




Barriers to optimal management of syphilis in pregnancy and congenital syphilis in south-east Queensland: a qualitative investigation

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Handling Editor:

Tiffany Renee Phillips

Received: 29 June 2023
Accepted: 3 August 2023
Published: 21 August 2023

Cite this:

Fowler JA et al. (2023)
Sexual Health, **20**(6), 506–513.
doi:[10.1071/SH23119](https://doi.org/10.1071/SH23119)

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ABSTRACT

Background. Australia, like many high-income countries, is experiencing a resurgence of infectious syphilis in pregnancy and congenital syphilis. Evaluations of public health notifications and clinical records suggest that healthcare systems may not be providing optimal care to women and their neonates. This study aims to explore the barriers to optimal management of syphilis in pregnancy and congenital syphilis to identify key areas for improvement. **Methods.** Between 2021 and 2022, 34 healthcare workers (HCW) practicing in south-east Queensland (SEQ) Australia were recruited to complete semi-structured interviews regarding their perceptions towards management of syphilis in pregnancy and congenital syphilis. Interviews were analysed thematically. **Results.** Thematic analysis identified four themes related to the management of syphilis in pregnancy. These included poor communication between disciplines, services, and teams from delivery through to management and post-delivery, lack of formal internal and external referral pathways, unclear and often complex maternal and congenital syphilis management procedures, and limited HCW knowledge of infectious syphilis in pregnancy and congenital syphilis. **Conclusion.** As congenital syphilis numbers continue to rise in SEQ, it is imperative that healthcare systems and HCWs identify and address gaps in the provision of health care.

Keywords: congenital syphilis, health personnel, healthcare provider, management, pregnancy, qualitative, syphilis, treatment.

Introduction

Syphilis is a sexually transmissible infection (STI) caused by the bacterium *Treponema pallidum*, which is readily transmitted through sexual contact as well as vertically from mother to foetus.^{1,2} Syphilis is easily identifiable and treatable³ but if untreated, can result in the development of chronic sequelae and premature death, as well as posing a public health risk of onward transmission.¹ Recent years have seen a resurgence of infectious syphilis in higher income countries – particularly among men-who-have-sex-with-men (MSM)^{4–6} but also among women. While representing only a small number of the total infectious cases,⁵ women and people with reproductive capacity comprise a growing and important cohort due to the impact of syphilis in pregnancy and subsequent risk of congenital syphilis. Mothers with untreated infectious syphilis have a 76.8% risk of adverse pregnancy outcomes⁷, which include stillbirth and perinatal death.^{8,9} Affected children may also have a range of long-term disabilities.^{10,11} People diagnosed with syphilis during pregnancy require cohesive and streamlined clinical and public health management.

Aligned with other high income countries such as the United States and Europe,^{4–6} infectious syphilis is on the rise in Australia – with notifications doubling between 2012 and 2016.¹² In Queensland, one of Australia's largest states, notifications of infectious syphilis have increased from 3.1 to 22.9 per 100 000 between 2001 and 2019.¹³ Until

recently, MSM¹⁴ and Aboriginal and Torres Strait Islander peoples living in northern Australia (a sparsely populated region comprising 54% of Australia's land mass but only 5.3% of its population)^{15,16} have been the focus of targeted interventions. However, the profile of infectious syphilis is changing in Queensland, with over two-thirds of notifications from densely populated south-east Queensland (SEQ) in 2019¹³ and one-third of all syphilis in pregnancy notifications between 2010 and 2019 occurring in non-Indigenous women in SEQ.¹³ This was paralleled by a rise in congenital syphilis in SEQ with 33 cases and 12 infant deaths confirmed in Queensland between 2001 and 2019.¹³ Similar trends have been reported many metropolitan areas^{17,18} both in Australia and in other high income countries such as the United States.¹⁹ This emphasises the importance of ensuring access to evidence-informed 'best-practice' management, as well as other key areas such as health care, testing, and contact tracing. Of concern, a recent evaluation of the management of syphilis in pregnancy in SEQ suggests that care is sub-optimal, with only 73% of patients receiving care in line with appropriate guidelines.²⁰

While there has been limited research exploring the barriers to optimal management in SEQ, investigations from other countries offer some insight. Barriers can occur at multiple, intersecting policy, healthcare worker (HCW), and patient levels. Examples include unclear guidelines, leading to reduced rates of screening and treatment,^{21,22} poor knowledge among HCWs^{21–26} and breakdowns in communication between multi-disciplinary teams,²⁷ and patients.²¹ One investigation in SEQ showed that HCWs had knowledge deficits and discomfort regarding screening for syphilis during antenatal care,²⁸ which may later contribute to missed diagnoses and thus complicating management and compromising maternal/neonatal outcomes. At the patient level, stigma around STIs, sociodemographic barriers, and a lack of screening during the antenatal period contribute to challenges in identifying and treating infectious syphilis.^{24,29–32} Strategies to overcome the complex and inter-connected barriers to management are necessary and need to be responsive to changing epidemiological trends. However, to develop these, contextualised understanding of the barriers relevant to the area of practice is needed. The aim of this study was to use a qualitative perspective to understand HCW's perceived barriers to optimal management of syphilis in pregnancy and congenital syphilis.

Materials and methods

Participants and recruitment

Thirty-four HCWs practising in SEQ were recruited via targeted recruitment and snowball sampling. Targeted emails were sent to HCWs who may have had prior experience in managing syphilis in pregnancy and/or congenital syphilis. Study information was also circulated to tertiary hospitals and primary healthcare services providing antenatal care in areas with higher syphilis notification rates. All information

provided to participants described the aims of the research and who was involved. Participants who completed interviews were encouraged to share study information within their professional networks. The coronavirus disease 2019 (COVID-19) pandemic and public health directives restricting access to health facilities compounded pre-existing low levels of recruitment noted within this demographic.^{33,34} Therefore, strategies to circumnavigate these challenges were utilised such as offering an AUD\$150 'thank you' gift card and flexible interview locations (e.g. via Zoom/phone or at the HCWs place of employment or a location of choice) and times (pre, during and after workhours). Prior to recruitment, ethical approval was provided by the Royal Brisbane and Women's Hospital Human Research Ethics Committee (approval number HREC/2019/QRBW/59360).

Data collection

Interviews were conducted by three members of the research team (JD, JF, ML) in pairs alongside the participant (with no others present for interviews) and were approximately 1 h long. They were undertaken at a location of the participant's choice, usually via Zoom conferencing software. The senior author (JD) was present for all interviews, and their position as a senior research fellow and midwife was disclosed to participants during interviews. Some participants were known to the researchers and therefore had pre-established relationships but for others, no relationship was established prior to data collection.

Interviews were guided by a semi-structured interview guide developed by the research team of multi-disciplinary clinicians and researchers. It was not formally piloted prior to interviews but was continually refined throughout data collection. It contained questions pertaining to five key areas of interest implicated in the management of syphilis in pregnancy and congenital syphilis: (1) awareness of guidelines, protocols or referral pathways; (2) experience treating syphilis in pregnancy; (3) support needed to facilitate optimal management; (4) barriers to optimal management; and (5) recommendations for overcoming identified barriers and for optimal management. Participants' awareness of the shifting demographic of syphilis infection within SEQ was also explored. Interviews were completed once; however, participants were invited to contact researchers with additional information to add to their transcripts if they wished, but none did. Interview transcripts were not made available to participants unless specifically requested and no HCWs asked to view them. Field notes were taken during interviews and initial impressions were later used in the analytical process. No participants who expressed interest dropped out of the study prior to or following interviews.

Data analysis

Interviews were digitally recorded, and a paid transcription service was used for accuracy. Prior to analysis, transcripts

were exported into NVivo 12, and all analyses were conducted using this software. A deductive, reflexive thematic analysis approach informed by Braun and Clarke^{35,36} was utilised to analyse the data due to its simplicity in use and flexibility to analyse complicated data. Two authors (JF, SW) generated eight initial codes which aligned with the five key areas of interest. These codes were discussed with JD and following resolution of inconsistencies and discrepancies, JF and SW categorised 50% of the data each. Following this, one author (JF) analysed the data pertaining to management, education, and guidelines usage and formulated a series of initial semantic (surface level) and latent (underlying) codes. Once these codes were applied, codes were articulated into themes through a non-linear, reflexive process of reading and re-reading. Final codes were defined and formulated into thematic maps. Continual consultation was undertaken between JF, SW, and JD and with the research team on themes to ensure alignment with the research questions, with disagreements resolved through group deliberation. Participants did not provide feedback on results. Furthermore, all authors agreed on the final themes. To protect the identities of participants, no identifiable information beyond speciality and years in practice are reported in-text.

Results

A broad range of HCWs practising in both tertiary hospital (midwives, infectious diseases specialists, obstetricians, paediatricians, doctors in training) and primary healthcare settings (general practitioners) were interviewed (Table 1). Most of the 34 HCWs interviewed had treated a woman with infectious syphilis in pregnancy within the past year (67%). Self-reported knowledge levels varied across disciplines and experience levels but most reported intermediate knowledge about treating syphilis in pregnancy, but novice knowledge in treating and managing congenital syphilis.

Barriers to optimal management of syphilis in pregnancy and congenital syphilis

An overarching theme identified was that current healthcare systems allow for women and their neonates to slip through gaps in care. Some midwives and paediatricians compared this to 'holes in Swiss cheese aligning'.

I think they [clinicians] do their best to catch things that fall through the gaps, but the gaps exist and so, you know, it's like the holes in Swiss cheese all lining up. (Midwife, 14 years' practice, managed three cases)

HCWs perspectives demonstrated four key areas where these 'holes' or barriers are present and contribute to sub-optimal management of maternal and congenital syphilis: (1) communication challenges; (2) dysfunctional electronic

Table 1. Demographics and treatment knowledge of included participants (N = 34).

Category	Years	n
Age (mean, 46.21 years)	20–29	6
	30–39	6
	40–49	7
	50–59	10
	60+	5
Gender	Male	6
	Female	28
Specialty	Resident – senior house officer	2
	Sexual health physician	2
	Nurse practitioner	2
	Public health nurse	2
	Obstetrician	2
	Infectious disease physician	3
	Paediatrician	4
	General practitioner	5
	Midwife	12
Number of syphilis in pregnancy patients managed in the past year (N = 30)	0	10
	1	7
	2	5
	3	2
	4	2
	5–10	4
Number of syphilis in pregnancy patients managed in the past 10 years (n = 27)	0	8
	1	5
	2	5
	3	3
	4	1
	5–10	4
	>20	1
Self-reported knowledge of:	Range	Mean
Treatment of syphilis in pregnancy	2 (novice) – 5 (expert)	M = 3.12 (intermediate)
Treatment of congenital syphilis	1 (poor) – 5 (expert)	M = 2.76 (novice)
Management of congenital syphilis	1 (poor) – 5 (expert)	M = 2.65 (novice)

management systems; (3) guideline awareness and usability; and (4) HCW knowledge around syphilis and its management.

Theme 1: communication is inconsistent, complicated, and 'many things are missed'

Poor communication was reported as a primary barrier reported across multiple disciplines. At times communication was unclear or inconsistent between HCWs, as well as directly

with patients. Participants described that communication could be complicated if there were multiple cross-discipline teams involved or if the women were accessing care across multiple services. Some HCWs were cognisant of this risk as described by a paediatrician:

...[I always] read up on the stuff...sometimes you discover something later on that no one's handed over to you. (Paediatrician, 7.5 years practice, managed zero cases)

Some HCWs expressed concern that miscommunications could lead to potential serious outcomes for women, neonates, and their communities – as described by one midwife who disclosed they had been involved with the management of a patient who thought that they had been treated for syphilis when they had not.

We had a near miss, that a woman did think she was [treated]... because I chased it up, she had never been treated for her latent... So, she thought she was, but she was given oral tablets for something else. (Midwife, 9 years' practice, managed 5–10 cases)

Theme 2: electronic management systems make it hard to flag and transfer vital information and allows women and babies to 'disappear'

Within hospital settings, electronic data systems play a vital role in storing patient information but HCWs interviewed described them as often lacking functionality, such as the inability to use alerts systems to flag positive syphilis results. This requires clinicians to fully read patient notes, posing the risk of missing important information and results, especially if other urgent matters arise such as late presentation to birthing suites.

In ieMR [integrated electronic medical record] a lot of things are missed, on that sticky note, because you've got to rely on the clinician receiving her to read it all... You know with your paper chart, you might have had a red or whatever sheet in there; you don't have that. (Midwife, 17 years in practice, managed zero cases)

There was also concern raised about the lack of ability to link mother and baby pairs via the electronic systems in place. HCWs considered this could have significant implications on both treatment and follow-up of infants as patients and neonates can be 'lost in the system'.

But then the baby has a name and a surname so unless you link it to the mother's properly and you actually take the extra effort to go and look at the mother's chart, it's hard to tell. (Obstetrician Staff Specialist, 24 years in practice, managed four cases)

Some considered that electronic management systems make it harder for multi-disciplinary care teams to communicate

with one another, particularly if care is taking place across multiple health settings or facilitates. As one midwife shared, being unable to access appropriate records caused women to be re-tested. Some considered over-testing not to be an issue, but some felt this could be a deterrent for women accessing care.

Better that they're tested more often than not, so yes it's just a waste of resources and the woman getting bled more often than necessary. (Infectious Disease Physician, 12 years in practice, managed 5–10 cases)

Electronic management systems limitations combined with the earlier described challenges with communication between HCWs may contribute to HCWs making sub-optimal care-related decisions as they lack key information.

You know, a lot of the mums, it's hard to make a decision for optimal care when you don't have all the information... It would be nice I guess as an overall thing if our computer systems integrated a little bit more. (Paediatric Registrar, 5 years in practice, managed three cases)

Theme 3: guidelines can be hard to find and to follow

Overall, the HCWs reflected on a lack of awareness of key state guidelines.³⁷ Professional updates were provided across Queensland with the implementation of new state guidelines in 2018; however, very few within our sample reported attending or were aware of guideline introduction sessions, possibly reflecting some gaps in dissemination of information to key service providers. Among the few that attended a recent update on syphilis on pregnancy, some felt the sessions did not meet their needs. Some HCWs reported that they were unaware of where to find the relevant Queensland guidelines within their place of employment.

...we've actually got the ASID [Australasian Society for Infectious Diseases] guidelines for all those other congenital infections on our billboard there. So I think we've just then assumed the syphilis one we take from there as well. (Paediatrician, 7.5 years in practice, managed zero cases)

While these national guidelines are not significantly different to the Queensland guidelines, other HCWs stated that when presented with cases of maternal or congenital syphilis, guidelines were found by 'Googling' which resulted in some using guidelines which were not relevant for management in SEQ or Australia:

Honestly, I just go to Google and see which one. Probably Australian or Queensland... if that doesn't tell me much I'll go to the ETG [Electronic Therapeutic Guidelines]. I [also use] the Sanford guidelines as well and Infectious

Diseases Society of America. (Resident, 3 years in practice, managed two cases)

Some HCWs suggested that the key state guidelines and incorporated flowcharts can be difficult to follow. As shared by one paediatric registrar:

There's a little bit of lack of clarity in the guidelines because I guess it being a flowchart it continues on assuming that all the bloods have been done, and so when you skip some bloods or you've skipped some treatment then it becomes a little bit unclear where the flowchart goes if that makes sense. (Paediatric Registrar, 5 years in practice, managed three cases)

Others pointed to the length and circular nature of treatment guidelines as being 'too complicated', and 'won't work in practice'. One infectious disease physician (12 years in practice, managed 5–10 cases) further clarified that the relatively generic nature of guidelines may also not be able to provide HCW with the appropriate answers given that they only use them in 'unusual scenarios', especially those with less experience or experiencing difficulties communicating with other HCWs.

Overall, inconsistency around which guidelines to use contributed to one paediatrician reporting being unable to determine if a mother's current care was adequate.

So I now know that we have a guideline but I didn't even know that actually prior to managing the neonate. And interestingly that morning when it was handed over to me by the night Reg they suggested a different guideline to use... but it didn't really ring any bells about having inadequate [treatment]. Because of the lack of knowledge on my end. (Paediatrician, 7.5 years in practice, managed zero cases)

Theme 4: a lack of knowledge leads to disorganised and inadequate care

Of the participants interviewed for this study, there appeared to be an overall lack of knowledge of how to treat syphilis, particularly congenital syphilis. This may be understandable due to the complexity and breadth of knowledge and skill HCWs need to retain and, until recently, the low rates of infectious syphilis experienced by the HCWs interviewed, as one midwife suggests:

So, I'm kind of bumbling through life not having any of this stuff at the forefront of my mind, I've got enough to keep up there, but relying on policy usually. (Midwife, 15-years in practice, managed one case)

Women diagnosed with syphilis bear witness to misinformation and experience first-hand, its 'fumbly' ramifications.

It was a fumbly, fumbly one and this poor woman [the patient] was given lots of misinformation... We're all going oh we don't do this very often and so this poor young woman was quite lovely working with us. (Midwife, 15 years in practice, managed one case)

The knowledge deficit among HCWs, both on how to manage and where to find accurate, relevant management information, was thought to be contributing to 'clumsy' handover of care between HCWs. Regular multidisciplinary team meetings may be a key solution and many of our sample suggested a need for more formalised or streamlined procedures for acquiring information between the multidisciplinary teams responsible for providing care for women diagnosed with syphilis and their babies:

I guess there should probably be a more streamlined process but often we find that the O&G team is often not aware of the syphilis in pregnancy guideline or there's a lot more history taking around whether the mum's treatment is adequate... So it's a bit of a clumsy – you know, if someone's already not sort of known and a team of specialists hasn't spoken about their case already. (Paediatrician Registrar, 5 years in practice, managed three cases)

Participants in this study considered that a lack of education across all disciplines is a major barrier for providing optimal management and this needs to be overcome with concise and clear communication of guideline updates, and promotion of the changing epidemiological picture of syphilis in pregnancy.

Discussion

The findings from this study reveal difficulties with communication of relevant information across teams and to patients as a key barrier to optimal management. These findings mirror those from international studies.^{21,22,27} However, our study noted that electronic management systems were a leading factor contributing to communication issues, particularly when these systems did not allow for clear flagging of positive syphilis incidences to assist with cross discipline follow-up. Electronic systems also impeded the transferability of patient information across health contexts (e.g. as patients entered outpatient care). Participants described at times a lack of awareness and education about syphilis management and relevant treatment guidelines – contributing to disorganised or inadequate treatment. This was not an unexpected finding as knowledge deficits are widely documented^{21–26} as major barriers in the appropriate management and treatment of syphilis in pregnancy. However, when occurring together, the intersection of these barriers may contribute to instances

of sub-optimal syphilis in pregnancy management identified in SEQ.²⁰

One method to address these barriers is to streamline the access to relevant guidelines to facilitate prompt and effective management. Some participants noted the value of having relevant guidelines publicly available in communal areas such as hospital common areas and intranet sites. Within SEQ, considerable efforts have been undertaken to promote awareness around management of syphilis in pregnancy through the 2018 Syphilis in Pregnancy guidelines.³⁷ The experiences of some of the participants in this study reflect that further translational efforts are necessary. Overall, future research should continue to investigate other ways HCW can access knowledge and support and how this can be better integrated into and shared across hospital and primary healthcare systems.

A key barrier noted by participants was the difficulty in using some electronic management systems – particularly in ‘flagging’ positive cases. A scoping review by Tsai and colleagues³⁸ also noted HCW difficulty using electronic health systems in countries around the world, particularly when integration between different systems is not possible. Therefore, an important step forward may be to consider the unification of electronic management systems across the state to allow for clearer communication of relevant health information. Poor communication is frequently identified as a major issue in healthcare spaces with potential impact on patient outcomes,³⁹ and teams working in maternity contexts emphasise the importance of improving it among their teams.⁴⁰ Work by O’Daniel and Rosenstein⁴¹ highlights that positive interdisciplinary communication is facilitated by open communication, shared responsibility, and clear direction. Other recommendations by O’Leary and colleagues⁴² suggest that factors such as team training and formalised checklist procedures may be useful. However, these authors also highlight the importance of understanding each unique clinical space’s needs. Therefore, future research is necessary to understand how interdisciplinary communication amongst HCWs in SEQ can be improved.

Strengths and limitations

One strength of this study was that a wide range of HCWs were consulted allowing for a broad perspective. A further strength is that members of the research team work in a variety of disciplines and roles across the SEQ hospital and primary healthcare systems, allowing for consideration of contextual factors related to specific professions. One limitation of the current study is that the impact of COVID-19 on women’s antenatal care⁴³ was not discussed, which may have had influence on the barriers described in this study. The impacts of COVID-19 further reduced our ability to recruit a greater, balanced, number of participants from key health areas (e.g. primary health care). Therefore, while a range of professions were included, midwives represented just under a third of the

total sample. While efforts have been made to describe these results across the entirety of the care continuum, this should be considered when drawing conclusions for entire health systems. Finally, some of the experiences analysed in this research reflect individuals who have not yet managed cases of syphilis in pregnancy (24%). HCW with no or minimal experience of management were included if they had experience with testing for syphilis in pregnancy as they were able to provide useful information on barriers to testing,²⁸ the first step to early diagnosis and treatment, along with understanding of how they would manage a diagnosis (e.g. their knowledge of current guidelines and what treatments they would provide), and what resources they would require to do this (e.g. how they would find relevant guidelines, consultation and referral pathways).

Conclusion

Congenital syphilis is a serious infection with potential lifelong sequelae. It can be prevented by detection and treatment of syphilis in pregnancy at least 4 weeks prior to birth. Current evidence suggests that aspects of the healthcare electronic systems, communication between health care providers and with pregnant people and HCW knowledge are key barriers to optimally managing this escalating public health concern. However, these barriers to optimal management can only be fully overcome when deficits in communication and knowledge are addressed simultaneously as they cannot be considered in isolation of one-another. Multilevel and multidisciplinary strategies are needed to overcome the complex inter-connected personnel and system level barriers identified.

References

- 1 French P. Syphilis. *BMJ* 2007; 334(7585): 143–7. doi:10.1136/bmj.39085.518148.BE
- 2 Stoltey JE, Cohen SE. Syphilis transmission: a review of the current evidence. *Sex Health* 2015; 12(2): 103–9. doi:10.1071/SH14174
- 3 Clement ME, Okeke NL, Hicks CB. Treatment of syphilis: a systematic review. *JAMA* 2014; 312(18): 1905–17. doi:10.1001/jama.2014.13259
- 4 Schmidt R, Carson PJ, Jansen RJ. Resurgence of syphilis in the United States: an assessment of contributing factors. *Infect Dis: Res Treat* 2019; 12: 1178633719883282. doi:10.1177/1178633719883282
- 5 Spiteri G, Unemo M, Mårdh O, Amato-Gauci AJ. The resurgence of syphilis in high-income countries in the 2000s: a focus on Europe. *Epidemiol Infect* 2019; 147: e143. doi:10.1017/S0950268819000281
- 6 Kojima N, Klausner JD. An update on the global epidemiology of syphilis. *Curr Epidemiol Rep* 2018; 5(1): 24–38. doi:10.1007/s40471-018-0138-z
- 7 Qin J, Yang T, Xiao S, Tan H, Feng T, Fu H. Reported estimates of adverse pregnancy outcomes among women with and without syphilis: a systematic review and meta-analysis. *PLoS ONE* 2014; 9(7): e102203. doi:10.1371/journal.pone.0102203

- 8 Schmid GP, Stoner BP, Hawkes S, Broutet N. The need and plan for global elimination of congenital syphilis. *Sex Transm Dis* 2007; 34(7): S5–S10. doi:[10.1097/01.olq.0000261456.09797.1b](https://doi.org/10.1097/01.olq.0000261456.09797.1b)
- 9 Newman L, Kamb M, Hawkes S, Gomez G, Say L, Seuc A, et al. Global estimates of syphilis in pregnancy and associated adverse outcomes: analysis of multinational antenatal surveillance data. *PLoS Med* 2013; 10(2): e1001396. doi:[10.1371/journal.pmed.1001396](https://doi.org/10.1371/journal.pmed.1001396)
- 10 Arnold SR, Ford-Jones EL. Congenital syphilis: a guide to diagnosis and management. *Paediatr Child Health* 2000; 5(8): 463–9. doi:[10.1093/pch/5.8.463](https://doi.org/10.1093/pch/5.8.463)
- 11 Lim J, Yoon SJ, Shin JE, Han JH, Lee SM, Eun HS, et al. Outcomes of infants born to pregnant women with syphilis: a nationwide study in Korea. *BMC Pediatr* 2021; 21(1): 47. doi:[10.1186/s12887-021-02502-9](https://doi.org/10.1186/s12887-021-02502-9)
- 12 Communicable Diseases Branch. Notifications of syphilis in Queensland, 2010–2015. Brisbane: Queensland Department of Health; 2016.
- 13 Communicable Diseases Branch. Notifications of syphilis in Queensland 2019 report. Brisbane: Queensland Health; 2020.
- 14 Kirby Institute and the Centre for Social Research in Health. National update on HIV, viral hepatitis and sexually transmissible infections in Australia: 2009–2021. Sydney: Kirby Institute and the Centre for Social Research in Health, UNSW; 2020.
- 15 State of Queensland (Queensland Health). North Queensland Aboriginal and Torres Strait Islander sexually transmissible infections action plan 2016–2021. Brisbane: Queensland Health; 2016.
- 16 Department of Infrastructure, Transport, Regional Development, Communications and the Arts. Office of Northern Australia. 2023. Available at <https://www.infrastructure.gov.au/territories-regions-cities/regional-australia/office-northern-australia>
- 17 Government of Western Australia Department of Health. Metropolitan Perth syphilis outbreak alert. 2020. Available at https://www.health.wa.gov.au/Articles/J_M/Metropolitan-Perth-syphilis-outbreak-alert [last reviewed 28 July 2020]
- 18 Victoria State Government. Health advisory – congenital syphilis in Victoria. Melbourne: Victoria State Government; 2020. Available at <https://www.health.vic.gov.au/health-advisories/congenital-syphilis-in-victoria>
- 19 Korenromp EL, Rowley J, Alonso M, Mello MB, Wijesooriya NS, Mahiané SG, et al. Global burden of maternal and congenital syphilis and associated adverse birth outcomes—estimates for 2016 and progress since 2012. *PLoS ONE* 2019; 14(2): e0211720. doi:[10.1371/journal.pone.0211720](https://doi.org/10.1371/journal.pone.0211720)
- 20 Wu M, Seel M, Britton S, Dean JA, Lazarou M, Safa H, et al. Addressing the crisis of congenital syphilis: key findings from an evaluation of the management of syphilis in pregnancy and the newborn in South-East Queensland. *Aust N Z J Obstet Gynaecol* 2022; 62: 91–7. doi:[10.1111/ajo.13424](https://doi.org/10.1111/ajo.13424)
- 21 Kanai M, Arima Y, Shimada T, Hori N, Yamagishi T, Sunagawa T, et al. Sociodemographic characteristics and clinical description of congenital syphilis patients and their mothers in Japan: a qualitative study, 2016. *Sex Health* 2018; 15(5): 460–7. doi:[10.1071/SH18033](https://doi.org/10.1071/SH18033)
- 22 Munro CH, Henniker-Major R, Homfray V, Browne R. Improving the antenatal and post-partum management of women presenting to Sexual Health Services with positive syphilis serology through audit. *Int J STD AIDS* 2017; 28(9): 929–31. doi:[10.1177/0956462417691443](https://doi.org/10.1177/0956462417691443)
- 23 Matteelli A, Dal Punta V, Angeli A, Basché R, Carvalho AC, Tomasoni LR, et al. Congenital syphilis in Italy. *Sex Transm Infect* 2007; 83(7): 590–1. doi:[10.1136/sti.2007.025338](https://doi.org/10.1136/sti.2007.025338)
- 24 Patel SJ, Klinger EJ, O'Toole D, Schillinger JA. Missed opportunities for preventing congenital syphilis infection in New York City. *Obstet Gynecol* 2012; 120(4): 882–8. doi:[10.1097/AOG.0b013e31826ac25f](https://doi.org/10.1097/AOG.0b013e31826ac25f)
- 25 Plitt SS, Osman M, Sahni V, Lee BE, Charlton C, Simmonds K. Examination of a prenatal syphilis screening program, Alberta, Canada: 2010–2011. *Can J Public Health* 2016; 107(3): e285–90. doi:[10.17269/CJPH.107.5320](https://doi.org/10.17269/CJPH.107.5320)
- 26 Townsend CL, Francis K, Peckham CS, Tookey PA. Syphilis screening in pregnancy in the United Kingdom, 2010–2011: a national surveillance study. *BJOG* 2017; 124(1): 79–86. doi:[10.1111/1471-0528.14053](https://doi.org/10.1111/1471-0528.14053)
- 27 Doroshenko A, Sherrard J, Pollard AJ. Syphilis in pregnancy and the neonatal period. *Int J STD AIDS* 2006; 17(4): 221–8. doi:[10.1258/095646206776253354](https://doi.org/10.1258/095646206776253354)
- 28 Warzywoda S, Fowler JA, Nourse C, Wu M, Britton S, Rowling D, et al. Syphilis in pregnancy: a qualitative investigation of healthcare provider perspectives on barriers to syphilis screening during pregnancy in south-east Queensland. *Sex Health* 2023. doi:[10.1071/SH22193](https://doi.org/10.1071/SH22193)
- 29 Trepka MJ, Bloom SA, Zhang G, Kim S, Nobles RE. Inadequate syphilis screening among women with prenatal care in a community with a high syphilis incidence. *Sex Transm Dis* 2006; 33(11): 670–4. doi:[10.1097/01.olq.0000216032.52731.ea](https://doi.org/10.1097/01.olq.0000216032.52731.ea)
- 30 Magalhães M, Basto L, Areia AL, Franco S, Malheiro ME, Afonso ME, et al. Syphilis in pregnancy and congenital syphilis: reality in a Portuguese Central University Hospital. *Rev Bras Ginecol Obstet* 2017; 39(6): 265–72. doi:[10.1055/s-0037-1603646](https://doi.org/10.1055/s-0037-1603646)
- 31 Chan EYL, Smullin C, Clavijo S, Papp-Green M, Park E, Nelson M, et al. A qualitative assessment of structural barriers to prenatal care and congenital syphilis prevention in Kern County, California. *PLoS ONE* 2021; 16(4): e0249419. doi:[10.1371/journal.pone.0249419](https://doi.org/10.1371/journal.pone.0249419)
- 32 Zhang X, Wang X, Wang H, He X, Wang X. Stigmatization and social support of pregnant women with HIV or syphilis in eastern China: a mixed-method study. *Front Public Health* 2022; 10: 764203. doi:[10.3389/fpubh.2022.764203](https://doi.org/10.3389/fpubh.2022.764203)
- 33 Broyles LM, Rodriguez KL, Price PA, Bayliss NK, Sevcik MA. Overcoming barriers to the recruitment of nurses as participants in health care research. *Qual Health Res* 2011; 21(12): 1705–18. doi:[10.1177/1049732311417727](https://doi.org/10.1177/1049732311417727)
- 34 Salmon P, Peters S, Rogers A, Gask L, Clifford R, Iredale W, et al. Peering through the barriers in GPs' explanations for declining to participate in research: the role of professional autonomy and the economy of time. *Fam Pract* 2007; 24(3): 269–75. doi:[10.1093/fampra/cmm015](https://doi.org/10.1093/fampra/cmm015)
- 35 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; 3(2): 77–101. doi:[10.1191/1478088706qp0630a](https://doi.org/10.1191/1478088706qp0630a)
- 36 Braun V, Clarke V. Successful thematic analysis. London: Sage Publications; 2013.
- 37 Queensland Clinical Guidelines. Syphilis in pregnancy. Brisbane: Queensland Health; 2018.
- 38 Tsai CH, Eghdam A, Davoody N, Wright G, Flowerday S, Koch S. Effects of electronic health record implementation and barriers to adoption and use: a scoping review and qualitative analysis of the content. *Life* 2020; 10(12): 327. doi:[10.3390/life10120327](https://doi.org/10.3390/life10120327)
- 39 Taran S. An examination of the factors contributing to poor communication outside the physician-patient sphere. *McGill J Med* 2011; 13(1): 86. doi:[10.26443/mjmv.v13i1.253](https://doi.org/10.26443/mjmv.v13i1.253)
- 40 Pereda-Goikoetxea B, Huitzi-Egilegor JX, Zubeldia-Etxeberria J, Uranga-Iturrioz MJ, Elorza-Puyadena MI. Hospital childbirth: perspectives of women and professionals for a positive experience—a qualitative study. *Int J Environ Res Public Health* 2021; 18(19): 10238. doi:[10.3390/ijerph181910238](https://doi.org/10.3390/ijerph181910238)
- 41 O'Daniel M, Rosenstein A. Professional communication and team collaboration. In: Hughes RG, editor. Patient safety and quality: an evidence-based handbook for nurses. Rockville, MD: Agency for Healthcare Research and Quality (US); 2008.
- 42 O'Leary KJ, Sehgal NL, Terrell G, Williams MV, for the High Performance Teams, the Hospital of the Future Project Team. Interdisciplinary teamwork in hospitals: a review and practical recommendations for improvement. *J Hosp Med* 2012; 7(1): 48–54. doi:[10.1002/jhm.970](https://doi.org/10.1002/jhm.970)
- 43 Esegbona-Adeigbe S. Impact of COVID-19 on antenatal care provision. *Eur J Midwifery* 2020 doi:[10.18332/ejm/121096](https://doi.org/10.18332/ejm/121096)

Data availability. Due to the confidential nature of the data collected, data is not available for access by those external to the research team.

Conflicts of interest. The authors have no conflicts of interest to declare.

Declaration of funding. This research is supported by the Sexual Health Research Fund, an initiative of the Sexual Health Ministerial Advisory Committee, funded by Queensland Health. It is administered by ASHM.

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