International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Chong JY et al. Int J Reprod Contracept Obstet Gynecol. 2024 Dec;13(12):3491-3497
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20243579

Original Research Article

Knowledge and attitudes regarding perinatal infections among pregnant women in Singapore: a cross-sectional study

Jia Y. Chong[1]*, Hanis B. A. Kadir[2], Pamela S. Partana[1], Vic K. J. Tan[3], Liying Yang[1]

[1]Department of Obstetrics and Gynaecology, Singapore General Hospital, Singapore
[2]Department of Health Research Service Unit, Singapore General Hospital, Singapore
[3]Department of Maternal Fetal Medicine, KK Women's and Children's Hospital, Singapore

Received: 23 October 2024
Revised: 19 November 2024
Accepted: 20 November 2024

***Correspondence:**
Dr. Jia Y. Chong,
E-mail: chongjiayinggg@gmail.com

ABSTRACT

Background: Cytomegalovirus (CMV), toxoplasma and listeria infections during pregnancy can result in devastating consequences and lifetime burden on parents and child. No vaccines are available. Risk of acquiring infections may reduce with greater awareness of preventive measures that can be undertaken during pregnancy and periconceptional period. This is the first study in Singapore to evaluate the knowledge and awareness of perinatal infections. No public health campaigns were done about perinatal infections and they are not routinely included in prenatal discussion. The aim of this study is to understand knowledge and attitudes of pregnant women regarding perinatal infections to better direct preventive efforts.
Methods: 400 pregnant respondents from two maternity outpatient units in Singapore completed the questionnaire. Univariate logistic regression analysis was performed to investigate relationship between knowledge levels and sociodemographic variables.
Results: Awareness of CMV (17.5%), toxoplasmosis (25.2%) and listeria (24.3%) infections was very low. In addition, while women with young children (OR 1.02, 95% CI 0.58-1.77) and those in childcare-related occupations (OR 0.47, 95% CI 0.16-1.13) are at higher risk of acquiring CMV during pregnancy, they were no better informed than respondents without these risk factors. Women aware of CMV remained poorly informed about risks and preventive methods with almost half being unable to identify risk-reducing measures. Knowledge of preventive measures against toxoplasma and listeria infections was higher but still incomplete. Only 52% of respondents received information about precautionary measures, although most (83.5%) indicated they would have liked to receive more information.
Conclusions: Our findings highlight urgent need to improve educational efforts to increase awareness of these infections and preventive measures.

Keywords: Perinatal infections, Cytomegalovirus, Toxoplasmosis, Listeria

INTRODUCTION

Perinatal infections with cytomegalovirus (CMV), toxoplasmosis and listeria are often asymptomatic or result in non-specific symptoms in the pregnant women, but can result in devastating consequences in the fetus, and can have lifetime burden on the affected family.

CMV is the most common congenital infection internationally and the leading non-hereditary cause of congenital hearing loss.[1] It spreads via direct contact with bodily fluids such as saliva and urine. CMV infection during pregnancy can result in hearing and vision loss, microcephaly, cerebral palsy and neurodevelopmental delay in the infant, with primary infections conferring the highest risk.[2] The seroprevalence of CMV varies worldwide but is typically lower in developed compared to

developing countries.[3] The seroprevalence of CMV in Singapore has fallen from 87% in the 1990s to 71.7% in 2022.[4,5]

Toxoplasmosis is caused by the parasite *Toxoplasmosis gondii (T. gondii).* Maternal infection can occur after ingestion of *T. gondii* bradyzoites in undercooked, contaminated meat or *T. gondii* oocysts in cat litter or contaminated soil. As with CMV, adults infected with *T. gondii* are typically asymptomatic or have non-specific symptoms such as fever, malaise and lymphadenopathy.[6] Transplacental passage of the parasite can however result in congenital toxoplasmosis, which can lead to stillbirth, neonatal death and severe neurological illness.

Listeriosis is a foodborne infection caused by the gram-positive bacteria, *Listeria monocytogenes.* Common food sources include dairy products made from unpasteurized milk, deli, raw or undercooked meat and unwashed raw fruits and vegetables.[7] Pregnant women are ten times more likely than healthy adults to contract listeriosis.[8] While maternal infection typically results in fever or non-specific flu-like symptoms, fetal infection is serious and can result in spontaneous abortion, preterm labour, central nervous system involvement and stillbirth.[6]

There are currently no vaccines available for these infections, and these infections can occur due to poor hygiene. Awareness of these perinatal infections and adoption of various food safety and hygiene recommendations can reduce the risk of infection in the preconception and pregnancy period.[6,9,10] Prior studies have shown that education reduces the risk of infection, and that pregnant women are highly motivated to adopt risk-reducing behaviours.[11,12]

Unfortunately, pregnant women appear to have poor knowledge and awareness of perinatal infections and receive little education about these infections from their obstetricians. For instance, only a minority of pregnant women are aware of CMV infections, and fewer than half of obstetricians routinely provide pregnant women with information about CMV and measures to prevent infection.[13,14]

Data regarding knowledge and awareness of perinatal infections among pregnant women in Singapore is scarce. Our study was therefore conducted to evaluate the awareness and knowledge of important perinatal infections among pregnant women in Singapore.

We decided to focus on CMV, listeria, and toxoplasmosis for three reasons: they can result in serious congenital infection, they are potentially preventable via food safety and hygiene measures, and awareness regarding these infections appears to be low. The information from our study will be useful for improving preconception and antenatal education strategies to reduce the risk of perinatal infections in pregnancy. This is the first study done in the local Singaporean population as there are no previous studies done in Singapore before and there are also no public health campaigns targeting on perinatal infections or routinely included in prenatal discussion. The aim of this study is to understand the knowledge and attitudes of pregnant women regarding perinatal infections in Singapore so as to better direct preventive efforts.

METHODS

Participants and study design

This descriptive, cross-sectional study was conducted at the outpatient antenatal clinics in Singapore General Hospital and KK Women's and Children's Hospital in Singapore between the time period August 2022 to January 2023. These two tertiary centres perform approximately 14 000 deliveries each year. Pregnant women attending antenatal clinics between August 2022 to January 2023 at both sites were invited to participate, and those who agreed did so by completing an anonymous electronic survey on a secure online platform. Patients under 18 years of age and those with a language barrier were excluded. The study was exempted from review by the SingHealth Institutional Review Board.

Questionnaire

The questionnaire was designed by two senior obstetricians after group discussion and in reference to previously published studies on perinatal infections in pregnancy.[12,13] It comprised a total of 18 questions. Question 1 pertained to awareness of antenatal infections and other antenatal conditions, as well as sources of information regarding these conditions. Questions 2-9 related to essential knowledge regarding transmission risks, pregnancy complications and relevant precautionary measures. Question 10 was regarding attitudes towards receiving antenatal education on antenatal infections, and questions 11 to 19 were related to demographics, including risk factors for certain antenatal infections (questions 11 to 18).

Questions 4 to 9 were assigned a score of 1 for a correct response, 0 for a not sure response or a wrong response.

The questionnaire was tested on a pilot group of 10 participants for ease of use, clarity and comprehension, and the final version was created based on their feedback and comments.

Statistical methods

The pregnant patients' characteristics and distribution of knowledge and attitudes were presented in frequencies and percentages. Univariate logistic regression analysis was performed to investigate the relationship between knowledge levels and various sociodemographic variables. Data analysis was performed using R version 4.2.1.[14] A p value <0.05 was considered statistically significant.

RESULTS

Participants

A total of 400 pregnant women attending the antenatal clinics in Singapore General Hospital and KK Women's and Children's Hospital between August 2022 to January 2023 were recruited for the study.

The predominant age group was 31-40 years (245, 61.2%), and the majority experienced spontaneous pregnancies (369, 92.3%). Approximately one third (124, 31.0%) of respondents had children aged 3 and under, while 186 (46.5%) worked in healthcare-related professions. The sociodemographic characteristics of the participants are summarized in Table 1.

Table 1: Demographic characteristics of participants (n=400).

Demographics	Number (%)
Age (years)	
<21	1 (0.3)
21-30	148 (37.0)
31-40	245 (61.2)
>40	6 (1.5)
Education level	
Primary or secondary	38 (9.5)
Post-secondary	140 (35.0)
Tertiary	222 (55.5)
Citizenship status	
Singaporean/Singapore PR	373 (93.3)
Foreigner	27 (6.7)
Occupation	
Healthcare-related	186 (46.5)
Childcare-related	51 (12.8); n=399
Children aged 3 and under	
Yes	124 (31.0)
No	276 (69.0)
Method of conception	
Spontaneous	369 (92.2)
IVF	31 (7.8)
Trimester of pregnancy	
1st	118 (29.5)
2nd	158 (39.5)
3rd	124 (31.0)

Denominators, N, that do not equal the sample sizes are due to missing data. If no denominator is given, all data were present

Awareness of perinatal infections

Of the 400 participants, only 101 (25.2%) had heard of toxoplasmosis, 97 (24.3%) of listeria and 70 (17.5%) of CMV. In contrast, larger proportions of patients were aware of human immunodeficiency virus (HIV) (349, 87.3%), trisomy 21 (244, 61%) and autism (197, 49.3%). These results are summarized in Figure 1.

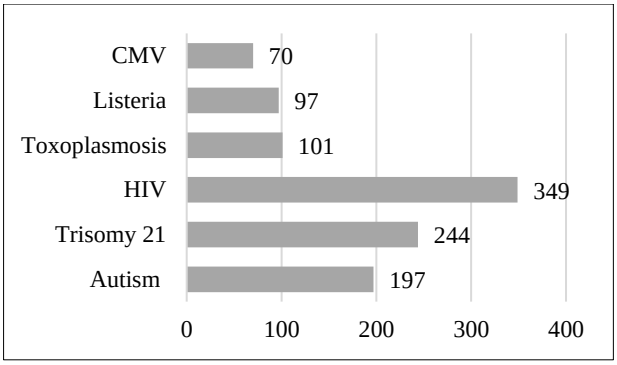

Figure 1: Awareness of congenital infections.

Knowledge regarding CMV

Women employed in a healthcare-related job demonstrated a significantly higher awareness of CMV compared to those who were not (OR 4.23, 95% CI 2.41-7.72, p<0.001). Notably, individuals not affiliated with either the healthcare or childcare sectors exhibited lower CMV awareness compared to those in one or both sectors (OR 0.35, 95% CI 0.19-0.61, p<0.001). No statistically significant differences in awareness of CMV were found when respondents were compared by age group, whether they worked in childcare-related jobs or whether they had young children aged 3 and younger (Table 2).

Of those who had heard of CMV infection (n=70), 22 (38.6%) did not know what it could cause in the fetus, 22 (38.6%) were aware that it could lead to miscarriage or stillbirth, 19 (27.1%) knew that it could result in hearing loss, and 12 (17.1%) knew that it could lead to intellectual disability in the child (Figure 2). Only 5 (7.1%) could correctly answer all the questions related to the potential consequences of CMV infection during pregnancy.

Regarding precautionary measures to reduce risks of CMV infection, 28 of women (40%) were not aware of any preventive measures. 22 (31.4%) women knew to avoid sharing a cup of water with a young child, 23 (32.9%) to avoid sharing utensils with a young child, and 33 (47.1%) to avoid kissing a young child on the mouth. Only 14 women (20%) could correctly identify all the measures to avoid during pregnancy to reduce risks of CMV infection.

Knowledge regarding Toxoplasmosis and Listeria

Of the 97 respondents who had heard of Listeria, over a third (38, 39.2%) did not know about the risks of listeriosis to the fetus. Slightly over half (58, 59.8%) knew that it could result in miscarriage or stillbirth, while 7 (8.2%) were aware that it could result in intellectual disabilities.

Similarly, of the 101 respondents who had heard of toxoplasmosis, a significant proportion (45, 44.5%) were not aware of the risks of toxoplasmosis infection to the fetus. 50 (49.5%) were aware that toxoplasmosis infection during pregnancy could result in miscarriage or stillbirth,

while 19 (18.8%) knew that it could result in intellectual disabilities (Figure 2).

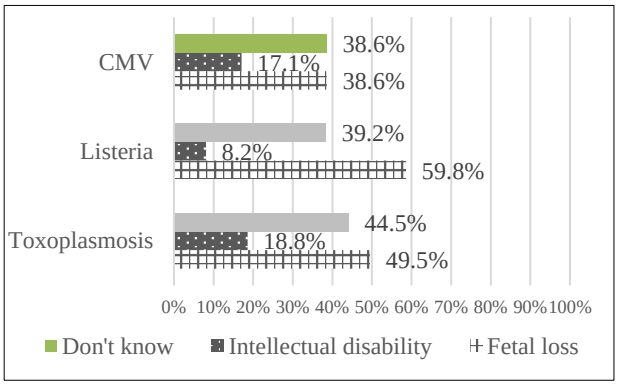

Figure 2: Knowledge of risks of *Listeria* and *Toxoplasmosis* infection in pregnancy.

The majority of respondents who had heard of Listeria (n=97) knew to avoid unpasteurized soft cheese (83, 85.6%), medium rare beef steaks (73, 75.3%) and raw spouts (53, 54.6%). However, few knew that soft-serve ice cream could be a potential source of Listeria (15, 15.5%). 8 (8.2%) did not know of any preventative measures.

For toxoplasmosis, approximately three quarters (74, 73.3%) knew to avoid contact with cat faeces, but fewer were aware that food sources such as undercooked meat (40, 39.6%) and raw eggs (26, 25.7%) posed a risk, and that gardening (18, 17.8%) could increase exposure via contact with contaminated soil. 13 (12.9%) of women were not aware of methods to prevent toxoplasmosis.

Attitudes of pregnant women regarding perinatal infections

Only slightly above half (208/400, 52%) of respondents had received information about precautionary measures to lower the risk of perinatal infections during pregnancy. This information came from obstetricians in 106/400 (26.5%), online pregnancy-related resources in 70/400 (17.5%) and family and friends in 18/400 (4.5%).

The majority of participants (334, 83.5%) indicated that they would have liked to receive more information about potential perinatal infections during their antenatal visits. Individuals with tertiary education exhibited greater interest in acquiring receiving antenatal education versus those with primary or secondary education (OR 3.82, 95% CI 1.57-8.92, p=0.002). Individuals who were more advanced in gestational age were less interested in receiving information compared to those still in their first trimester (2nd trimester OR 0.46, 95% CI 0.21-0.93, p=0.038; 3rd trimester OR 0.39, 95% CI 0.18-0.81, p=0.014) (Table 3).

Table 2: Sociodemographic characteristics of participants regarding knowledge of CMV.

Demographics	Knowledge of CMV (%)			Univariate logistic regression		
	All, n=400	No, n=330	Yes, n=70	OR	95% CI	P value
Age (years)						
<21	1 (0.3)	1 (0.3)	0 (0.0)	NA	NA	>0.9
21-30 (reference)	148 (37.0)	125 (37.9)	23 (32.9)	-	-	-
31-40	245 (61.2)	199 (60.3)	46 (65.7)	1.26	0.73, 2.2	0.4
>40	6 (1.5)	5 (1.5)	1 (1.4)	1.09	0.06, 7.16	>0.9
Type of employment						
Healthcare-related (reference: non-healthcare related)	186 (46.5)	134 (40.6)	52 (74.3)	4.23	2.41, 7.72	<0.001
Childcare-related (reference: non-childcare related)	51 (12.8); N=399	46 (14.0); N=329	5 (7.1)	0.47	0.16, 1.13	0.13
Neither in healthcare nor childcare (reference: either in healthcare or childcare or both)	183 (45.8)	165 (50.0)	18 (25.7)	0.35	0.19, 0.61	<0.001
Children aged 3 and younger						
No (reference)	276 (69.0)	228 (69.1)	48 (68.6)	-	-	-
Yes	124 (31.0)	102 (30.9)	22 (31.4)	1.02	0.58, 1.77	>0.9

[1]OR: Odds ratio; OR >1 indicates a better understanding of CMV, whereas an OR <1 indicates a reduced knowledge of CMV in the patient group relative to the reference group; [2]CI: confidence interval

Table 3: Sociodemographic characteristics of participants' interest in receiving information on perinatal infections.

Demographics	Interest in receiving more information (%)			Univariate logistic regression		
	All, n=400	No, n=66	Yes, n=334	OR	95% CI	P value
Age (years)						
<21	1 (0.3)	0 (0.0)	1 (0.3)	NA	NA	>0.9
21-30	148 (37.0)	28 (42.4)	120 (35.9)	-	-	-

Continued.

Demographics	Interest in receiving more information (%)			Univariate logistic regression		
	All, n=400	No, n=66	Yes, n=334	OR	95% CI	P value
31-40	245 (61.2)	35 (53.0)	210 (62.9)	1.40	0.81, 2.41	0.2
>40	6 (1.5)	3 (4.5)	3 (0.9)	0.23	0.04, 1.32	0.084
Education level						
Primary or secondary	38 (9.5)	10 (15.2)	28 (8.4)	-	-	-
Post-secondary	140 (35.0)	37 (56.1)	103 (30.8)	0.99	0.42, 2.1	>0.9
Tertiary	222 (55.5)	19 (28.8)	203 (60.8)	3.82	1.57, 8.92	0.002
Trimester						
1st (0-13 weeks) (reference)	118 (29.5)	11 (16.7)	107 (32.0)	-	-	-
2nd (14 to 26 weeks)	158 (39.5)	29 (43.9)	129 (38.6)	0.46	0.21, 0.93	0.038
3rd (27 to 40 weeks)	124 (31.0)	26 (39.4)	98 (29.3)	0.39	0.18, 0.81	0.014
Type of conception						
IVF (reference)	31 (7.8)	3 (4.5)	28 (8.4)	-	-	-
Spontaneous conception	369 (92.2)	63 (95.5)	306 (91.6)	0.52	0.12, 1.53	0.3

DISCUSSION

Our results highlight the overall low awareness of important perinatal infections amongst pregnant women in Singapore. Awareness of CMV was the lowest at 17.5% (70/400), followed by listeria (97, 24.3%), then toxoplasmosis (101, 25.3%). Interestingly, awareness of CMV does not appear to have improved since over a decade ago, when a local study reported that only 20% of respondents had heard of CMV.[15]

Contact with preschool-aged children and working in a healthcare setting are known to be risk factors for CMV infection.[16,17] We found that women working in a healthcare setting were significantly more likely to be aware of CMV infection than women who did not (OR 4.23, 95% CI 2.41-7.72). Women who worked in childcare were however not more likely to be aware of CMV infection than women who did not (OR 0.47, 95% CI 0.16-1.13), and neither were those who had young children compared to those who did not (OR 1.02, 95% CI 0.58-1.77). This highlights two important groups of women to whom preventive education efforts may be directed to reduce the risk of seroconversion in pregnancy.

The risk of transmission of CMV can be reduced via hygiene measures include handwashing after changing diapers or contact with a child's saliva and nasal secretions, as well as avoiding sharing food, utensils or cups with a child and kissing on the lips.[18] These measures should be taken in the high-risk period preconception and before 14 weeks of gestation.[17] It was therefore concerning that almost half (28/70, 40%) of our respondents who had heard of CMV were not aware of any risk reducing measures.

For listeria and toxoplasmosis, food safety measures include keeping raw meat and poultry separate from ready to eat food, thorough cooking of raw meat and seafood and avoiding raw sprouts, cold deli meats, soft cheese and unpasteurized milk.[19] Pregnant women should also avoid direct contact with cat litter and wear gloves and practice hand hygiene after contact with soil as they can be contaminated with Toxoplasma gondii parasites. In our study, we found that while respondents knew of some preventive measures, this knowledge was incomplete with a significant proportion being unaware of important risk factors such as raw sprouts (53, 54.6%) and soft-serve ice cream for Listeria (15, 15.5%), and raw eggs (26, 25.7%) and contaminated soil (18, 17.8%) for Toxoplasma.

Hygiene measures are effective for primary prevention of listeria and toxoplasmosis during pregnancy, though few healthcare providers discuss these with pregnant patients.[20-22] Various guidelines also recommend education on hygiene measures before conception and during pregnancy as primary prevention against CMV, and education appears to be effective in reducing the risk of seroconversion and congenital CMV infection.[10,11,23-25]

However, only slightly over one quarter (106, 26.5%) of our cohort had received information about perinatal infections from their obstetricians. While this was higher than the percentage reported in previous studies from Switzerland and Barcelona, there is still room for improvement.[14,15]

Some possible reasons why obstetricians do not counsel patients may include lack of knowledge and not wanting to cause anxiety in their patients.[26,27] However, women in our study and others appear to welcome these educational measures and studies have shown that parents of children with congenital CMV were frustrated about their lack of knowledge about CMV during pregnancy and not having the chance to take preventive action.[13,15,28]

Educational efforts on preventive measures against perinatal infections, particularly for the less commonly known sources of infection, are therefore likely to be useful to enable pregnant women to take the necessary precautions. This may take the form of individual discussions with patients during preconception and antenatal visits, educational messaging via written or electronic media, and larger public health campaigns.[29]

Finally, a proportion of women will still acquire infections during pregnancy despite education and taking hygiene and food safety measures. With new evidence showing the effectiveness of oral valacyclovir in reducing fetal CMV infection after maternal primary infection in the first trimester, universal CMV screening may be considered depending on local seroprevalence rates.[30] Healthcare providers should also have a high index of suspicion for maternal listeriosis in pregnant women with fever, particularly those with elevated inflammatory markers and threatened preterm labour, and a low threshold to start empiric treatment.[31]

Limitations

Our study has some limitations. Self-selection bias and the fact that healthcare workers (186/400, 46.5%) made up a sizeable proportion of respondents to our survey could have led to an overestimation of knowledge and awareness levels.

CONCLUSION

This is the first study in Singapore to evaluate the knowledge and awareness of important perinatal infections amongst pregnant women. We found that awareness of CMV, toxoplasma and listeria infections was very low, with less than a quarter of women having heard of each of these pathogens. In addition, while women with young children and those in childcare-related occupations are at higher risk of acquiring CMV during pregnancy, we found that they were no better informed than respondents without these risk factors.

Women who were aware of CMV remained poorly informed about the potential risks posed the virus and methods of preventing CMV infection, with almost half being unable to identify any risk reducing measure that could be taken. Knowledge of preventive measures against toxoplasma and listeria infections was higher than for CMV but still incomplete, with a significant proportion being unaware of important risk factors.

Only slightly above half of respondents had received information about precautionary measures to lower the risk of perinatal infections during pregnancy, although most indicated that they would have liked to receive more information.

Our findings highlight the fact that pregnant women are at risk of acquiring serious perinatal infections due to lack of awareness and education. Educational efforts need to be urgently improved to increase awareness and empower our patients for primary prevention against perinatal infections during pregnancy.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Xie M TT, Holmes NE, Hui L. Serological screening for cytomegalovirus during pregnancy: A systematic review of clinical practice guidelines and consensus statements. Prenat Diagn. 2023;43(7):959-67.
2. Boppana SB RS, Fowler KB. Congenital cytomegalovirus infection: clinical outcome. Clin Infect Dis. 2013;57(4):S178-81.
3. Fowler K, Mucha J, Neumann M, Lewandowski W, Kaczanowska M, Gryse M, et al. A systematic literature review of the global seroprevalence of cytomegalovirus: possible implications for treatment, screening, and vaccine development. BMC Public Health. 2022;22:1659.
4. Wong KT, Tee CS, Yeo GSH. Seroprevalence of cytomegalovirus, toxoplasma and parvovirus in pregnancy. Singapore Med J. 2000;41(4):151-5.
5. Partana P, Wan WY, Chow XYV, Chan JKY, Tan LK, Tan WC, et al. Seroprevalence of cytomegalovirus among pregnant women in Singapore. Trop Med Health. 2024;52(1):67.
6. Ross JJ, Lynch MF. Toxoplasmosis, Cytomegalovirus, Listeriosis and Preconception Care. Matern Child Health J. 2006;10(1):189-93.
7. Ryser ET, Marth E. Foodborne listerosis. In: Ryser ET, Marth E, editor. Listeria, Listeriosis and Food Safety New York: Marcel Dekker. 1999;300-58.
8. Farber PP. Listeria monocytogenes, a foodborne pathogen. Microbiol Rev. 1991;55:476-511.
9. Adler SP FJ, Manganello AM, Best AM. Prevention of chid-to-mother transmission of cytomegalovirus by changing behaviors: a randomized controlled trial. Pediatr Infect Dis J. 1995;15(3):240-6.
10. Revello MG TC, Masuelli G, Frisina V, Sacchi A, Furione M. Prevention of primary cytomegalovirus infection in pregnancy. EBioMedicine. 2015;2(9):1205-10.
11. Vauloup-Fellous C PO, Cordier AG, Parent-du-Chatelet I, Senat MV, Frydman R, et al. Does hygiene counseling have an impact on the rate of CMV primary infection during pregnancy? Results of a 3-year prospective study in a French hospital. . J Clin Virol. 2009;46(4):S49-53.
12. Price SM BE, Zador P, Levis DM, Kilgo CL, Cannon MJ. Educating women about congenital cytomegalovirus: assessment of health education materials through a web based survey. BMC Women's Health. 2014;14:144.
13. Castillo K H-VA, Valdés-Bango M, Guirado L, Scazzocchio E, Porta O, Falguera G, et al. Congenital Cytomegalovirus Awareness and Knowledge among Health Professionals and Pregnant Women: An Action towards Prevention. Fetal Diagn Ther. 2022;49(5-6):265-72.
14. Willame A B-RG, Combescure C, Irion O, Posfay-Barbe K, Martinez de Tejada B. Awareness of Cytomegalovirus Infection among Pregnant Women in Geneva, Switzerland: A Cross-sectional Study. Int J Environ Res Public Health. 2015;12(12):15285-97.

15. Lim SL TW, Tan LK. Awareness of and attitudes towards congenital cytomegalovirus infection among pregnant women in Singapore. Int J Gynaecol Obstet. 2012;2012(117):268-72.
16. Hyde TB SD, Cannon MJ. Cytomegalovirus seroconversion rates and risk factors: implications for congenital CMV. Rev Med Virol. 2010;20(5):311-26.
17. Leruez-Ville M FI, Pass R, Ville Y. Cytomegalovirus infection during pregnancy: state of the science. Am J Obstet Gynecol. 2020;223(3):330-49.
18. Centers for Disease Control and Prevention. Cytomegalovirus (CMV) and Congenital CMV infection: CMV Fact Sheet for Pregnant Women and Parents. Available at: https://www.cdc.gov/cmv/index.html. Accessed on 12 September 2024.
19. FoodSafety.com. People at Risk: Pregnant Women. Available at: https://www.foodsafety.gov/people-at-risk/pregnant-women. Accessed on 12 September 2024.
20. Wehbe K PL, Lhuaire M, Sibiude J, Mandelbrot L, Villena I, Picone O. Hygiene measures as primary prevention of toxoplasmosis during pregnancy: A systematic review. J Gynecol Obstet Hum Reprod. 2022;51(3):102300.
21. Morales S KP, Medeiros LC, Hillers V, Schroeder M. Health care providers' attitudes toward current food safety recommendations for pregnant women. Appl Nurs Res. 2004;17(3):178-86.
22. Cook JL GL, Kirkham C. Listeriosis in Pregnancy: Practitioners' Food Safety Counselling Practices to Pregnant Women. J Obstet Gynaecol Can. 2018;40(9):1139-47.
23. Boucoiran I YM, Poliquin V, Caddy S, Gantt S, Castillo E. Guideline No. 420: Cytomegalovirus Infection in Pregnancy. J Obstet Gynaecol Can. 2021;43(7):893-908.
24. Royal Australian and New Zealand College of Obstetricians and Gynaecologists. Prevention of Congenital Cytomegalovirus (CMV) Infection. 2019. Available at: https://ranzcog.org.au/RANZCOG_SITE/media/RANZCOG-MEDIA/Women%27s%20Health/Statement%20and%20guidelines/Clinical-Obstetrics/Prevention-of-congenital-cytomeglovirus(CMV)infection-(C-Obs-64)-New-Statement-March-2019-Amended.pdf?ext=.pdf. Accessed on 12 October 2024.
25. Barber V CA, Vandrevala T, Star C, Khalil A, Griffiths P, Heath PT, 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.
26. Fellah T SJ, Vauloup-Fellous C, Cordier AG, Guitton S, Grangeot-Keros L, Benachi A, et al. Evolution of awareness and knowledge of congenital cytomegalovirus infection among health care providers in France between 2011 and 2018. J Clin Virol. 2020;129:104335.
27. Pesch MH SN, Abdelnabi S. Cytomegalovirus Infection in Pregnancy: Prevention, Presentation, Management and Neonatal Outcomes. J Midwifery Womens Health. 2021;66(3):397-402.
28. Vandrevala T BV, Mbire-Chigumba E, Calvert A, Star C, Khalil A, Griffiths P, et al. Parenting a child with congenital cytomegalovirus infection: a qualitative study. BMJ Paediatr Open. 2020;4(1).
29. Kirkham C BJ. Listeriosis in pregnancy. Can Fam Physician. 2010;56(4):e158-66.
30. Shahar-Nissan K, Pardo J, Peled O, Krause I, Bilavsky E, Wiznitzer A, 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.
31. Fouks Y AS, Many A, Haham A, Mandel D, Shinar S. Listeriosis in pregnancy: under-diagnosis despite over-treatment. J Perinatol. 2018;38(1):26-30.

Cite this article as: Chong JY, Kadir HBA, Partana PS, Tan VKJ, Yang L. Knowledge and attitudes regarding perinatal infections among pregnant women in Singapore: a cross-sectional study. Int J Reprod Contracept Obstet Gynecol 2024;13:3491-7.