Awareness and knowledge of congenital infections (TORCH) among women and health care providers in Al Taif area Saudi Arabia

Manal A. Elnashar (1)
Nisreen Kh. Aref (2)
Ruba G. Qadi (3)
Aishah A. Al-kabi (3)
Jameela A. ALMathami (4)

(1) Assistant Professor, Pediatric department, College of Medicine, Taif university, Saudi Arabia
(2) Associate Professor Head of Department Medical college, Taif University, Saudi Arabia .
(3) Medical student, College of medicine, Taif university, Saudi Arabia
(4) Joint program of family medicine in Taif, Saudi Arabia

Corresponding author:
Dr. Aishah A. Al-kabi
Taif city,
Saudi Arabia
Tel: 0532318767
Email: moonaishah_2017@hotmail.com

Received: October 2019; Accepted: November 2019; Published: December 1, 2019.
Citation: Manal A. Elnashar, Nisreen Kh. Aref, Ruba G. Qadi, Aishah A. Al-kabi, Jameela A. ALMathami. Awareness and knowledge of congenital infections (TORCH) among women and health care providers in Al Taif area Saudi Arabia, Saudi Arabia. World Family Medicine. 2019; 17(12): 82-90. DOI: 10.5742MEWFM.2019.93714

Abstract

Background: Women should be aware of preventive measures against congenital infections transmitted from mother to the embryo, fetus, or baby during pregnancy or childbirth.

Objectives: This study aimed at assessing the awareness of vertically transmitted infections (TORCH) among health care providers, female students in Taif University, and women of reproductive age.

Methods: A cross sectional study was done on a convenient sample of 100 women of reproductive age; 139 female students of Taif university, and 96 health care providers at a primary health care clinic in Taif city, Saudi Arabia. A pre-designed questionnaire was used to collect data on the women and students' knowledge of vertically transmitted infections (TORCH). Health care providers were asked about the laboratory tests for serological detection of early infection with the vertically transmitted organisms.

Results: About 87% and 71% of students and mothers respectively, did not know that congenital infections are contagious, and 57.46% and 75% of them did not know that congenital infections can cause congenital anomalies. Both students and mothers with college level of education had a significant higher percentage of those who had satisfactory knowledge. The most common source of the students' information about congenital infection was the media, parents and friends (32.37%) and for mothers, it was the media (65%) then the Gynecologists / Obstetricians.

Conclusion: The deficient knowledge of studied females regarding congenital infections observed in this study calls for health education programs on congenital infections to be directed toward female students and women in the reproductive age. about.

Key words: Awareness, congenital, infections, women, providers, Saudi Arabia

Introduction

Congenital infection is a vertically transmitted infection caused by bacteria, viruses, or in rare cases parasites transmitted directly from the mother to an embryo, fetus, or baby during pregnancy or childbirth. It can occur when the mother acquires an infection as an inter-current disease in pregnancy (1).

Congenital anomalies (birth defects, congenital disorders or congenital malformations) are a structural or a functional anomaly (e.g. metabolic disorders) that occur during intrauterine life and can be identified prenatally, at birth or later in life (2).

In spite of approximately 50% of all congenital anomalies not being linked to a specific cause, congenital anomalies risk factors might be TORCH, which includes Toxoplasmosis, Other (syphilis, varicella-zoster, parvovirus B19), Rubella virus, Cytomegalovirus and Herpes simplex virus (2).

These groups of infections are the main cause of fetal damage or other anomalies. The infection in most cases can be severe enough to cause more serious damage to a fetus than his/her mother. The gestational age of the fetus influenced the degree of severity (3,4). All the infections spread through poor hygienic conditions, contaminated blood, water and soil or airborne respiratory droplet.

Information on the risks of congenital infection and clinical signs may be useful for women deciding on whether to proceed with amniocentesis or a termination of pregnancy (5).

Congenital CMV infection can result in major neurological disorders such as sensorineural hearing loss and developmental disabilities (6), as treatments and vaccinations against CMV are currently under development (7). Rubella virus might cause congenital rubella syndrome if the mothers are infected with rubella virus during the first trimester of pregnancy (8). Toxoplasma gondii causes congenital toxoplasmosis. Toxoplasma gondii maternal medication does not always prevent the development of congenital toxoplasmosis (9). Parvovirus B19 causes hydrops fetalis and fetal anemia, miscarriage, fetal or neonatal death, or severe disability in infected infants, and there is currently no effective treatment or vaccination against parvovirus B19 (10). The most susceptible time of mother-to-fetus infection that can cause severe disease for all pathogens is the first trimester (11). Rubella virus is transmitted by droplets (9,12) while Parvovirus B19 is transmitted by droplets and contaminated blood. Toxoplasma gondii is transmitted by cat faeces or eating unwashed fruit or vegetables, and undercooked meat. The transmission route for CMV is via body fluids including saliva, urine, blood, breast milk and tears through kissing and sexual intercourse and transmission routes for CMV occurs through organ transplantation or blood transfusions (13). Transmission of HBV, human immunodeficiency virus occurs during and soon after delivery, through direct contact of the infant with infectious blood and other body fluids (14), while Herpes Simplex virus is transmitted through direct contact with an infected vaginal canal during birth. Infections with syphilis can be transmitted through direct contact with a spirochete containing lesion, sexually, or trans-placentally. Congenital syphilis transmitted from mother has primary and secondary stages of the disease rather than the tertiary stage (15).

Serology, culture, histopathology, and PCR technique are the specific techniques for detection of TORCH disease (16).

Several studies have reported the awareness and knowledge of pregnant women about congenital infection (16,17,18). No studies have evaluated the awareness and knowledge about pathogens that may cause severe congenital diseases or anomalies by vertical transmission in Al Taif region Saudi Arabian women.

Women should be aware of, and know the prevention measures, against maternal infection with mother-to-child infections during pregnancy to reduce the incidence of infants with congenital infections.

The present study aimed at assessing the awareness and knowledge of vertically transmitted infections (TORCH) among three different groups; the first group was the health care providers, the second group was the students in Al Taif university, girls section, and the third group was women at reproductive age (18 - 49) at Al Taif area Saudi Arabia aiming to decrease the incidence of congenital infections via increasing their knowledge of the causative organisms, symptoms, ways of transmission and the preventive method of vertically transmitted infection and to increase the awareness of the importance of antenatal care.

Materials and Methods

Study design: A cross sectional study was done
Time frame: The study period was from May 2016 till October 2017.
Sampling methodology: The study participants were a convenient sample of 100 women of reproductive age (18-49) who attended the Gynecology and Obstetrics outpatient clinics of King Abdul-Aziz hospital in Al Taif , and another sample of 139 students in Al Taif university, girls section, in addition to 96 health care providers at primary health care units in Al Taif area, Saudi Arabia who were invited to participate in the study.
Study instrument: A questionnaire was prepared by the researchers for the women of reproductive age and female students in Al Taif University, girls section containing demographic data (age, academic class) and special questions about their knowledge of vertically transmitted infections (TORCH).

Knowledge questions included whether TORCH infection is contagious, does (TORCH) in pregnant women cause birth defects, mode of transmission, preventive method of infection, presence of a vaccine to prevent, or medicine to treat. Finally, the questionnaire asked about the source of

any knowledge about (TORCH). The questionnaire item options were " know, or do not know" for each item. If they answered with 'I know' for any question, they should clarify (11).

Another questionnaire was prepared by the researchers for the health care providers at primary health care units in Al Taif Area, Saudi Arabia containing specific laboratory tests for serological detection of early infection with the vertically transmitted organisms (17).

Statistical analysis

Recorded data were analyzed using the Statistical Package for Social Sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage, and Chi-square (x2) test was applied to assess the relationship between variables, and a p-value less than 0.05 was considered significant.

Results

Table 1 shows that an average of 78.13% of the sample of health care providers, were aware of the important investigations needed during pregnancy follow up, for the prevention of congenital infections.

Table 2 shows a statistically significant relation (p 0.032) between total knowledge of providers and the scientific degree of the health care providers, as consultants had a significant higher percentage of those who had satisfactory knowledge.

In Table 3, about (87.8% - 71%) of the students and mother group respectively didn't know that congenital infections are contagious (transmitted from mother to fetus), while only (12.2 % - 29%) knew. (57.46% & 75%) of the students and mother group respectively didn't know that congenital infections can cause congenital anomalies and 42.54% - 25% knew.

Regarding mode of transmission, (65.40% - 51%) of the students and mother group respectively didn't know that congenital infections with Rubella and Parvovirus B19 can be transmitted by contact with drops of respiratory secretions. (71.20% - 45%) of the students and mother group respectively didn't know that the CMV congenital infections can be transmitted by child care implement exchange, (53.20% - 50%) by sexual intercourse and (41.00% - 45%) by infected hands. (56.80% - 47%) of the students and mother group respectively didn't know that tToxoplasma gondii congenital infections can be transmitted by contact with cat faeces, (69.10% - 48%) by eating raw meat, (70.50% - 48%) by drinking of contaminated water, (67.00% - 49%) by unpacked Goat Milk. (75.50% - 59%) of the students and mother group respectively didn't know that Herpes Simplex Virus can be transmitted by direct contact with infected areas and (76.20% - 63%) by physical contact of the infected areas.

Of the participants, (51.10% - 47%) of the students and mother group respectively didn't know that HBV can be transmitted by contamination with blood or body fluids during birth, (56.80% - 38%) by contamination with polluted blood (69.80% - 38%) by direct contact with blood or urine.

Table 4 demonstrates that, regarding infection prevention, (61.20% - 35%) of the students and mother group respectively didn't know that avoiding kissing on the child's mouth can prevent congenital infection, (44.60% - 36%) didn't know that vaccination before and during pregnancy can prevent infection with Rubella virus, but (95.60% - 46%) of the students and mother group respectively didn't know that using a condom during sexual intercourse can prevent congenital infection with CMV. (44.60% - 38%) of the students and mother group respectively didn't know that avoiding cleaning the cat box and (59.00%-52%) didn't know that eating raw meat and unprocessed dairy products can prevent congenital infection with Toxoplasma gondii. (52.50% - 25%) of the students and mother group respectively didn't know that avoidance of contact with blood, urine and saliva can prevent congenital infection with HBV. Of the participants, (75.50% - 59%) of the students and mother group respectively didn't know that Herpes simplex virus can be prevented by Cesarean delivery.

Table 5 shows a statistically significant relation (p 0.018) between total knowledge of student and their educational level, as those with college level of education had a significant higher percentage of those who had satisfactory knowledge. On the other hand, a non-significant relationship was found between the total knowledge of student and their age and social status.

Table 6 shows a statistically significant relation (p=0.021) between total knowledge of mothers and their educational level, as those with college level of education had a significant higher percentage of those who had satisfactory knowledge. On the other hand, a non-significant relationship was found between the total knowledge of student and their age and social status.

Figure 1 demonstrates that the most common source of the students' information about congenital infection was the media, parents and friends (32.37%) while information from Gynecologist /Obstetricians represented only (5.75%), and general Physician represented (8.6%). On the other hand, the most common source of the mothers' information about congenital infection was the media (65%) then from Gynecologist / Obstetricians who represented (42%), media, parents and friends (47%) while General Physician represented only (7%).

Table 1: Distribution of items knowledge of health care providers in the study group (N=96)

Item knowledge of Caregivers	Know		Don't know	
	No.	%	No.	%
1- Do you know the importance of some investigations during pregnancy follow up	95	98.96%	1	1.04%
Rubella virus				
Rubella virus (IgM)	85	88.54%	11	11.46%
Rubella virus (IgG)	83	86.46%	13	13.54%
Rubella virus RNA , Qualitative , Real-Time PCR from Amniotic fluid	66	68.75%	30	31.26%
Cytomegalovirus				
Cytomegalovirus (IgM)	72	75.00%	24	25.01%
Cytomegalovirus (IgG)	72	75.00%	24	25.00%
Cytomegalovirus DNA PCR (qualitative or quantitative)	59	61.46%	37	38.55%
Toxoplasma gondii				
Toxoplasma (IgM)	82	85.42%	14	14.59%
Toxoplasma (IgG)	78	81.25%	18	18.75%
Toxoplasma (PCR)	70	72.92%	26	27.08%
Treponema pallidum				
Treponema pallidum antibody (IgM)	76	79.17%	20	20.83%
Treponema pallidum antibody (IgG)	72	75.00%	24	25.00%
Treponema pallidum (PCR)	59	61.46%	37	38.55%
Hepatitis B virus				
HBsAg	90	93.75%	6	6.26%
HB DNA qualitative PCR	69	71.88%	27	28.13%
Anti-hepatic B core (anti-HBc) , IgM	79	82.29%	17	17.17%
Varicella Zoster				
Varicella Zoster virus or Herpes simplex virus (IgM)	79	82.29%	17	17.71%
Varicella zoster virus or herpes simplex virus (IgG)	74	77.08%	22	22.92%
Varicella Zoster virus or Herpes simplex virus (PCR)	68	70.83%	28	29.17%
Total	75	78.13%	21	21.88%

Table 2: Relation between total knowledge of health care providers according to degree of the health care providers (N=96)

Variable	Beck Depression Inventory Score (a) (Mean ± SD)	Multidimensional Assessment of Fatigue Scale (b) (Mean ± SD)
Mean	(17.7213 ± SD 10.131)	(29.9132 ± 8.176)
Minimum	0.00	6.36
Maximum	53.00	43.73

*p-value <0.05 S

Table 3: Comparison between the percentage of Items knowledge among the students and mothers group (No: 139 - 100 respectively).

Items knowledge of student	Know		Don't know	
	students %	mothers %	students %	mothers %
Is congenital infection contagious (transmitted from mother to infant)?	12.2%	29%	87.80%	71%
Is it dangerous?	56.8%	57%	43.20%	43%
Congenital infection cause:				
Hearing loss?	45.3%	33%	54.70%	67%
Mental retardation?	50.4%	28%	49.70%	72%
Jaundice	28.8%	29%	71.20%	71%
Convulsions	34.5%	20%	65.50%	80%
Small head?	47.5%	32%	52.50%	68%
Heart deformity	46.0%	32%	54.00%	68%
Death?	45.3%	2%	54.60%	98%
average	42.54%	25%	57.46%	75%
Mode of transmission:				
Rubella, Parvovirus B19				
Contact with drops of respiratory secretions	34.5%	49%	65.40%	51%
CMV				
Child implement exchange?	28.8%	55%	71.20%	45%
Sexual intercourse?	46.8%	50%	53.20%	50%
Infected hands	59.0%	55%	41.00%	45%
Toxoplasma gondii				
Contact with cat faeces?	43.2%	53%	56.80%	47%
Eating raw meat?	30.9%	52%	69.10%	48%
Drinking of contaminated water?	29.5%	52%	70.50%	48%
Unpacked Goat Milk?	33.1%	51%	67.00%	49%
Herpes simplex virus				
Direct contact with infected areas?	24.5%	41%	75.50%	59%
Direct physical contact?	23.7%	37%	76.20%	63%
HBV				
Contamination with blood or body fluids during birth?	48.9%	53%	51.10%	47%
Contamination with polluted blood?	43.2%	62%	56.80%	38%
Direct contact with blood or urine?	30.2%	62%	69.80%	38%

Table 4: Comparison between the percentage of preventive methods of congenital infections knowledge among the students and mothers group (No: 139 - 100 respectively)

Items knowledge of student	Know		Don't know	
	students %	mothers %	students %	mothers %
What can people do to prevent infection?				
Rubella virus				
Be away from people with fever or rash	18.0%	43%	82.00%	57%
Avoid kissing on child mouth?	38.8%	65%	61.20%	35%
Vaccination before and during pregnancy?	55.4%	64%	44.60%	36%
Parvovirus B19				
Wear a mask	55.4%	6%	44.60%	94%
Keep away from crowded places	48.9%	3%	51.10%	97%
CMV				
Cleaning hands after diaper change?	50.4%	62%	49.60%	38%
Do not share child implements?	60.4%	59%	39.60%	41%
Use a condom during sexual intercourse	4.3%	54%	95.60%	46%
Toxoplasma gondii				
Avoid cleaning the cat box?	55.4%	62%	44.60%	38%
Avoid eating raw meat and unprocessed dairy products?	41.0%	48%	59.00%	52%
Drinking of contaminated water?	32.4%	19%	67.60%	81%
HBV				
Avoid contact with blood, urine and saliva?	47.5%	75%	52.50%	25%
Herpes simplex virus				
Cesarean delivery	24.5%	41%	75.50%	59%
Total	**41.0%**	49%	59.00%	51%

Table 5: Relation between total knowledge of students according to demographic data of students (N=139)

Demographic Data of students	Total Knowledge of students		Chi-square test	
	Unsatisfied (N=69)	Satisfied (N=70)	x2	p-value
	%	%		
Age (years)	97.1%			
From 18- 29years	2.9%	97.1%	1.334	0.513
From 30-49 years		2.9%		
Educational level				
Secondary education	23.2%	5.7%	4.194	0.018*
(New comers)	76.8%	94.3%		
College				
Social status	0.0%	1.4%		
Widow	88.4%	85.7%	1.060	0.589
Single	11.6%	12.9%		
Married				

**p-value <0.05 S*

Discussion

Mother-to-child infections (congenital infections) occur when pathogens are transmitted from mother to child during pregnancy or the perinatal period. These pathogens can lead to severe congenital neonatal diseases including anomalies, or childhood and adulthood diseases, spontaneous abortion, fetal death or intrauterine growth restriction (11). To reduce the incidence of infants with congenital infections, pregnant women, and females of childbearing age, need to be aware of, and know the pathogens' way of transmission and prevention of maternal infection with pathogens capable of mother-to-child transmission.

Although vaccination is the most effective preventive method for congenital infection, vaccinations against some pathogens (such as cytomegalovirus [CMV], Toxoplasma gondii, and parvovirus B19) are not currently available (6).

This study demonstrated the awareness of and knowledge about pathogens, routes of transmission, and ways of prevention of mother-to-child infections among students, mothers, and health care providers in Al Taif area, Saudi Arabia. We found that healthcare providers have more awareness and knowledge about mother-to-child infections during pregnancy (78.13%) while 21.88% didn't know, especially for PCR technique as Cytomegalovirus DNA PCR qualitative or quantitative (38.55%) then HB DNA qualitative PCR (28.13%) Rubella virus RNA, Qualitative, Real-Time PCR from Amniotic fluid (31.26%) and Treponema Pallidum (PCR) (38.55%). These results can be explained by that PCR technique needs more specialty or even needs consultants.

Comparing our study result with similar study on healthcare professionals in Japan done by Ross et al. 2009, Cordier et al. 2012b) (17,19) they reported the same results as our study, that generally healthcare professionals have more awareness and knowledge about mother-to-child infections during pregnancy and there were no physicians, and only four healthcare professionals and 11 care workers, had more awareness of Toxoplasma gondii as mother-to-child infection.

According to the demographic data of the study group results, we showed that increasing the educational levels of the population will reflect on increasing of the awareness and the knowledge. The current study has confirmed these results by a statistically significant relation (p 0.032) between total knowledge of health care providers and their scientific degree. Also, there was a statistically significant relation between total knowledge of congenital infections of the student and the mothers and their educational level. (p 0.018), (p 0.021) respectively.

According to the student's group results of the current study, we found that their total knowledge was (41.0%). Most of their knowledge was about mode of transmission of rubella syndrome, the awareness and knowledge of the infection and the preventive methods of rubella syndrome which might be due to the compulsory vaccine program of Saudi health ministry to prevent rubella infection (20).

According to the mothers' group results of the current study, we found that their total knowledge of congenital infections was (49%). Most of the mothers' group knowledge about mode of transmission was via contamination with polluted blood and direct contact with blood or urine (62%), contact with cat faeces, eating raw meat, drinking of contaminated water (53%), child care implement exchange (55%) contamination with blood or body fluids during birth (50%), sexual intercourse (50%) contact with drops of respiratory secretions (49%).

The high percentage of total knowledge of the mothers' group (49%) in comparison with the percentage of total knowledge of the students' group (41.0%) regarding congenital infection may be due to the source of knowledge; the mothers' group got their knowledge from the media (65%) , while (42%) of the mothers' group got their knowledge from specialists as Gynecologist and Obstetrician doctors while students group source of knowledge was from the Media, Parents and friends (32.37%), while only (5.75%) got their information from specialists such as gynecologist and obstetricians and (8.6%) from general physicians.

In comparison to our study the knowledge and awareness of congenital rubella syndrome was relatively well known in Japan (76%) as well as in France (97%) (17), Brazil (74%) (21), and USA (53%) (16).

Lim et al. 2012 (16) reported that the percentage of women in Singapore who were aware of CMV was (18%). Low percentages of awareness for CMV were also demonstrated in France (34%) (17) and USA (22%) (16).

In the current study we reported less knowledge about mode of transmission and preventive method of other congenital diseases especially Parvovirus B19 infection. Also, a low proportion of Japanese women (28%) was aware of and had knowledge about parvovirus B19 infection during pregnancy. The percentages of awareness for parvovirus B19 were similar in France (24%) (17) and USA (32 %(16)).

Parvovirus B19 infection occurs via contact with infected children at home. The pregnant women who has older children should be aware of a route of transmission and preventive method of parvovirus B19 infection due to high risk of family transmission (10).

The percentage of women who were aware of Toxoplasma gondii in our study is nearly similar to the percentage reported in the USA (48%) (14) while it was 58% in Japan, and 98% in France (17). The women before pregnancy or early in gestation had to be informed not to eat uncooked meat and wear gloves during any contact with soil(16).
Current study results showed that the health care providers are more informed and prepared to raise awareness in their communities. The mothers were obtaining their

information from many sources especially when attending the gynecological and obstetric outpatient clinic, and from general doctors, and reading to increase their knowledge after getting pregnant, and from social media.

Awareness of and knowledge about congenital infections were found to be low in our study especially among the students group. Counseling and education for women of childbearing age, to prevent maternal infection should be urgently developed to reduce the incidence of these mother to child infections. The best options to prevent maternal infection are by behavioral and educational interventions (6).

Our study results strongly suggest that women should receive counseling and more education about congenital infection pathogens, transmission, infection and preventive methods prior to pregnancy or early in pregnancy.

The first step for prevention of congenital infections is via raising the awareness and the knowledge of the pathogens, ways of transmission and the methods of prevention of congenital infections among women (the students and the mothers) and their healthcare providers. Such awareness can lead to improvement in hygiene behaviors among pregnant women. Furthermore, as the women and their healthcare providers become educated about congenital infection, they will better appreciate the potential for interventions such as prenatal screening and diagnosis (22), newborn screening (23), and antiviral (24) or hyper-immunoglobulin treatments (25), and they will see the urgent need for the development of an effective vaccine (26).

Increasing public awareness by talking to the local community, by sharing information on social media, regional radio as well as newspapers, public awareness campaigns, workshops, community meetings, house visits and pamphlets are good ways of spreading information about prevention, non-discrimination and care (27).

Limitations

One of the limitations of this study was using a self-reported questionnaire that may be prone to recall bias. The use of a cross-sectional study showed the relation between variables without closing a cause-effect relationship.

Conclusion

About 87% and 71% of students and mothers respectively didn't know that congenital infections arecontagious, and 57.46% and 75% of them didn't know that congenital infections can cause congenital anomalies. Of them, 61.% and 35% didn't know that avoiding kissing a child's mouth can prevent congenital infection and 44.60% and 36% didn't know that vaccination before and during pregnancy can prevent infection with Rubella virus. Both students and mothers with college level of education had a significant higher percentage of those who had satisfactory knowledge. The most common source of the students' information about congenital infection was the media, parents and friends (32.37%) and for mothers, it was the media (65%) then the Gynecologist / Obstetricians. The present study demonstrates deficient knowledge of female students and women in the reproductive age regarding congenital infections. The study calls for health education programs about congenital infections directed to female students and women in the reproductive age.

Acknowledgement:
All authors gratefully acknowledge the support provided from the directors of the study settings. Special thanks to the study participants.

Conflicts of interest: none declared
Funding: none

References

1. Pizzo JD. Congenital Infection. Ped. in Review 2011;32: 537-42.
2. Sadik MS, Fatima H, Jamil K, Patil C. Study of TORCH profile in patients with bad obstetric history. Biology and Medicine 2012; 4: 95-101
3. Mets MB, Chhabra MS. Eye Manifestations of intrauterine infections and their impact on childhood blindness. Surv. Ophthalmol 2008; 53: 95-111
4. David D, Martine W, François P, Eskild P, Catherine P, Ruth G. Mother-to-child transmission of toxoplasmosis: risk estimates for clinical counseling. Lancet 1999;353:1829–33
5. Koyano S, Inoue N, Oka A, Moriuchi H, Asano K, Ito Y, et al. Screening for congenital cytomegalovirus infection using newborn urine samples collected on filter paper: feasibility and outcomes from a multicentre study. BMJ Open 2011;1: e000118.
6. Lazzarotto T, Lanari M. Why is cytomegalovirus the most frequent cause of congenital infection? Expert Rev Anti Infect Ther 2011; 9:841–3.
7. Nassetta L, Kimberlin D, Whitley R. Treatment of congenital cytomegalovirus infection: implications for future therapeutic strategies. J Antimicrob Chemother 2009; 63:862–7.
8. Ueda K. Development of the rubella vaccine and vaccination strategy in Japan. Vaccine 2009; 27:3232–3.
9. Yamada H, Nishikawa A, Yamamoto T, Mizue Y, Yamada T, Morizane M, et al. Prospective study of congenital toxoplasmosis screening with use of IgG avidity and multiplex nested PCR methods. J Clin Microbiol 2011; 49:2552–6.
10.. de Jong EP1, de Haan TR, Kroes AC, Beersma MF, Oepkes D, Walther FJ. Parvovirus B19 infection in pregnancy. J Clin Virol 2006; 36:1–7.
11 Ichiro M, Ayako S, Shinya T, Shinya T. Awareness of and knowledge about mother to child infections in Japanese pregnant women. Congenit Anom (Kyoto) 2014;54(1):35-40
12. Lamont RF, Sobel JD, Vaisbuch E, Kusanovic JP, Mazaki S, Kim SK, et al. Parvovirus B19 infection in human pregnancy. International Journal of Obstetrics and Gynaecology 2011; 118 (2): 175–86.

13. Sterkers Y, Ribot J, Albaba S, Issert E, Bastien P, Pratlong F. Diagnosis of congenital toxoplasmosis by polymerase chain reaction on neonatal peripheral blood. Diagnostic Microbiology and Infectious Disease 2011;71 (2): 174–6.
14.. Hu Y, Chen J, Wen J, Xu C, Zhang S, Xu B, Zhou YH. Effect of elective cesarean section on the risk of mother-to-child transmission of hepatitis B virus. BMC Pregnancy Childbirth. 2013;24;13:119.
15 Rajnish K Y, Siddhartha M, Sudipta S. A review on TORCH: groups of congenital infection during pregnancy. Journal of Scientific and Innovative Research, 2014;3 (2): 258-64
16. Jeon J1, Victor M, Adler SP, Arwady A, Demmler G, Fowler K, et al. Knowledge and awareness of congenital cytomegalovirus among women. Infect Dis Obstet Gynecol. 2006; 2006:80383.
17. Cordier A, Guitton S, Vauloup F, Grangeot K, Benachi A, Picone O. Awareness and knowledge of congenital cytomegalovirus infection among health care providers in France. J Clin Virol 2012; 55:158–63.
18. Lim SL, Tan WC, Tan LK. Awareness of and attitudes toward congenital cytomegalovirus infection among pregnant women in Singapore. Int J Gynaecol Obstet 2012; 117:268–72.
19. Ross DS, Rasmussen SA, Cannon MJ, Anderson B, Kilker K, Tumpey A, et al. Obstetrician/gynecologists' knowledge, attitudes, and practices regarding prevention of infections in pregnancy. J Womens Health (Larchmt) 2009;18:1187–93.
20. Ibidapo O. Awareness and Perception of HIV/AID Preventive Strategies amongst undergraduate students of Adeleke University, Ede Osun State. Nigeria. Library Philosophy and Practice (e-journal), 2016; 1470.
21. Vieira JC, Carvalho MT, Checchia RL, Trombiere M, Flannery B. Survey of rubella knowledge and acceptability of rubella vaccination among Brazilian adults prior to mass vaccination. Rev Panam Salud Publica2011; 30:335–41.
22. Revello MG, Gerna G. Diagnosis and management of human cytomegalovirus infection in the mother, fetus, and newborn infant. Clinical Microbiology Reviews 2002; 15(4):680–715.
23. Donald B. Bailey JR. Newborn Screening for Fragile X Syndrome. Mental Retardation and Developmental Disabilities Research Reviews 2004;10(1):3–10.
24. Maine GT, Lazzarotto T, Landini MP. New developments in the diagnosis of maternal and congenital CMV infection. Expert Review of Molecular Diagnostics 2001; 1(1):19–29.
25. Nigro G, Adler SP, La Torre R. Passive immunization during pregnancy for congenital cytomegalovirus infection. New England Journal of Medicine 2005; 353(13):1350–62
26. Arvin AM, Fast P, Myers M, Plotkin S, Rabinovich R. National Vaccine Advisory Committee Vaccine development to prevent cytomegalovirus disease: report from the National Vaccine Advisory Committee. Clinical Infectious Diseases2004; 39(2):233–9.
27. Hasanov E, Zeynalova S, Geleishvili M, Maes E, Tongren E, Marshall E et al. Assessing the impact of public education on a preventable zoonotic disease: rabies. Epidemiol Infect 2018;146(2):227-35.