Educating antenatal patients about cytomegalovirus infection: An e-learning package improves general practitioners' knowledge and intention to implement clinical guidelines

Hayley Smithers-Sheedy, Katherine Swinburn, Natalia Rode, Tanya Tripathi, Natasha Holmes, Emma Waight, Annabel Webb, Philip N Britton, Hugh Stump, Antonia Shand, Lisa Hui

Background and objective
The Australian Government's Living Evidence for Australian Pregnancy and Postnatal Care guideline recommend all pregnant women be informed about cytomegalovirus (CMV) infection risk-reduction strategies. The aim of this paper was to determine the effectiveness of the 'Infections in Pregnancy' e-learning module in improving general practitioner (GP) knowledge, confidence in counselling and intended practice regarding CMV patient education.

Methods
This study used a pre-post quasi-experimental design. GPs undertaking the module in March to December 2023 completed questionnaires before and after completing the module. An adjusted linear mixed effects model was used to evaluate change in scores.

Results
Of 164 study participants, 94% had not previously received CMV prevention education. Total adjusted mean CMV knowledge scores and confidence in CMV counselling were significantly higher after completing the module (P<0.001). The proportion of GPs intending to counsel pregnant patients about CMV increased from 24% to 97% after completing the module.

Discussion
Targeted e-learning can improve GP knowledge and confidence, and can support the implementation of the national congenital CMV risk-reduction guidelines.

CONGENITAL CYTOMEGALOVIRUS (CMV) is a major cause of life-long neurodevelopmental disabilities such as sensorineural hearing loss, epilepsy, learning difficulties and cerebral palsy.[1–3] Although the prevalence of congenital CMV in Australia is not known, data from comparable high-income countries suggest that around one in 200 infants are born with congenital CMV, making it the most common congenital infection.[2,4] Hygiene precautions, including avoiding contact with a child's saliva or urine and handwashing after such exposure, reduce the risk of CMV in pregnancy and are acceptable to women.[5–7] The Australian Government's 'Living Evidence for Australian Pregnancy and Postnatal Care' guideline recommends advising 'all pregnant women about hygiene measures to help reduce the risk of cytomegalovirus infection'.[8] This advice is in line with recommendations from both the Royal Australian and New Zealand College of Obstetricians and Gynaecologists, international consensus guidelines and a recently published evidence-based European guideline.[9–11] Educating all pregnant women and those planning a pregnancy as early as possible and at each pregnancy is important, as a primary maternal infection in the first trimester of pregnancy holds the greatest risk of poor fetal outcomes.[3]

However, most pregnant women in Australia do not know about CMV or how to reduce their risk of infection in pregnancy.[12] Maternity health professionals including general practitioners (GPs) have a pivotal role in providing preconception and early antenatal care, including education about preventive measures to reduce the risk of perinatal infections.[13,14] However, less than 20% of GPs feel confident giving advice about CMV, with a 'lack of knowledge about CMV' identified as a major barrier to providing patient education about reducing their risk of infection.[15]

Previous research by this author group has found that an e-learning course significantly improved midwives' knowledge about CMV and confidence in providing antenatal counselling; however, to our knowledge, no studies to date have evaluated the impact of CMV education for GPs.[16]

The objectives of this study were to evaluate the effectiveness of the education module in improving GPs' knowledge and confidence in CMV counselling and their intention to provide CMV prevention advice to pregnant women.

Methods

The e-learning module content was developed, reviewed and piloted with support from an expert reference group, which included GPs, maternal fetal medicine specialists, paediatric infectious disease specialists, virologists and people with lived experience of CMV. Early feedback from GPs indicated that a stand-alone module on CMV would be too narrow in scope; therefore, education on another high-priority perinatal infection, congenital syphilis, was added. Only the results of the CMV education evaluation are presented here.

Participants accessed the free 'Infections in Pregnancy' module via the Praxhub™ health education platform.[17] The module was accredited with The Royal Australian College of General Practitioners (RACGP) and The Australian College of Rural and Remote Medicine (ACCRM). The CMV component of the module included five lessons requiring approximately 30 minutes to complete (Figure 1). The module was advertised to GPs by Praxhub™, social media, Primary Health Networks and shared-care GP networks.

GPs undertaking the module between March and December 2023 were invited to participate in an optional evaluation that included online questionnaires completed at three time points: timepoint 1 (T1) – before accessing the module content; timepoint 2 (T2) – immediately after completing the module; and timepoint 3 (T3) – eight weeks later. All questionnaires were designed in accordance with recommended methodology for questionnaire research.[18] A GP (NR), specialist maternal fetal medicine subspecialist (LH) and researchers with experience in adult education and participant-reported outcomes research (HSS, KS, LH) were involved in the questionnaire design. The questionnaire was piloted by three GPs for face validity and refined (eg amendments to question phrasing and reduced number of knowledge questions asked) prior to recruitment. The T1 questionnaire collected data on demographics, practice setting and previous CMV education. A combination of multiple-choice questions, Likert scales and space for limited free-text responses were used to assess CMV knowledge and current practice. The T2 and T3 questionnaires included knowledge, confidence and current practice questions as per T1, plus additional questions about access to CMV patient information resources and course content and format (Appendix 1, available online only).

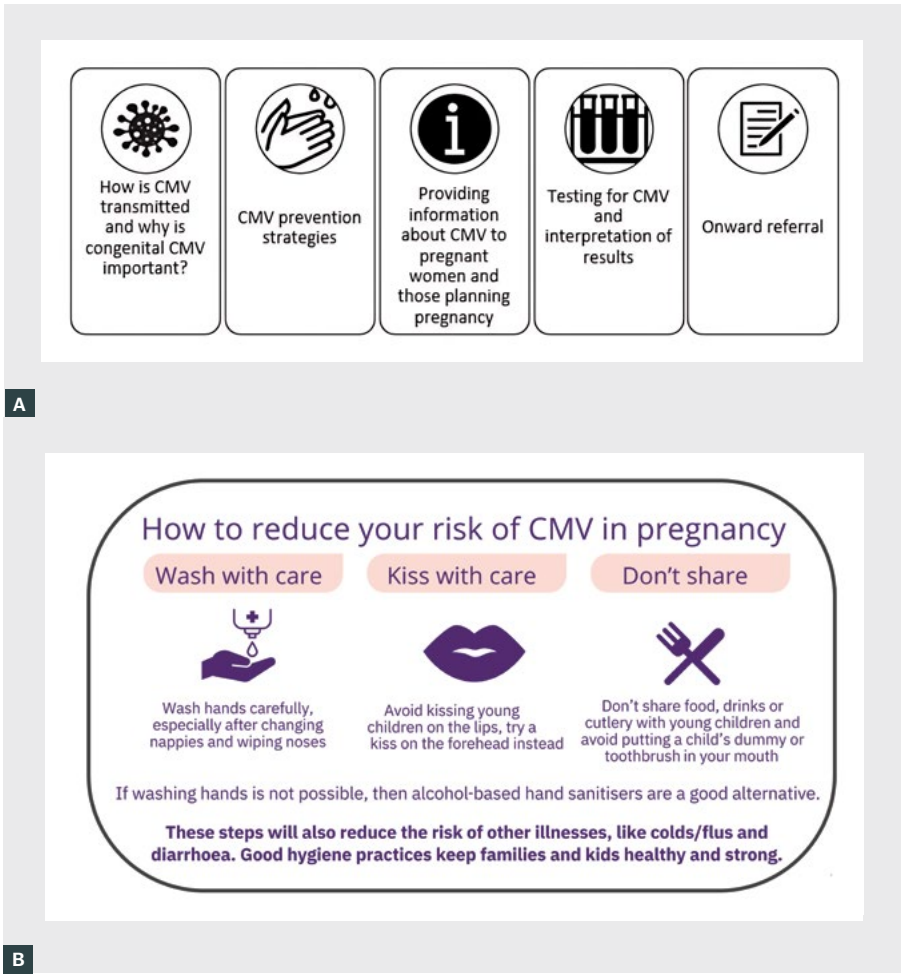

Figure 1. (A) Congenital CMV e-learning content. **(B)** Congenital CMV hygiene precautions. CMV, cytomegalovirus.

All GPs participating in the evaluation of the e-learning module provided informed consent using an online information and consent form in REDCap (Research Electronic Data Capture) before being directed to the online questionnaire.[19,20] Survey responses were collected and managed in REDCap electronic data capture tools hosted at The University of Melbourne. Individual participant responses at T1, T2 and T3 were linked. Participants who completed the questionnaires were able to claim 'Reviewing Performance Continuing Professional Development' hours and were eligible to go into a draw to receive one of five $50 gift cards. Additional aggregated, de-identified summary data required for RACGP accreditation were provided by Praxhub™ and these were exempt from specific research consent.

Statistical analysis

Participant demographic data at each time point were analysed using descriptive statistics. The mean change in congenital CMV knowledge scores between the pre-course timepoint (T1) and: (1) the immediate post-course timepoint (T2); and (2) the eight-weeks' post-course time

point (T3) were estimated using a linear mixed effects model, with test scores as the response, timepoint as a fixed predictor and a random intercept for each participant to account for repeated measures. The Akaike information criteria were used to identify the preferred model that adjusted for previous CMV education, length of practice and metropolitan practice location, and this mode was used to calculate adjusted mean scores.

An ordinal regression model with a random intercept, controlling for prior CMV education, was used to investigate changes in participant responses to statements about confidence in counselling about CMV and inclusion of CMV counselling in routine care. Knowledge of where to access CMV patient resources at T2 and T3 were reported using descriptive statistics. A *P* value of <0.05 was considered statistically significant. Statistical analyses were performed in R (www.r-project.org), using the packages lme4 and ordinal.

Free-text responses were examined with inductive content analysis to create categories that provided additional context for specific survey responses.

This study was approved by the Mercy Health human research ethics committee (HREC no. 2022-047).

Results

From March to December 2023, a total of 353 people registered to complete the e-learning module, and 169 (56%) consented to participate in the course evaluation. Characteristics of the study participants are presented in Table 1. Participants were geographically spread across all Australian states and territories and the majority (57%) had more than 10 years' experience working as a GP. The majority (93%) of participants reported that they had not previously received CMV education (Table 1).

Table 1. Participant characteristics

	Pre-course (T1)	Post-course (T2)	8 weeks post-course (T3)
	n=169	n=118	n=79
Role			
Shared care GP	95 (56)	62 (53)	45 (57)
GP obstetrician	6 (4)	4 (3)	2 (3)
GP (non-shared care)	56 (33)	36 (31)	24 (30)
Registrar/other	12 (8)	11 (9)	7 (9)
Not stated	–	5 (4)	1 (1)
Previously received CMV education			
Yes	11 (7)	5 (4)	5 (6)
No	158 (93)	108 (92)	73 (94)
Not stated	–	5 (4)	–
Practice location			
Metropolitan	119 (70)	79 (71)	56 (71)
Regional	31 (18)	20 (18)	14 (18)
Rural/Remote	18 (11)	13 (12)	7 (9)
Not stated	1 (1)	–	2 (3)
Years practising as a GP			
GP Registrar	6 (4)	4 (2)	3 (4)
<5	36 (21)	25 (21)	19 (24)
5–9	30 (18)	21 (18)	13 (16)
10–14	24 (14)	17 (14)	12 (15)
≥15	72 (43)	45 (38)	30 (38)
Not stated	1 (1)	6 (5)	2 (3)

Data are presented as n (%). – means zero.

CMV, cytomegalovirus; GP, general practitioner; T, timepoint.

CMV knowledge and confidence in providing CMV counselling

Of the 169 participants who completed the evaluation questionnaire prior to starting the course (T1), 118 (69%) completed a second questionnaire immediately after finishing the course (T2) and 79 (47%) completed the eight-week post-course questionnaire (T3). Participants' adjusted mean scores improved significantly between T1 and T2 (T1: 7.06, 95% confidence interval [CI]: 6.80, 7.34; T2: 9.41, 95% CI: 9.09, 9.74, *P*<0.001). Eight weeks after completing the course (T3), improvements in participants' adjusted scores remained significant compared with those at T1 (T1: 7.06, 95% CI: 6.80, 7.34; T3: 9.06, 95% CI: 8.68, 9.46; *P*<0.001) (Table 2).

Participant confidence in counselling about CMV was measured by participant response to the statement 'I feel confident giving advice and answering questions about CMV'. The range of responses on a five-point Likert scale ranged from 'Strongly agree' to 'Strongly disagree'. After adjusting for previous CMV education, we identified that the improvements in participant confidence observed between T1 and T2 and between T1 and T3 were both statistically significant (*P*<0.001) (Figure 2).

CMV counselling practice

Prior to the e-learning module (T1), 24% of GPs agreed/strongly agreed with the statement 'I routinely provide CMV information to pregnant women or those planning a pregnancy'. Reasons for not agreeing with this statement provided in the free-text field included limited knowledge about CMV, being unsure what information to share with patients and the misconception that CMV is uncommon.

After completing the e-learning module (T2), 97% of GPs agreed/strongly agreed with the statement 'I intend to provide CMV information to pregnant women or those

Table 2. Participant response scores to CMV knowledge evaluation questions

	T1 Pre-module (n=169)	T2 Post-module (n=118)	T1–T2 Mean change	T3 8 weeks post-module (n=79)	T1–T3 Mean change
	Knowledge evaluation scores (maximum score=10)				
Unadjusted score[A]	6.99 (2.25)	9.46 (0.91)	+2.41 (0.38) *P*<0.001	9.04 (1.76)	+1.97 (0.44) *P*<0.001
Adjusted score[B]	7.06 (6.80, 7.34)	9.41 (9.09, 9.74)	+2.35 (1.98, 2.72) *P*<0.001	9.06 (8.68, 9.46)	+2.00 (1.58, 2.43) *P*<0.001

[A]Unadjusted mean change from the random effects model which accounts for uneven dropout between timepoints. Data are presented as mean (SD).

[B]Adjusted measures accounting for previous CMV education, practice location and years' experience. Data are presented as mean (95% CI).

CI, confidence interval; CMV, cytomegalovirus; SD, standard deviation; T, timepoint.

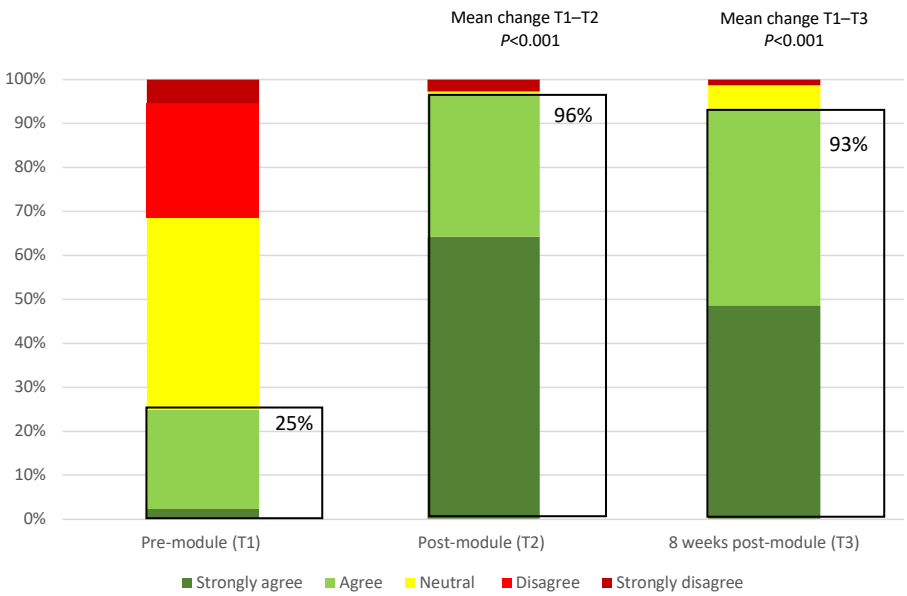

Figure 2. Participant confidence in providing cytomegalovirus (CMV) counselling before and after completing the e-learning module. T, timepoint.

planning a pregnancy', with 83% continuing to agree/strongly agree with this statement eight weeks later (T3) (Figure 3).

At T3, one-third (35%) of GPs reported that they had counselled 'almost all' pregnant patients that they had seen in the last month about CMV, around one-third (32%) had counselled 'about half' their patients, with the remainder indicating they had counselled 'less than 10% of their pregnant patients'.

After completing the e-learning module (T2), 92% of participants indicated that they knew where to access CMV information resources to share with pregnant women; at T3, this remained high at 80%.

Feedback on the e-learning module

De-identified summary module feedback data collected by Praxhub™ for RACGP accreditation purposes indicated that 98.5% felt the e-learning module 'entirely met' their expectations in terms of content and delivery. Almost all GPs (97.5%) indicated that they would recommend the e-learning module to others.

Discussion

GPs have a key role to play in antenatal counselling about CMV.[14] However, in this study, 93% of GPs reported that they had not previously received education on CMV infection in pregnancy, underlining the need for new and accessible education offerings. This study showed that an e-learning module, developed in partnership with GPs, clinical experts and people with lived experience, supported the implementation of the CMV clinical practice guidelines by significantly improving GP knowledge and confidence in this area. Importantly, immediately after completion of the e-learning module, almost all (97%) of the GPs in this study intended to routinely provide CMV education, compared with only 24% who were providing this advice before completing the module.

Clarity and consistency of messaging around CMV risk reduction within routine antenatal counselling is essential. Notably, the 2024 'Guidelines for preventive activities in general practice' (ie the RACGP's Red Book)[21] does not include CMV education in the recommended content for the 'First antenatal visit'. Interestingly, counselling around listeriosis and salmonella is included despite these infections impacting substantially fewer pregnant women and their

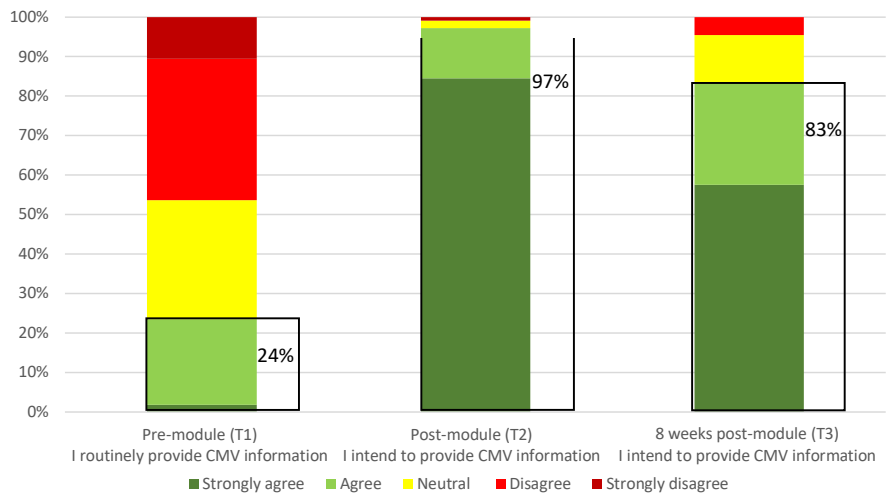

Figure 3. Participant responses to statements about sharing information about cytomegalovirus (CMV). T, timepoint.

babies (around 10 cases per year).[21,22] This is a missed opportunity as CMV is the most common congenital infection in Australia and maternal hygiene precautions need to be discussed early in pregnancy when the risk to the developing fetus is greatest.[3]

Strengths and limitations

The strengths of this study were the use of three timepoints in the analysis, allowing evaluation of changes in knowledge and motivation beyond immediate completion of the education module. The analyses also accounted for confounders and modifiers, by adjusting for prior CMV education and length of clinical practice in our model. The online delivery supported inclusion of GPs from across Australia and a variety of practice settings.

Limitations of this research included potential selection bias as not all GPs who registered for the e-learning module participated in the evaluation surveys and some participants were lost to follow-up over time. To address some of these issues, we used a mixed-effects model and included a random intercept to account for differences between those lost and not lost to follow-up. This research study was not designed to identify the barriers and enablers impacting GPs' antenatal counselling about CMV; however, we are exploring this important issue in a qualitative study.

Conclusion

Looking forward, there is now increasing attention on the role of routine CMV screening in pregnancy, especially given the effectiveness of maternal treatment with valaciclovir for the prevention of fetal infection after maternal primary infection.[23,24] A European consensus group has recently recommended routine CMV serology for all women at the first antenatal visit, with follow-up testing in seronegative women to detect maternal primary infection in the first trimester.[12] If this is adopted into Australian clinical practice, then GP knowledge of CMV will become an even more important part of the first antenatal visit. Ensuring the timely update of general practice guidelines such as the RACGP's 'Red Book' and promoting greater knowledge about CMV risk reduction through flexible resources such as this e-learning module will be important steps in preparing GPs for these anticipated changes in practice.

The 'Infections in pregnancy' e-learning module significantly improved GP knowledge and confidence in providing CMV education for pregnant patients and those planning a pregnancy. After completing the module, almost all GPs planned to routinely provide risk-reduction advice about CMV to their patients. Ongoing work to understand the barriers and enablers to implementing national guidelines is currently underway and will inform future policy measures.

Authors

Hayley Smithers-Sheedy BAppSc (SpPath), MPH, PhD, Principal Research Fellow, Cerebral Palsy Alliance, Sydney, NSW; Adjunct Associate Professor, The University of Sydney, Sydney, NSW

Katherine Swinburn BAppSc (SpPath), MPH, Research Officer, Cerebral Palsy Alliance, The University of Sydney, Sydney, NSW

Natalia Rode MBBS, BSc (Med) (Hons), FRACGP, DRANZCOG, DCH, Education and Research General Practitioner, Department of Obstetrics, Gynaecology and Newborn Health, The University of Melbourne, Melbourne, Vic

Tanya Tripathi BPT, PhD, Research Fellow, Department of Obstetrics, Gynaecology and Newborn Health, The University of Melbourne, Melbourne, Vic

Natasha Holmes MBBS (Hons), PhD, Infectious Diseases Physician, Department of Infectious Diseases and Immunology, Austin Health, Melbourne, Vic; Associate Professor, Department of Infectious Diseases, The University of Melbourne at the Peter Doherty Institute for Infection and Immunity, Melbourne, Vic; Infectious Diseases Physician, Department of Perinatal Medicine, Mercy Hospital for Women, Melbourne, Vic

Emma Waight BAppPH, Research Associate, Cerebral Palsy Alliance, The University of Sydney, Sydney, NSW

Annabel Webb BSc, MRes (Stat), Statistician, Cerebral Palsy Alliance Research Institute, The University of Sydney, Sydney, NSW

Philip N Britton FRACP, MPH&TM, PhD, Staff Specialist in Infectious Diseases, The Children's Hospital at Westmead and The University of Sydney, Sydney, NSW

Hugh Stump FRACGP-RG, FRACGP, MBBS, DCH, BAgEc (Hons), Rural Generalist General Practitioner, Orange Aboriginal Medical Service, Orange, NSW; Adjunct Academic, Charles Sturt University, Orange, NSW

Antonia Shand MBChB, FRANCOG, CMFM, Mmed (Clin Epi), Staff Specialist, Royal Hospital for Women, Sydney, NSW; Research Fellow, The University of Sydney, Sydney, NSW

Lisa Hui MBBS, PhD, Professor, Department of Obstetrics, Gynaecology and Newborn Health, Melbourne Medical School, Faculty of Medical, Dentistry and Health Sciences, The University of Melbourne, Melbourne, Vic; Group Leader, Reproductive Epidemiology, Murdoch Children's Research Institute, Melbourne, Vic; Maternity Fetal Medicine Specialist, Mercy Hospital for Women, Melbourne, Vic; Maternal Fetal Medicine Specialist, Northern Health, Melbourne, Vic

Competing interests: None.

Funding: LH, NR and TT were supported by the Norman Beischer Medical Research Foundation. KS, EW, AW and HSS were supported by the Cerebral Palsy Alliance Research Foundation.

Provenance and peer review: Not commissioned, externally peer reviewed.

Correspondence to:
hsmitherssheedy@cerebralpalsy.org.au

Acknowledgements

The authors wish to thank the following individuals who so generously contributed their time and expertise to the development of the 'Infections in Pregnancy' module and/or review/piloting of the evaluation questionnaires: Mrs Hanako Stump, Dr Hugh Stump, Professor Pam Palasanthiran, Professor Bill Rawlinson, Mrs Kate Russ-Daly and Dr Simone Ridge.

References

1. Smithers-Sheedy H, Raynes-Greenow C, Badawi N, et al. Congenital cytomegalovirus among children with cerebral palsy. J Pediatr 2017;181:267–271.e1. doi: 10.1016/j.jpeds.2016.10.024.
2. McMullan BJ, Palasanthiran P, Jones CA, et al. Congenital cytomegalovirus — time to diagnosis, management and clinical sequelae in Australia: Opportunities for earlier identification. Med J Aust 2011;194(12):625–29. doi: 10.5694/j.1326-5377.2011.tb03144.x.
3. Manicklal S, Emery VC, Lazzarotto T, Boppana SB, Gupta RK. The "silent" global burden of congenital cytomegalovirus. Clin Microbiol Rev 2013;26(1):86–102. doi: 10.1128/CMR.00062-12.
4. Ssentongo P, Hehnly C, Birungi P, et al. Congenital cytomegalovirus infection burden and epidemiologic risk factors in countries with universal screening: A systematic review and meta-analysis. JAMA Netw Open 2021;4(8):e2120736. doi: 10.1001/jamanetworkopen.2021.20736.
5. Pesch MH, Saunders NA, Abdelnabi S. Cytomegalovirus infection in pregnancy: Prevention, presentation, management and neonatal outcomes. J Midwifery Womens Health 2021;66(3):397–402. doi: 10.1111/jmwh.13228.
6. Barber V, Calvert A, Vandrevala T, et al. Prevention of acquisition of cytomegalovirus infection in pregnancy through hygiene-based behavioral interventions: A systematic review and gap analysis. Pediatr Infect Dis J 2020;39(10):949–54. doi: 10.1097/INF.0000000000002763.
7. Adler SP. Prevention of maternal-fetal transmission of cytomegalovirus. EBioMedicine 2015;2(9):1027–28. doi: 10.1016/j.ebiom.2015.08.004.
8. Australian Living Evidence Collaboration. Pregnancy and postnatal care: Evidence-based clinical recommendations for everyone who needs or works in pregnancy and postnatal care. Australian Living Evidence Collaboration, 2024. Available at https://livingevidence.org.au/living-guidelines/leapp [Accessed 27 September 2024].
9. Rawlinson WD, Boppana SB, Fowler KB, et al. Congenital cytomegalovirus infection in pregnancy and the neonate: Consensus recommendations for prevention, diagnosis, and therapy. Lancet Infect Dis 2017;17(6):e177–88. doi: 10.1016/S1473-3099(17)30143-3.
10. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Prevention of congenital cytomegalovirus (CMV) infection. RANZCOG, 2019. Available at https://ranzcog.edu.au/?s=CMV [Accessed 14 February 2025].
11. Leruez-Ville M, Chatzakis C, Lilleri D, et al. Consensus recommendation for prenatal, neonatal and postnatal management of congenital cytomegalovirus infection from the European congenital infection initiative (ECCI). Lancet Reg Health Eur 2024;40:100892. doi: 10.1016/j.lanepe.2024.100892.
12. Lazzaro A, Vo ML, Zeltzer J, et al. Knowledge of congenital cytomegalovirus (CMV) in pregnant women in Australia is low, and improved with education. Aust N Z J Obstet Gynaecol 2019;59(6):843–49. doi: 10.1111/ajo.12978.
13. Sutherland G, Yelland J, Wiebe J, Kelly J, Marlowe P, Brown S. Role of general practitioners in primary maternity care in South Australia and Victoria. Aust N Z J Obstet Gynaecol 2009;49(6):637–41. doi: 10.1111/j.1479-828X.2009.01078.x.
14. The Royal Australian College of General Practitioners (RACGP). Maternity care in general practice: Position statement. RACGP Specific Interests, 2021. Available at www.racgp.org.au/FSDEDEV/media/documents/RACGP/Position%20statements/Maternity-care-in-general-practice.pdf [Accessed 25 February 2025].
15. Shand AW, Luk W, Nassar N, Hui L, Dyer K, Rawlinson W. Cytomegalovirus (CMV) infection and pregnancy – potential for improvements in Australasian maternity health providers' knowledge. J Matern Fetal Neonatal Med 2018;31(19):2515–20. doi: 10.1080/14767058.2017.1344968.
16. Smithers-Sheedy H, Swinburn K, Waight E, et al. eLearning significantly improves maternity professionals' knowledge of the congenital cytomegalovirus prevention guidelines. Aust N Z J Obstet Gynaecol 2022;62(3):445–52. doi: 10.1111/ajo.13500.
17. Rode N, Swinburn K, Holmes N, Smithers-Sheedy H, Hui L. Infections in pregnancy. PraxhubTM, 2023. Available at https://on.praxhub.com/unimelb/infections-in-pregnancy [Accessed 17 September 2024].
18. Boynton PM, Greenhalgh T. Selecting, designing, and developing your questionnaire. BMJ 2004;328(7451):1312–15. doi: 10.1136/bmj.328.7451.1312.
19. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) — A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009;42(2):377–81. doi: 10.1016/j.jbi.2008.08.010.
20. Harris PA, Taylor R, Minor BL, et al; REDCap Consortium. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform 2019;95:103208. doi: 10.1016/j.jbi.2019.103208.
21. The Royal Australian College of General Practitioners (RACGP). Guidelines for preventive activities in general practice. 10th edn. RACGP, 2024. Available at www.racgp.org.au/getattachment/082da4be-5898-4045-82d7-be75e2d03905/Guidelines-for-preventive-activities-in-general-practice.aspx [Accessed 27 September 2024].
22. NSW Government Food Authority. Listeria and pregnancy, the foods you should avoid and why. NSW Food Authority, 2014. Available at www.foodauthority.nsw.gov.au/sites/default/files/_Documents/foodsafetyandyou/listeria_and_pregnancy.pdf [Accessed 27 September 2024].
23. Shahar-Nissan K, Pardo J, Peled O, et al. Valaciclovir to prevent vertical transmission of cytomegalovirus after maternal primary infection during pregnancy: A randomised, double-blind, placebo-controlled trial. Lancet 2020;396(10253):779–85. doi: 10.1016/S0140-6736(20)31868-7.
24. Chatzakis C, Shahar-Nissan K, Faure-Bardon V, et al. The effect of valacyclovir on secondary prevention of congenital cytomegalovirus infection, following primary maternal infection acquired periconceptionally or in the first trimester of pregnancy. An individual patient data meta-analysis. Am J Obstet Gynecol 2024;230(2):109–117.e2. doi: 10.1016/j.ajog.2023.07.022.

correspondence **ajgp@racgp.org.au**