Do you think you need to see a dentist?” (response options ‘yes’ or ‘no’).

Social-demographic variables included age, employment status, education level and geographic remoteness of residential location. The definition of the remoteness of the resident location followed the Accessibility/Remoteness Index of Australia (ARIA+)[35], with the location subsequently categorised as remote and non-remote area. Age was presented as mean values (years) and its standard deviation and was re-categorised as ‘34 years or less’ and ‘over 35 years’ to facilitate multivariable analysis. Education was categorised as ‘no schooling’, ‘primary/secondary education’, and ‘tertiary education’. Employment status was categorised as ‘employed’ or ‘receiving Centrelink payment/other’.

Statistical analysis

Age was presented as means and standard deviations. All other variables were categorical, and thus presented as frequency and percentage. Chi-square tests were used in bivariate analysis, while adjusted prevalence ratios and their corresponding 95% confidence intervals were used in multivariable analysis using Generalised Poisson regression models[36], because the distribution of outcome variables was under-dispersed[37]. Factors related to service approachability (perceived need for dental care, oral health belief, dental service health literacy and trust and expectation toward service) were tested in bivariate analysis, with variables with statistically significant differences (P<0.05) entered into multivariable models. Confounders were adjusted for, and included remoteness of residency, education level and employment status. Age was an additional confounder in the model involving dental attendance (Model 1). Additional analyses were performed to examine the association between dental attendance and self-reported gum disease. Annual dental visit was entered into the regression model as an exposure for self-
reported gum disease, and adjusted for remoteness, education and employment status. Variables with \( P<0.05 \) in 2-sided \( \alpha \) level were considered as being statistically significantly different in all analyses. Data were analysed using R version 3.6.1.

**Results**

A total of 554 eligible participants were invited to take part in the study, with 427 (77%) providing consent and completing the questionnaire. The average age of participants was 25.3 years (Table 1). Most participants reported having received primary/secondary education (70.3%), and approximately one-third (28.1%) had received tertiary education. Approximately 15% of participants were in current employment. The majority of participants lived in non-remote locations (86.9%).

| Table 1: Demographic characteristic of women pregnant with an Indigenous child in South Australia |
|----------------|----------------|---------------------------------|----------------|
|                | n              | % (95% CI)                      |
| **Total**      | 427            |                                |
| **Age**        | 25.28 ± 5.84 (mean) |                                |
| 36 years       | 381            | 94.1 (91.3-96.1)                |
| <36 years      | 24             | 5.9 (3.8-8.6)                   |
| **Education level** |            |                                |
| No schooling   | 7              | 1.7 (0.6-3.4)                   |
| Primary/secondary education | 298 | 70.3 (65.7-74.6) |
| Tertiary education | 119 | 28.1 (23.8-32.6) |
| **Employment** |                |                                |
| Job            | 61             | 14.5 (11.3-18.2)                |
| Other/Centrelink payment | 360 | 85.5 (81.8-88.7) |
| **Location**   |                |                                |
| Non-Remote     | 359            | 86.9 (83.2-90.0)                |
| Remote         | 54             | 13.1 (1.0-16.7)                 |
Table 2 presents characteristics of the dependent variables. Around 43% of participants reported having experience of gum disease; of these, 30% reported attending for dental care in the previous 12 months. Almost all participants (97%) reported having seen a dentist in their lifetime, with just over one-third (36%) having visited in the previous 12 months. Of participants who had visited a dentist in the last 12 months, 37% self-reported having gum disease. Around 86% of participants perceived a need for dental care. Of these, one-third (33%) had visited a dentist in the previous 12 months. Most participants (88%) perceived visiting a dentist to be very important. Of these, just over one-third (37%) had attended for dental care in the last 12 months. Just under one quarter of participants (22%) reported not knowing what to do if they needed to visit the dentist the next day. Just over 60% of participants reported that they did not think a dentist would be able to see them the next day. Most participants (86%) strongly agreed that going to the dentist would help their teeth.

Table 2 Service approachability-related factors by self-reported gum disease and dental attendance among women pregnant with an Indigenous child in South Australia
|                        | n  | %     | Self-reported gum disease | Last dental visit <1 year ago |
|------------------------|----|-------|---------------------------|-----------------------------|
|                        |    | % (95% CI) | % (95% CI)                |                             |
| **Total**              | 427| 100.0 | 42.7 (37.9-47.5)          | 35.7 (29.9-39.1)            |
| **Oral health outcome**|    |       |                           |                             |
| Do you have gum disease/bleeding gums? |    |       |                           |                             |
| Yes                    | 182| 42.7  | .                         | 30.2 (23.6-37.5)            |
| No                     | 244| 57.3  | .                         | 37.7 (31.6-44.1)            |
| **Dental service utilisation**|    |       |                           |                             |
| Have you seen the dentist before? |    |       |                           |                             |
| Yes                    | 411| 96.9  | 42.8 (38.0-47.7)          | 35.8 (31.1-40.6)            |
| No                     | 13 | 3.1   | 30.8 (9.1-61.4)           | 0.0                         |
| When did you last see a dentist? |    |       |                           |                             |
| <1 year                | 147| 35.7  | 37.4 (29.6-45.8)          | .                           |
| 1 year                 | 265| 64.3  | 45.7 (39.6-51.9)          | .                           |
| **Perceiving need of dental service**|    |       |                           |                             |
| Do you think you need to see a dentist? |    |       |                           |                             |
| Yes                    | 362| 85.8  | 47.3 (42.0-52.5)          | 32.9 (28.1-38.0)            |
| No                     | 60 | 14.2  | 15.0 (7.1-26.6)           | 46.7 (33.7-60.0)            |
| **Service-related oral health belief**|    |       |                           |                             |
| Visiting dentist       |    |       |                           |                             |
| Important              | 376| 88.3  | 41.8 (36.7-46.9)          | 36.7 (31.8-41.8)            |
| Doesn't matter much/Not important | 50 | 11.7  | 50.0 (35.5-64.5)          | 18.0 (8.6-31.4)             |
| **Service-related health literacy (system navigation)**|    |       |                           |                             |
If you needed to visit to the dentist tomorrow, would you know what to do?

|        | Yes | 78  |
|--------|-----|-----|
|        | 41.1 (35.8-46.6) | 39.9 (34.6-45.4) |
| No     | 94  | 22  |
|        | 47.9 (37.5-58.4) | 14.9 (8.4-23.7) |

Do you think there would be a dentist able to see you tomorrow?

|        | Yes | 39.8 |
|--------|-----|------|
|        | 36.3 (29.0-44.1) | 44.0 (36.4-51.9) |
| No     | 60.2 |
|        | 46.9 (40.6-53.2) | 28.3 (22.9-34.3) |

Trust and expectation

I believe going to dentist would help my teeth

| Strongly agree | Somewhat agree or don't know |
|----------------|-----------------------------|
| 367 86.2 | 59 13.8 |
| 42.5 (37.4-47.7) | 44.1 (31.2-57.6) |
| 37.1 (32.1-42.2) | 18.6 (9.7-30.9) |

Table 3 shows the unadjusted and adjusted estimates from the multivariable analysis with visiting a dentist less than 12 months ago as the outcome and the service approachability factors as exposures. With the exception of perceived need for dental care, all factors related to service approachability were associated with dental service utilisation in unadjusted analysis. After adjusting for remoteness of residency, education level, employment status and age, only one factor remained statistically significant; not knowing what to do if needed to make a visit to the dentist the next day (APR=0.86, 95%CI: 0.74-0.99);

Table 4 showed the analysis of service approachability factors with self-reported gum disease as the outcome variable. After adjusting for remoteness, employment status and education level, participants who perceived a need for dental care had 24% higher risk of having self-reported gum disease (APR=1.24, 95%CI: 1.06-1.45). There were no statistically significant associations observed between dental attendance in the last 12 months and self-reported gum disease (Table 5).

Table 3: Prevalence ratio (PR) and 95% CI of visiting dentist less than 1 year among women pregnant with an Indigenous child in South Australia
|                                      | PR 95% CI<sup>a</sup> | APR 95% CI<sup>b</sup> |
|--------------------------------------|------------------------|------------------------|
| Do you think you need to see a dentist? |                        |                        |
| No                                   | Ref.                   | -                      |
| Yes                                  | 1.24 (0.96-1.58)       | -                      |
| If you needed to visit to the dentist tomorrow, would you know what to do? |                        |                        |
| yes                                  | Ref.                   | Ref.                   |
| no                                   | 0.39 (0.24-0.64)       | 0.86 (0.74-0.99)       |
| Do you think there would be a dentist able to see you tomorrow? |                        |                        |
| yes                                  | Ref.                   | Ref.                   |
| no                                   | 0.64 (0.49-0.82)       | 0.91 (0.81-1.02)       |
| Visiting dentist                     |                        |                        |
| Important                            | Ref.                   | Ref.                   |
| Doesn’t matter much/Not important    | 0.51 (0.28-0.92)       | 0.93 (0.77-1.13)       |
| I believe going to dentist would help my teeth |                        |                        |
| Strongly agree                       | Ref.                   | Ref.                   |
| Somewhat agree or don’t know         | 0.49 (0.28-0.85)       | 0.91 (0.77-1.09)       |

Notes: Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

PR: Prevalence ratio

APR: Adjust prevalence ratio

a: Univariable analysis without any adjustment

b: Reducing variable showing no statistical significance in univariable analysis and adjusting for remoteness, education level, employment and age.

**Table 4: Prevalence ratio (PR) and 95 % CI of self-reported gum disease among women pregnant with an Indigenous child in South Australia**
| Question                                                                 | PR 95% CI<sup>a</sup> | APR 95% CI<sup>b</sup> |
|------------------------------------------------------------------------|------------------------|------------------------|
| Do you think you need to see a dentist?                                |                        |                        |
| No                                                                     | Ref.                   | Ref.                   |
| yes                                                                    | 3.15 (1.71-5.82) ***   | 1.24 (1.06-1.45) **    |
| If you needed to visit to the dentist tomorrow, would you know what to do? |                        |                        |
| yes                                                                    | Ref.                   | -                      |
| no                                                                     | 1.18 (0.92-1.51)        |                        |
| Do you think there would be a dentist able to see you tomorrow?        |                        |                        |
| yes                                                                    | Ref.                   | Ref.                   |
| no                                                                     | 1.29 (1.02-1.65) *      | 1.05 (0.94 -1.17)      |
| Visiting dentist                                                       |                        |                        |
| Important                                                              | Ref.                   | -                      |
| Doesn't matter much/Not important                                     | 1.19 (0.88-1.62)       |                        |
| I believe going to dentist would help my teeth.                        |                        |                        |
| Strongly agree                                                         | Ref.                   | -                      |
| Somewhat agree or don't know                                          | 1.03 (0.76-1.41)       |                        |

Notes: Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘ ’ 0.1 ‘’ 1

PR: prevalence ratio

APR: Adjust prevalence ratio

a: Univariable analysis without any adjustment

b: Reducing variable showing no statistical significance in univariable analysis and adjusting for remoteness, education level, employment.

Table 5: Prevalence ratio (PR) and 95 % CI of self-reported gum disease and visiting dentist less than 1 year among women pregnant with an Indigenous child in South Australia
| Visiting dentist < 1 year | PR 95% CI<sup>a</sup> | APR 95% CI<sup>b</sup> |
|-------------------------|----------------------|----------------------|
| No                      | Ref.                 | Ref.                 |
| yes                     | 0.82(0.64-1.04)      | 0.95(0.86-1.05)      |

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1

PR: prevalence ratio

APR: Adjust prevalence ratio

a: Univariable analysis without any adjustment

b: Reducing variable showing no statistical significance in univariable analysis and adjusting for remoteness, education level, employment.

**Discussion**

Our research aimed to apply a modified version of the Levesque model to examine the relationship between dental service approachability, dental care attendance and self-reported gum disease among women pregnant with an Aboriginal child in South Australia. The hypothesis was that participants with a perceived need for dental care would have a higher uptake of dental care, resulting in better oral health outcome. The findings showed that service-related factors were associated with dental attendance, which was consistent with the modified model. However, little effect was observed between service-related factors and self-reported gum disease, and no association was observed between dental attendance and self-rated gum disease. The results highlight the limitations of using the modified model in a quantitative study such as the one implemented.

Participants’ ability to navigate the dental care system was the key demand-side service approachability factor in utilising dental service. Previous research findings also reported Indigenous persons with higher skills in navigating dental services have higher compliance in long term dental treatment[38]. In this case, a person’s language capacity, knowing the information of location and contacts of dental clinics played an important role in the accomplishment of the dental care journey[38, 39]. However, due to the complexity of the Australian health system, many Indigenous and other socially or culturally marginalised groups struggle to adequately navigate the health system[40]. For some Indigenous Australians, mainstream dental services (private or public) may be the only options for dental care, because dental services may not be provided by their local Aboriginal community-controlled health service. Barriers to successfully navigate mainstream dental services include language and cultural barriers. Empirical research has demonstrated that awareness of dental service availability may be limited for some
Indigenous people[21], and also midwives[39]. Making dental service systems more navigable is crucial, given the negative impacts that poor dental care utilisation on oral health outcomes.

For Indigenous Australians to better navigate dental care systems, information in accessible formats is required[41]. According to Robards[41], navigation systems that integrate technologies, such as social media, may facilitate Indigenous Australians to better understand, connect and engage with dental care. Such interventions should be based in the Indigenous community setting. During the COVID-19 crises, Summer noted[42] that the application of social media channels shared through trustworthy local community networks enabled fast and effective health information sharing. Although dental care service provision may not always be available in the Aboriginal Community Controlled Health Organisation setting, such organisations had an indispensable role in the dissemination of health information, and a leading role of enhancing communication among Indigenous communities[43].

Based on these findings, future navigation programs that embrace social media and related technology might be more effective and economically friendly for women pregnant with an Indigenous child. Such services should be easy to contact to make health system navigation more approachable and understandable. Navigation support is just one example of improving system navigation. The health navigator program – targeting both Indigenous and non-Indigenous Australians - was increasingly used among patients with chronic disease who have difficulties in accessing health service, which improved the process of care[44]. There is evidence [45, 46] that Indigenous Liaison Officers can improve the engagement of Aboriginal families with health professionals, and may have a positive impact on diagnosis. There are some Aboriginal Liaison Programs for dental care[47, 48], although no study specifically examined its effect on uptake of dental care, the project was proven to be successful in dental referral to mainstream dental service[48]. There has been a Midwifery-Initiated Oral Health Dental Service program. In this program, midwives provided oral assessments and referrals to local and free public dental care for pregnant women. The referral letter included the contact details of a dentist, a checklist of date of visit, number of visits and treatment to better navigate participants to the service and to facilitate them to complete the course of recommended treatment[49]. The program was effective and promising in the improved uptake of dental care, and may be a beneficial pathway forward to implement among Indigenous populations [50].

One of our study hypotheses was that participants who had a perceived need for dental care would have better oral health than their counterparts with no perceived need; however, this did not prove to be the case. This suggests that the motivations or reason for participants’ perceived need for dental care were mixed and complicated. For example, the last visit for a dental appointment may have been for a check-up (a good oral health-related behaviour) and because of a problem. Thus, uptake of dental care within one year was not a good indicator for oral health outcome; reason for that last visit would have been a more reliable indicator for the phenomenon we were aiming to measure.

The design of the questionnaire enabled comparison with Aboriginal or non-Aboriginal pregnant women. A higher demand for dental care among Aboriginal women during pregnancy can be observed in this
study (85.8%) compared with non-Aboriginal pregnant women in the United States (50.1%) [51]. The rate of dental visit < 12 months in this study (35.7%) was very close to a comparable study in New Zealand (37.7%) [19]. However, non-Aboriginal pregnant women in high-income countries have nearly two times the rate of regular dental visiting, with approximately 70%-92% reported to have accessed dental care in the last 12 months [6, 52].

This study was the first study to describe dental uptake and service approachability for women pregnant with an Indigenous child in Australia. The modified model [25] used is well recognised in health service research, but has been mostly used in qualitative research in the Indigenous Australian context [27]. To the best of our knowledge, it has never been used in dental care. This study was also the first to test the association between approachability of dental care with dental uptake and self-reported gum disease among an Indigenous population. Most of studies [27] focus on provision of transport and reduction of cost to improve the accessibility of health care for Aboriginal people. Less empirical research has focused on the phases before actual interaction with the health care service, including participant motivation and capability to contact the service. This study reiterates the importance of system navigation in accessing dental care, which might also give more directions to improve accessibility of primary health care for Indigenous people. Indications for future research include: 1) Dental health literacy on how to navigate dental systems is important in the access outcome of dental care. Navigation support could be integrated with technologies, based on local community networks and collaborating with midwives. 2) The effect that approachability of a given service has on health outcomes (dental attendance). Motivations for visiting a dentist differ, and this has an impact on oral health outcomes. Previous uptake of dental care was not a good indicator of oral health. There is a need for better analytical approaches, and different measures of exposures and outcomes to better illustrate the impact that utilisation of dental care has on oral health outcomes.

The study limitations include; social desirability bias may have influenced participant responses; And no clinical data collected to ascertain objective measures of dental health. Our study was cross-sectional, meaning no assumptions of causality can be made.

**Conclusion**

Although dental care was recognised as being important among our sample of women pregnant with an Indigenous child in South Australia, dental utilisation was low. Ability to successfully navigate the dental care system was associated with regular dental attendance. Perceived need for dental care was associated with self-reported gum disease. No association was observed between service-approachability-related factors and self-reported gum disease.

**Abbreviations**

APR: Adjust prevalence ratio
PR: prevalence ratio

ECC: Early Childhood caries

Declarations

**Ethics approval and consent to participants:**

Ethics approval has been obtained from the University of Adelaide Human Research Ethics Committee (H-057-2010) and the Aboriginal Health Council of South Australia (04-09-362). All participants were provided with an information sheet outlining the study objectives and signed an informed consent form.

**Consent for publication**

All participants signed an informed consent form for the authors to publish the findings in the peer-reviewed scientific literature.

**Availability of data and material**

Data cannot be shared publicly because of privacy issues of the participants. Data are available from the University of Adelaide Data Access (contact via Australian Research Centre for Population Oral Health: arcpoh@adelaide.edu.au) for researchers who meet the criteria for access to confidential data.

**Competing interests**

The authors confirm that they have no competing interests.

**Authors’ contributions statement**

Lisa M Jamieson obtain the funding and design of the original study. Yuan Gao was responsible for the study design, did the statistical analyses, produced the figures, interpreted the data and contributed to writing manuscript drafts. Lisa M Jamieson and Xiangqun Ju are guarantors for this article. All authors contributed to data acquisition and interpretation, and critically reviewed and approved the manuscript.

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