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FROM ANTENATAL SCREENING TO DENTAL TREATMENT: THE EFFECTIVENESS OF COLLABORATIVE NURSING, MIDWIFERY, AND DENTAL REFERRAL PATHWAYS IN MATERNAL HEALTHCARE — A SYSTEMATIC REVIEW

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KEYWORDS

pregnancy; oral health; antenatal care; midwifery; nursing; dental referral; interprofessional collaboration; dental care; systematic review

ABSTRACT

Background: Oral disease is common in pregnancy and dental care is safe, yet many pregnant women do not see a dentist. Nurses and midwives could screen and refer women during antenatal care, but practice is inconsistent. Objective: To synthesise evidence on the effectiveness of collaborative nursing, midwifery and dental referral pathways in maternal health care, from training and screening to dental attendance, health outcomes, acceptability and cost. Methods: PubMed was searched for English-language records published up to 31 January 2024, combining terms for pregnancy, oral health and nursing or midwifery. Titles were screened and abstracts assessed against predefined criteria, and findings were synthesised narratively along the pathway in line with PRISMA 2020. Results: Of 205 records, 54 abstracts were assessed and 21 reports were included: five on referral programmes, three on interventions delivered by nurses or midwives, three on screening tools, three process evaluations and seven on training. Twelve reports came from one Australian programme. In a randomised trial of 638 women, dental services were used by 20.2% of controls, 28.3% of women who received midwifery education, screening and referral, and 87.2% of those who also had access to a free local dental service; oral health improved in the last group, but preterm birth and low birth weight did not differ. A rural programme raised attendance from 15.0% to 40.4%. A two-item screening tool had high sensitivity (88% to 98%) and low specificity (14% to 40%). Training improved knowledge and confidence in every study. The pathway was acceptable to women, midwives and dental staff, and the midwife-only model was cost-effective. No lasting effect on children's oral health was found at three to four years. Conclusions: Antenatal referral by nurses and midwives is feasible, acceptable

and inexpensive, but it leads to dental treatment mainly when linked to an accessible and affordable dental service. Both ends of the pathway should be planned together.

1. Introduction

Oral disease is common in pregnancy. Hormonal changes increase gingival inflammation, and untreated caries and periodontal disease cause pain, infection and poorer quality of life for the mother. Maternal oral health also matters for the child, because mothers with poor oral health and limited knowledge are more likely to have children with early childhood caries. Dental care is safe during pregnancy and is recommended by professional guidelines, yet many women do not receive it. In a systematic review of 14 studies, the proportion of women who used dental services during pregnancy ranged from 16% to 83%, and attendance depended on income, education, insurance, beliefs about oral health in pregnancy and perceived need [1].

Antenatal care is the obvious place to close this gap. Nurses and midwives see almost every pregnant woman, usually several times, and have her trust. They could ask about oral health at the booking visit, give advice and refer women to a dentist. In practice this happens inconsistently. A systematic review of 26 studies covering 3,519 antenatal care providers found that rates of assessing, advising and referring varied widely, and that the main barriers were limited oral health knowledge, concern about dental costs and the absence of organisational referral processes [2]. Dentists and antenatal practitioners also lack a shared view of dental care in pregnancy, and some still believe dental procedures are unsafe [3]. Women notice the result: in one Australian survey only 10% of pregnant women had received any oral health material, fewer than half of those with dental problems had sought treatment, and more than 90% said they would welcome education, assessment and referral from their midwife [4]. Midwives, for their part, were reluctant to raise oral health when they had no pathway into public dental services [5].

These findings point to a pathway with several linked steps: training of nurses and midwives, a quick screening method, a defined referral route, and a dental service that is ready and affordable when the woman arrives. An early review proposed such a role for midwives [6], and programmes have since been built and tested. Their results have not been brought together across the whole pathway, from screening in the antenatal clinic to treatment in the dental chair.

This systematic review aimed to synthesise evidence on the effectiveness of collaborative nursing, midwifery and dental referral pathways in maternal health care, covering the training of nurses and midwives, screening, referral and dental attendance, oral health and birth outcomes, acceptability and cost.

2. Methods

2.1 Design and reporting

This systematic review with narrative synthesis is reported in line with the PRISMA 2020 statement. The protocol was not registered.

2.2 Eligibility criteria

Studies were eligible if they involved pregnant women, or nurses, midwives or students of these professions who provide antenatal care, and if they implemented or evaluated at least one component of an antenatal oral health pathway in which nurses or midwives took part. Four components were defined: (a) a referral programme in which nurses or midwives screen, advise or refer pregnant women to dental services; (b) an oral health intervention delivered by nurses or midwives within antenatal care; (c) a screening tool or examination used by nurses or midwives to identify women who need referral; and (d) a training programme that prepares nurses or midwives for this role. Eligible designs were randomised and non-randomised trials, before-and-after studies, cohort studies, validation studies, economic evaluations and qualitative or mixed-methods process evaluations of an implemented programme. Outcomes of interest were referral, dental attendance and treatment, clinical oral health, oral health knowledge and behaviour, quality of life, birth and child outcomes, provider knowledge and confidence, acceptability and cost.

Surveys and qualitative studies of knowledge, attitudes or current practice that were not

linked to an implemented programme were excluded, as were reviews, protocols, policy papers, descriptions of programmes without evaluation data, and programmes in which the referring professional was not identified as a nurse or midwife. Only records in English were considered.

2.3 Information source and search strategy

PubMed was searched for records published from database inception to 31 January 2024. Three blocks of terms, for pregnancy, oral health and nursing or midwifery, were combined and searched in titles and abstracts (Box 1). Terms for referral were not required, so that programmes described in other words would not be missed. Reference lists were not hand-searched and no other database or grey-literature source was used.

Box 1. PubMed search strategy

Block	Terms (title/abstract)
Pregnancy	pregnan* OR antenatal OR prenatal OR perinatal OR maternity OR "expectant mother*"
Oral health	"oral health" OR dental OR dentist* OR periodont* OR "oral care"
Nursing and midwifery	midwi* OR nurs* OR "antenatal care provider*" OR "prenatal care provider*"
Combination and limits	Pregnancy AND Oral health AND Nursing and midwifery; English language; publication date to 31 January 2024

2.4 Selection and data collection

Titles were screened first, and the abstracts of potentially relevant records were then assessed against the eligibility criteria. Screening and assessment were done in a single pass, without independent duplicate review. For each included report, the citation, country and setting, design, participants, pathway component and main findings were collected from the abstract in the PubMed record. Full texts were not retrieved. Reports from the same programme were kept as separate entries but are identified as such.

2.5 Appraisal and synthesis

No formal risk-of-bias tool was applied, because data were taken from abstracts and the designs were heterogeneous; design limitations are noted in the synthesis. Meta-analysis was not appropriate. Findings were organised along the pathway: referral programmes and their effect on dental attendance and oral health, interventions delivered by nurses and midwives, screening, acceptability and cost, and training. Results are reported as given by the study authors.

3. Results

3.1 Study selection

The search returned 205 records, with no duplicates. After title screening, 151 records were excluded and 54 abstracts were assessed. Thirty-three were excluded: 16 were surveys or qualitative studies not linked to an implemented programme; 10 were reviews, protocols or descriptions without evaluation data; 5 fell outside the population or provider criteria; 1 was a duplicate publication; and 1 was published after the review period. Twenty-one reports were included (Figure 1).

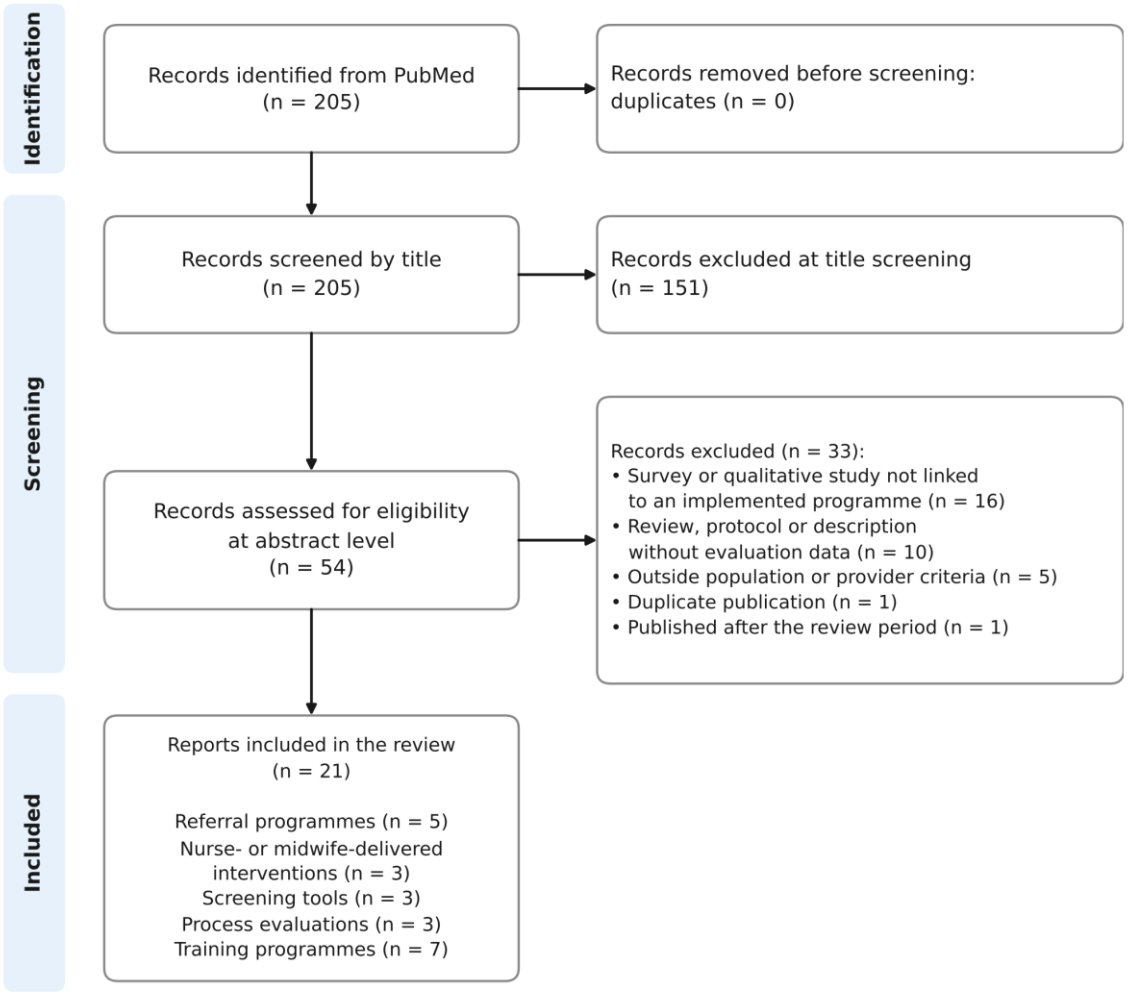


Figure 1. PRISMA 2020 flow diagram of study selection.

3.2 Study characteristics

The 21 reports were published between 2011 and 2023. Thirteen came from Australia, three from the United States, two from Iran and one each from Nigeria, Palestine and Nepal. Twelve reports arose from one Australian programme, the Midwifery Initiated Oral Health-Dental Service, and its education component. By pathway component, five reports evaluated referral programmes, three evaluated interventions delivered by nurses or midwives without a formal referral step, three tested screening tools or examinations, three were process evaluations and seven evaluated training. There were three randomised controlled trials, two non-randomised controlled studies, six before-and-after studies, one cohort follow-up, one economic evaluation, three validation studies and five qualitative, mixed-methods or pilot evaluations.

3.3 Referral programmes: dental attendance and oral health

Three programmes were evaluated in five reports (Table 1). The largest was a randomised trial in three public hospitals in Sydney, in which 638 women were allocated to written information only, to education, screening and referral by trained midwives, or to the midwifery intervention plus assessment and treatment at a free local dental service. Dental services were used by 20.2% of the control group, 28.3% of the midwifery-only group and 87.2% of the group that also had access to free dental care, an odds ratio of 29.72 for the combined intervention against control. Oral health knowledge, oral health-related quality of life and clinical measures, including bleeding, plaque, attachment loss and decayed or filled teeth, also improved in the combined group. Rates of preterm birth and low birth weight did not differ [7]. When 204 mothers and their children were followed three to four years later, the programme had no significant effect on maternal knowledge, preventive behaviours or early childhood caries, although higher maternal knowledge and education were protective against caries [8]. In the economic evaluation, the midwife-only model

was cost-effective compared with current practice at the Australian threshold of A$50,000, and the combined model became cost-effective when benefits were counted over six months or longer [9].

Two other programmes gave consistent results. In a rural Australian health service, midwives and obstetric general practitioners were educated and encouraged to use a priority referral pathway to the public dental clinic; the proportion of eligible antenatal women who received dental care rose from 15.0% to 40.4%, and 44 of 62 referred women were treated [10]. In a randomised trial in 170 low-income women in the United States, an advanced practice nurse provided education and dental supplies and scheduled a dental appointment; women in the intervention group reported more than twice as many dental check-ups as controls and improved their oral hygiene and diet, but barriers to obtaining dental services persisted [11] (Figure 2).

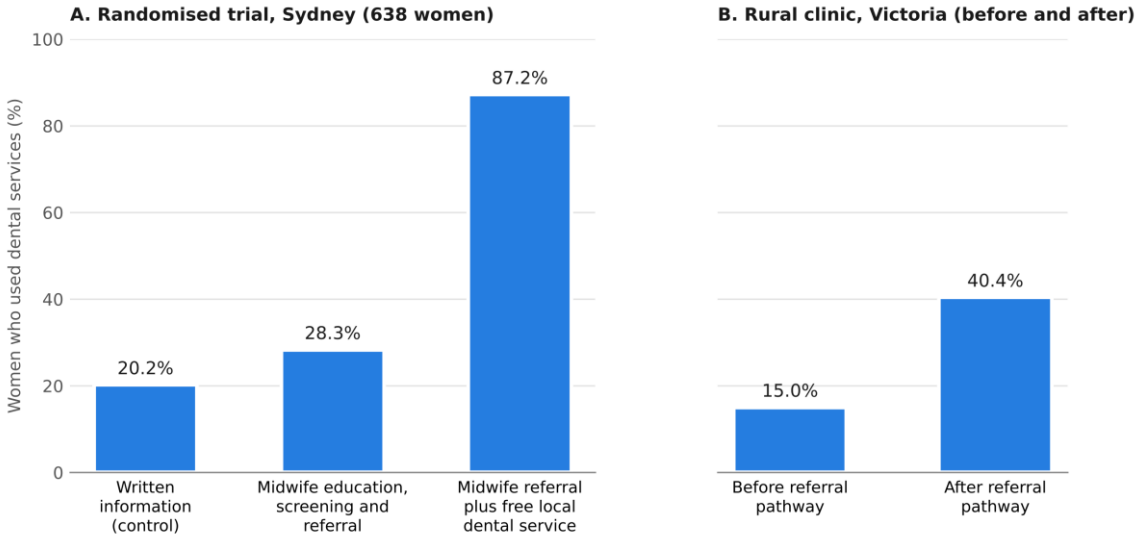


Figure 2. Proportion of pregnant women who used dental services, by study arm or period, in two referral programmes.

3.4 Interventions delivered by nurses and midwives

Three studies tested oral health care given within antenatal visits without a formal referral step. A nurse-midwife-led intervention of two 15-minute modules within group prenatal care improved plaque, bleeding on probing and pocket depth more than standard care in a controlled pilot of 101 women [12]. In Gaza City, antenatal nurses delivered a structured periodontal health intervention to 25 women; adherence was 88% and plaque and bleeding scores fell after three months, but clinic staff were concerned about the nurse time required [13]. In a trial of 750 women with moderate-to-severe gingivitis, oral hygiene instruction from nurse-led staff was followed by reduced gingival inflammation in both arms, with a modestly greater reduction when an educational video and advanced home-care products were added [14].

Table 1. Referral programmes and interventions delivered by nurses and midwives (n = 8 reports)

Report	Setting	Design and participants	Pathway component	Main findings
George 2018 [7]	Australia; three public hospitals, Sydney	Randomised controlled trial; 638 women	Trained midwives gave education, screening and referral (group 1); the same plus free local dental assessment and treatment (group	Dental service use 20.2% (control), 28.3% (group 1), 87.2% (group 2); odds ratio for group 2 vs control 29.72; better knowledge, oral health quality of life and clinical oral health in group 2; no

Report	Setting	Design and participants	Pathway component	Main findings
			2); control received written information	difference in preterm birth or low birth weight
George 2023 [8]	Australia; follow-up of the Sydney trial	Prospective cohort; 204 mothers and children aged 3 to 4 years	As above, assessed after the trial	No significant effect on maternal knowledge, behaviours or early childhood caries; maternal knowledge and education were protective against caries
Tannous 2021 [9]	Australia; data from the Sydney trial	Cost-utility analysis, 3 months to 4 years	Midwife-only and midwife plus dentist models compared with current practice	Midwife-only model cost-effective at the A$50,000 threshold; combined model cost-effective at 6 months and beyond
Ragade 2023 [10]	Australia; rural public dental clinic, Victoria	Quasi-experimental, 10 months before and after	Midwives and obstetric general practitioners educated and encouraged to refer through a priority pathway	Eligible women receiving dental care rose from 15.0% to 40.4%; 44 of 62 referred women received care
Cibulka 2011 [11]	United States; inner-city hospital clinic	Randomised controlled trial; 170 low-income women	Advanced practice nurse gave an education session and dental supplies and scheduled a dental appointment	More than twice as many dental check-ups as controls; more brushing and flossing, fewer sugary drinks; barriers to dental services remained
Adams 2017 [12]	United States; four health centres using group prenatal care	Non-randomised controlled pilot; 101 women	Nurse-midwife-led education and skills modules, two sessions of 15 minutes	Greater improvement in plaque, bleeding on probing and pocket depth than controls
Abuhaloob 2021 [13]	Palestine; primary care clinic, Gaza City	One-arm feasibility study; 25 women	Antenatal nurses delivered a structured periodontal health intervention at routine visits	Adherence 88%; plaque and bleeding scores fell after 3 months; staff concerned about nurse time and cost

Report	Setting	Design and participants	Pathway component	Main findings
Geurs 2023 [14]	United States; obstetric clinics of two medical centres	Randomised controlled trial; 750 women with moderate-to-severe gingivitis	Oral hygiene instruction from nurse-led staff in both arms; intervention arm added a video and advanced home-care products	Gingival inflammation fell in both arms; modestly greater reduction with the enhanced regimen

3.5 Screening by nurses and midwives

Three reports addressed how nurses and midwives can identify women who need dental care (Table 2). A two-item screening tool developed for midwives and tested in 300 women had a sensitivity of 98% and a specificity of 40% [15]. In a larger validation within the Sydney trial, 38 trained midwives used the tool with 211 women; it identified 88% to 94% of women at risk of poor oral health, with a specificity of 14% to 21% [16]. The tool therefore misses few women with dental problems but refers many who do not need treatment. In rural Nepal, auxiliary nurse midwives with no previous dental training performed full periodontal examinations in the home, and their measurements of probing depth agreed closely with those of a dentist [17].

3.6 Acceptability and process

Three qualitative process evaluations of the Sydney programme covered each party to the pathway. Midwives found the programme acceptable and feasible and most felt confident to refer, although some were uneasy about visual inspection of the mouth and felt it lay outside their scope of practice; they saw the cost of dental care and women's misconceptions as the main obstacles to wider use [18]. Dental professionals supported the programme, reported clear improvement in women's oral health and identified free dental care and the involvement of midwives as the reasons for uptake; persistent beliefs that dental treatment is unsafe in pregnancy were a challenge [19]. Women regarded midwives as appropriate professionals to assess, educate and refer, and those who were initially apprehensive about treatment were reassured by dental staff [20].

Table 2. Screening tools and process evaluations (n = 6 reports)

Report	Setting	Design and participants	Pathway component	Main findings
George 2015 [15]	Australia; South Western Sydney	Tool development; 300 women	Screening questions for midwives at the first antenatal visit	Two-item tool: sensitivity 98%, specificity 40%, positive predictive value 88%, negative predictive value 80%
George 2016 [16]	Australia; Sydney trial	Validation against a dentist's assessment and a quality-of-life measure; 211 women, 38 midwives	Maternal oral screening tool used by trained midwives	Sensitivity 88% to 94%; specificity 14% to 21%
Erchick 2020 [17]	Nepal; rural homes	Validation against a dentist; 21 pregnant women,	Full-mouth periodontal examination by	Agreement on probing depth within 1 mm above 99%; weighted kappa above 0.7

Report	Setting	Design and participants	Pathway component	Main findings
		5 auxiliary nurse midwives	trained auxiliary nurse midwives	
Dahlen 2019 [18]	Australia; Sydney trial	Qualitative; three focus groups, 21 midwives	Midwives' experience of the programme	Acceptable and feasible; most confident to refer; some unease about visual inspection and scope of practice; dental costs and women's misconceptions were barriers
Ajwani 2019 [19]	Australia; Sydney trial	Qualitative; two focus groups, 12 dental professionals	Dental team's experience of the programme	Supportive; free care and midwife involvement drove uptake; beliefs that treatment is unsafe in pregnancy were a challenge
George 2019 [20]	Australia; Sydney trial	Qualitative; 11 women	Women's experience of the programme	Midwives seen as appropriate to assess, educate and refer; initial fear of treatment eased by dental staff

3.7 Training of nurses and midwives

Seven reports evaluated training (Table 3). The Australian online programme was piloted with 22 midwives [21], then evaluated in Victoria, where the confidence of 33 midwives to promote oral health rose by 51.5% [22], and in two states, where the knowledge of 50 midwives rose by 21.5% and 77.6% felt confident to refer women to dental services afterwards [23]. An oral health module in an undergraduate midwifery degree produced knowledge gains that lasted three years, although confidence in carrying out a visual mouth check declined over time [24]. Outside Australia, a short course improved the attitudes and own oral hygiene of midwifery students in Tehran [25]; an interdisciplinary programme in Lagos raised nurses' knowledge, with a small decline by six months, and 84% of nurses then included oral health in routine health education [26]; and a single lecture-based session improved the knowledge of 340 antenatal care providers in Isfahan [27]. None of the training studies measured referral rates or women's dental attendance.

Table 3. Training programmes for nurses, midwives and students (n = 7 reports)

Report	Setting	Design and participants	Pathway component	Main findings
George 2014 [21]	Australia	Pilot; 22 midwives, 12 knowledge tests returned	Online, self-paced education programme	Mean 79% correct; midwives more confident to promote oral health
Heilbrunn-Lang 2015 [22]	Australia; Victoria	Mixed methods, before and after; 33 midwives	Online programme with three modules covering screening and referral	Confidence rose by 51.5%; time at the booking visit was the main barrier
George 2016 [23]	Australia; two states	Before-and-after study; 50 midwives	Online education programme	Knowledge rose by 21.5%; 82% confident to

Report	Setting	Design and participants	Pathway component	Main findings
				raise oral health and 77.6% to refer
George 2020 [24]	Australia; one university	Before-and-after study with 3-year follow-up; 44 midwifery students	Oral health module in the first year of the degree	Knowledge gain sustained at 3 years; confidence to refer rose by 48.2%; confidence in visual mouth checks faded
Mohebbi 2014 [25]	Iran; Tehran	Controlled study; 29 intervention and 33 control midwifery students	Short course with role play	Attitude score rose from 20.4 to 30.9; better own oral hygiene practice and plaque score
Olatosi 2019 [26]	Nigeria; Lagos	Before-and-after study; 110 nurses	Lectures and hands-on training including screening, referral and counselling	Knowledge score 22.4 before, 31.4 after and 28.6 at 6 months; 84% then included oral health in routine education
Faghihian 2023 [27]	Iran; Isfahan	Before-and-after study; 340 antenatal care providers, 120 of them midwives	Single lecture-based session	Knowledge score rose from 42.87 to 52.25

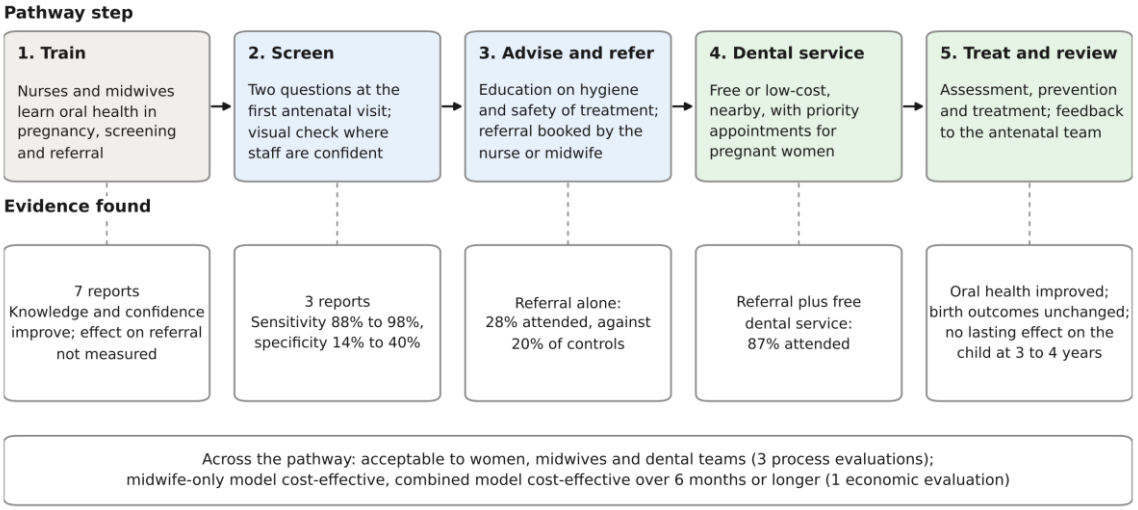


Figure 3. The antenatal oral health pathway from screening to dental treatment, with the evidence found for each step.

4. Discussion

4.1 Principal findings

This review followed the antenatal oral health pathway from the training of nurses and midwives to dental treatment. Four findings stand out. Training reliably improves the knowledge

and confidence of nurses, midwives and students. A short screening tool allows midwives to identify almost all women with dental problems at the first antenatal visit. Screening, advice and referral by midwives are acceptable to women, midwives and dental teams and are inexpensive. However, referral alone changed dental attendance very little: in the one large trial, attendance was 20% with written information, 28% with midwifery referral and 87% when a free, local dental service was attached to the pathway. The effectiveness of the pathway therefore depends on its last step.

4.2 Interpretation

The contrast between the two intervention arms of the Sydney trial is the most informative result in this review [7]. Both arms had trained midwives, the same screening tool and the same advice. What differed was whether the woman, once referred, had somewhere affordable to go. The rural programme points the same way: attendance rose when midwives and general practitioners referred into a public clinic that gave pregnant women priority [10]. In the United States trial, the nurse did not simply advise a visit but scheduled the appointment [11]. A programme outside the inclusion criteria, in which prenatal clinics integrated dental referral for low-income women, found that 67.3% of referred women saw a dentist compared with 35.1% of those not referred [28]. Taken together, these studies suggest that referral works when it is an active handover to an accessible service and works poorly when it is advice to seek care that the woman must then arrange and pay for herself. This fits the barriers that providers and women report, in which cost and the lack of a referral route are prominent [2,4].

The screening evidence has a practical implication. A tool with high sensitivity and low specificity will send most pregnant women to the dentist [16]. Where guidelines already recommend a dental check for every pregnant woman this is acceptable, and the value of the tool lies in prompting the conversation and prioritising women with symptoms. Where dental capacity is limited, the low specificity would overload the service, and a second step, such as triage by a dental hygienist or assistant, would be needed. The Nepal study shows that staff with a nursing or midwifery background can be trained to make periodontal measurements reliably [17], but it was small and did not test referral.

The clinical results need careful reading. Oral health improved where dental treatment was provided [7] and, to a smaller degree, where nurses or midwives taught oral hygiene skills [12–14]. No effect on preterm birth or low birth weight was shown, and the benefits measured during pregnancy had faded when mothers and children were reassessed three to four years later [8]. The pathway should be justified by the mother's oral health and comfort during pregnancy, not by expected gains in birth outcomes, and a single episode of antenatal care should not be expected to protect the child's teeth without postnatal follow-up.

Training is necessary but not sufficient. Every training study reported better knowledge or confidence, yet none measured whether trained staff referred more women or whether more women attended. Confidence in looking inside the mouth was the least durable skill [24], and some midwives questioned whether inspection belonged to their role [18]. Surveys show that practice varies between settings: most nurses in one Malaysian district reported routinely referring pregnant women to dentists [29], whereas the rates reported in other studies varied widely [2].

4.3 Implications for practice and research

For maternity and dental services that share a population, the evidence supports a pathway with five elements: brief training for antenatal nurses and midwives, repeated periodically; two screening questions at the booking visit, recorded in the antenatal record; a booked referral made by the nurse or midwife instead of general advice; dental appointments reserved for pregnant women at no or low cost and close to the antenatal clinic; and feedback from the dental team to the midwife. Dental hygienists and dental assistants are well placed to receive referrals, give preventive care and reassure women about safety, and their role in the included studies was described only in general terms. Each profession should give women the same message that dental care in pregnancy is safe.

No included study came from Saudi Arabia or the Gulf region, and twelve of 21 reports came

from one Australian programme. Local evaluation is therefore needed. Useful studies would measure referral and attendance rates before and after a pathway is introduced, compare advice with booked referral, test the screening tool in Arabic, and follow women and infants after birth.

5. Limitations

Only one database was searched and reference lists were not checked, so eligible studies will have been missed, particularly programmes led by physicians or community health workers and studies indexed without nursing or midwifery terms. Screening and data collection were done in a single pass and from abstracts, so details reported only in full texts were not available and some reports may have been misclassified. No formal risk-of-bias assessment was made. More than half of the reports described a single programme evaluated by its developers, which limits independence and generalisability. Only one large trial measured dental attendance, most training studies were small before-and-after designs with self-reported outcomes, and results could not be pooled.

6. Conclusions

Collaborative antenatal oral health pathways are feasible, acceptable to women and to both professions, and low in cost. Nurses and midwives can be trained quickly, can identify women with dental problems using two questions, and can deliver effective oral hygiene education. Their referral leads to dental treatment mainly when it connects to a dental service that is free or affordable, nearby and ready to see pregnant women; in the largest trial, almost nine in ten women then attended, compared with one in five under usual care, and their oral health improved. Effects on birth outcomes and on children's later oral health have not been shown. Health services should plan the antenatal and dental ends of the pathway together, and local studies should measure referral, attendance and treatment.

Declarations

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Conflicts of interest: The authors declare no conflicts of interest.

Ethical approval: Not required. This review used published literature only and involved no human participants or patient data.

Data availability: All data supporting this review are contained in the article and in the cited publications.

Author contributions: All authors contributed to the conception of the review, the interpretation of the findings and the revision of the manuscript, and all approved the final version.

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