

The Cost of Managing Congenital Rubella Syndrome in a Tertiary Government Hospital in Northern Luzon, Philippines

Roland Joseph D. Tan, MD, MS, MIH^{1,2} and Lendell Paul Leon, MD¹

¹Department of Ophthalmology, Baguio General Hospital and Medical Center, Baguio City, Philippines

²Department of Ophthalmology and Visual Sciences, College of Medicine and Philippine General Hospital, University of the Philippines Manila, Philippines

ABSTRACT

Background. Infants with congenital rubella syndrome (CRS) often require multiple diagnostic procedures and interventions that include cataract surgery and procedures for congenital heart abnormalities. CRS is a vaccine-preventable disease.

Objective. This study aimed to determine the costs incurred by the parents, Philippine Health Insurance Corporation (PHIC), hospital's medical social service (MSS), and non-governmental organization (NGO) in the management of CRS.

Methods. This is a costing study of five children diagnosed with probable CRS who were managed in a tertiary government hospital in Northern Luzon, Philippines. The parents or guardians of the patients were interviewed on the cost incurred particularly on non-medical related expenses during their outpatient department consultations and admissions. Hospital bills from our institutions and those from the previous institutions, if available, were retrieved. Expenses incurred from procedures or medical supplies relating to known complications of CRS were included in the computation.

Results. All five patients diagnosed with CRS had cardiac, ear, and eye manifestations. Two patients had postnatal complications. The average cost spent by the five patients' early years of life (mean age of patients was 16 ± 14 months) was ₱409,740.84. A quarter of the cost was out-of-pocket expenses while a third was covered by the hospital's MSS where the patients were seen. Another third was shouldered by an NGO. Most expenses were from the treatment of cardiac complications at 42% of the cost and had the highest average cost at ₱116,586.59. Case 1 had the highest financial cost at ₱833,514.24 mainly from the cardiac complications of CRS.

Conclusion. The cost of CRS in the early years of life is high. This is a significant financial burden to parents, PHIC, hospital's MSS, and NGO.

Keywords: Congenital rubella syndrome, cost of illness, cataract, congenital heart defect, vaccine-preventable disease

INTRODUCTION

Despite the introduction of rubella-containing vaccine (RCV) in the country a decade ago, congenital rubella syndrome (CRS) cases are still seen in the Philippines.¹ Due to the COVID-19 pandemic, vaccine coverage dropped further and prenatal care was also affected.^{2,3} The effects will be significantly felt by infants born to unvaccinated or unprotected mothers infected with rubella during pregnancy. The national incidence of CRS was estimated at 20-31 cases per 100,000 live births annually, ranging from 18 to 201.¹ Despite this, there is still no program directed to vaccinating women of reproductive age.¹

Corresponding author: Roland Joseph D. Tan, MD, MS, MIH
Department of Ophthalmology and Visual Sciences
College of Medicine and Philippine General Hospital
University of the Philippines Manila
Taft Avenue, Ermita, Manila 1000, Philippines
Email: rdtan@up.edu.ph

Infants with CRS require both specialized medical intervention for its clinical manifestations and closer care and additional spending from the parents/caregivers for the infants' medical and other needs.^{4,5} This further increases the already high out-of-pocket (OOP) expenses with our current health system.⁶ Add to that the non-medical related expenses (NMRE) which include fare, accommodation, and daily needs during hospital consultations or admission. Indirect costs such as lost income during time spent in hospital consultations and admission also add to the financial burden considering that many of those who accompany infants with CRS to the hospital are breadwinners and employed in "no work no pay" scheme.⁷ However, indirect cost is difficult to quantify.

The medical needs of infants with CRS also increase hospital spending, especially public ones thru their medical social service (MSS), and present logistical challenges since the infants with CRS need to be isolated.^{8,9} It also increases spending from the Philippine Health Insurance Corporation (PHIC) and public and non-governmental organizations (NGOs) who help fund the management of the patients.¹⁰

METHODS

A case study of the five patients diagnosed with CRS in our institution from October 2019 to March 2021 was done. All cases were probable CRS due to the absence of laboratory diagnosis required in the case definition set by the WHO and CDC for confirmed CRS cases.^{1,11} The parents or guardians of the patients were interviewed on the cost incurred particularly NMRE during their Out-Patient Department consultations and admissions. Two parents provided detailed lists of their expenses. Hospital bills from our institutions and those from the previous, if available, were retrieved. Expenses incurred from procedures or medical supplies relating to known complications of CRS were included in the computation. The principles of the Declaration of Helsinki were observed.

RESULTS

Case 1

A 3-year-old boy from Pangasinan was managed for bilateral cataracts, patent ductus arteriosus (PDA), and coarctation of the aorta (CoA) at our institution. He was born to a mother with history of rubella infection during the first month of pregnancy. At 4 months old, a murmur prompted consults to a pediatric cardiologist in Baguio, where they stayed with a relative. Electrocardiogram (ECG), chest x-ray (CXR), blood chemistry, and 2D Echocardiography (2D Echo) were done, amounting to ₱8,000.00 with NMRE of ₱2,000.00. He was diagnosed with PDA and CoA and was on lanoxin for 25 months amounting to ₱11,875.00 and furosemide for 32 months amounting to ₱6,400.00. Auditory test amounting to ₱440.00 was normal. He was referred to

another pediatric cardiologist where repeat 2D Echo was done amounting to ₱3,240.00 with NMRE of ₱3,400.00. He was then referred to Philippine General Hospital at the 8th month of life and scheduled for cardiac surgery with the help of an NGO. He was also noted to have bilateral cataracts by then and was advised by an ophthalmologist to undergo cataract extraction. However, parents got scared of the surgeries and just consulted and followed up instead at the Pediatric Cardiology section of our institution monthly for a year. NMRE amounted to ₱23,600.00 as the patient came from Pangasinan in most of the consultations.

He was then rescheduled for cardiac surgery at 32 months of age in a private hospital in Manila with the help of the same NGO. The stenting amounted to ₱370,000.00, which the NGO covered with deductions albeit not specified from PHIC. He was started on metoprolol until his last follow-up amounting to ₱800.00 with NMRE of ₱17,000.00 as they had to rent a place to stay in Manila. He also had two monthly follow-ups with NMRE of ₱20,000.00 since there was no regular public transportation due to the COVID-19 lockdown. At 34 months of age, he eventually consulted the Ophthalmology service in our institution where he was admitted twice for cataract extraction in each eye. Hospitalization amounted to ₱42,385.33, with ₱24,000.00 covered by PHIC while the remaining was covered by MSS. NRME for the admissions was ₱8,000.00. He also used aphakic glasses amounting to ₱4,600.00.

He underwent re-stenting at 37 months of age in Manila amounting to ₱220,000.00 with NMRE of ₱15,000.00. He was started on Aspirin until his last follow-up amounting to ₱500.00. He was seen at 40 months of age for follow-up in Manila with NMRE of ₱10,000.00. He is due for a follow-up after a year. He was then readmitted twice at our institution for secondary intraocular lens (IOL) implantation for each eye amounting to ₱57,033.91, with ₱32,000.00 covered by PHIC while the remaining was covered by MSS. NRME for the admission totaled ₱6,000. However, an IOL was not implanted on his left eye due to insufficient sulcus support, and will need another surgery in the future to implant an IOL. He continues to follow up with us with NRME of ₱2,000.00 as of the last consult. He has not undergone serology testing yet to check for antibodies against rubella. As of the last follow-up, the total expenses for Case 1 amounted to ₱833,514.24 (Table 1).

Case 2

A 10-month old boy from Benguet was managed for cataract in the right eye and pulmonary hypertension at our institution. The patient was born in a private institution to a mother with a history of rubella infection during the first trimester of pregnancy. He had meconium staining at birth and was admitted for 1 week at the neonatal intensive care unit for pneumonia. He was also noted to have a murmur and cataract in the right eye then. His hospitalization amounted to ₱23,774.12, with ₱15,650.00 covered by PHIC and

Table 1. Expenses of Case 1 from the management of the clinical manifestations attributed to CRS

	Philippine Health Insurance Corporation	Non-Governmental Organization	Medical Social Service	Out-of-Pocket	Total
Postnatal	-	-	-	-	-
Cardiac	?	₱590,000.00	-	₱123,055.00	₱713,055.00
Eyes	₱56,000.00	-	₱43,419.24	₱20,600.00	₱120,019.24
Ears	-	-	-	₱440.00	₱440.00
Rubella IgM/IgG test	-	-	-	-	-
Total	₱56,000.00	₱590,000.00	₱43,419.24	₱144,095.00	₱833,514.24

Table 2. Expenses of Case 2 from the management of the clinical manifestations attributed to CRS

	Philippine Health Insurance Corporation	Medical Social Service	Out-of-Pocket	Total
Postnatal	₱15,650.00	-	₱13,124.12	₱28,774.12
Cardiac	-	-	₱16,900.00	₱16,900.00
Eyes	₱50,520	₱33,318.53	₱58,050.75	₱141,889.28
Ears	-	-	₱3,500	₱3,500.00
Rubella IgM/IgG test	-	-	-	-
Total	₱66,170.00	₱33,318.53	₱91,574.87	₱191,063.40

OOP of ₱8,124.12. NMRE amounted to ₱5,000.00. Upon discharge, the patient followed up with a private pediatric cardiologist where he underwent 2D Echo, ECG, CXR, and blood chemistry amounting to ₱7,200.00 and with NRME of ₱1,500. The patient also underwent an auditory test amounting to ₱3,500.00 and was on regular follow-up with the cardiologist amounting to ₱2,700.00. NRME was ₱5,500.00. The patient consulted a private ophthalmologist and was admitted for cataract surgery of the right eye. The hospital bill amounted to ₱70,150.75, with ₱22,400.00 covered by PHIC and with OOP of ₱47,750.75. NRME was ₱3,000 for follow-up consultations and ₱1,600 for consultation fees. He wore aphakic eyeglasses amounting to ₱3,800.00. He was then readmitted for secondary IOL implantation at our institution. Hospitalization amounted to ₱27,376.52 with ₱16,000.00 covered by PHIC and ₱11,376.52 covered by MSS. NRME was at ₱300.00. His glasses were adjusted accordingly amounting to ₱1,600.00. He developed a membrane over the IOL, for which he was admitted to undergo membranectomy amounting to ₱30,562.01, with ₱12,120 covered by PHIC and ₱18,442.01 covered by MSS. NRME amounted to ₱3,500. Although the last 2D Echo showed that the PDA was already closing, the patient is still for fitting of hearing aid for the right ear quoted at ₱45,000.00 and for consultation with a developmental pediatrician. The patient also has not undergone rubella serology testing. As of the last follow-up, the total expenses for Case 2 amounted to ₱191,063.40 (Table 2).

Case 3

A 13-month-old boy from Benguet was managed for cataract of the left eye and PDA at our institution. The patient was born to a mother with no maternal rubella exposure or infection during pregnancy. On his well-

baby check-up, a murmur was appreciated that led to the referral to our institution. 2D Echo revealed PDA. He was diagnosed with congestive heart failure and was on furosemide 5 milligrams for six months amounting to ₱3,900.00 with NRME of ₱300.00. Cataract was noted at 2 months of life and was referred to the Ophthalmology service where he underwent cataract surgery of the left eye. Hospitalization amounted to ₱32,150.05, with ₱16,000.00 covered by PHIC and ₱16,150.05 covered by MSS with no OOP. NRME was ₱4,000.00. He wore aphakic glasses amounting to ₱3,500.00. He underwent rubella serology testing amounting to ₱3,500.00 and came back positive for rubella Immunoglobulin G (IgG) and immunoglobulin M (IgM). On follow-up, he developed keratitis that required close follow-up and additional topical medications costing ₱2,685.00. This, together with the outpatient follow-up with the Pediatric Cardiology service, resulted in NRME of ₱4,350.00. He was then readmitted for secondary IOL implantation. Hospitalization amounted to ₱26,113.70, with ₱16,000.00 covered by PHIC and ₱10,113.70 covered by MSS with no OOP. NRME was ₱1,000.00. His glasses were adjusted accordingly costing ₱2,000.00 with NRME of ₱300.00. He had a repeat 2D Echo costing ₱2,800.00 and was advised that the PDA spontaneously closed. He also underwent an auditory test amounting to ₱3,500.00 and was still awaiting the result. NRME was ₱200.00. As of the last follow-up, the total expenses for Case 3 amounted to ₱92,299.00 (Table 3).

Case 4

A 7-month-old girl from Nueva Vizcaya was managed for bilateral cataracts and pulmonary hypertension at our institution. She was born to a mother who had a history of rubella infection during the first month of pregnancy. She

had meconium staining at birth and was admitted for 2 weeks in the NICU for pneumonia. She also had bilateral cataracts. Hospitalization amounted to ₱70,718.32, with ₱19,850.00 covered by PHIC and the remaining covered by MSS. NMRE amounted to ₱13,600.00 since regular public transportation was limited during the COVID-19 lockdown. Upon discharge, she was seen by an ophthalmologist at a neighboring province and was advised cataract surgery prompting referral to our institution. An amount of ₱7,816.00 was spent for the consult and ocular ultrasound with NMRE of ₱3,500.00. Since the patient was from another province, the parents had to rent a place in Baguio where they stayed for 28 days for preoperative assessment, admission, and post-operative follow-up. This amounted to ₱15,000.00 for accommodation, ₱20,000.00 for daily needs, and ₱8,000.00 for transportation. Before admission for cataract surgery, she was found to have PDA and pulmonary artery hypertension on 2D Echo costing ₱2,640.00. She was started on sildenafil that amounted to ₱540.00 during the admission duration. An auditory test revealed congenital hearing loss on both ears.

The patient underwent cataract surgery of the left eye. Hospitalization amounted to ₱105,951.91, with ₱16,000 covered by PHIC and the rest covered by MSS. Her rubella serology test amounting to ₱3,360.00 came back positive for IgG and IgM. Upon discharge, parents had to spend ₱25,750.00 for the oxygen tank and refills for 2 months. The following were also spent: ₱900.00 for 2 month supply of sildenafil, ₱296.25 for multivitamins, and ₱1519.00 for the additional topical eye drops. The patient followed up after 2 months and underwent cataract surgery and anterior vitrectomy for the right eye. The hospital bill amounted to ₱64,184.56, with ₱45,000.00 covered by PHIC, ₱19,184.56 by MSS, and no OOP. NRME amounted to ₱1,700.00 for accommodation, ₱15,000.00 for daily needs,

and ₱8,000.00 for transportation for 21 days. The parent also spent ₱3,000.00 on additional laboratory tests and medications. The patient was prescribed aphakic glasses that amounted to ₱7,200.00 and is still for future secondary IOL implantation. She is also still for repeat auditory testing and possible fitting of a hearing aid and for repeat 2D Echo to reassess the status of her PDA. As of the last follow-up, the total expenses for Case 4 amounted to ₱378,676.04 (Table 4).

Case 5

A 5-month-old boy from Benguet was managed for neonatal pneumonia, pulmonary artery hypertension, and bilateral cataracts at our institution. He was born large-for-gestational age to a mother with gestational diabetes mellitus but with no history of rubella exposure or infection. His APGAR scores were 3, 5, 7 (1st, 3rd, and 5th minute) and was admitted to the NICU for 1.5 months. He was intubated for desaturation and was started on dobutamine and dopamine for inotropic support. He was also started on phenytoin and levetiracetam for generalized tonic-clonic seizures. He underwent a double-volume exchange transfusion and received fresh frozen plasma, platelet concentrate, and intravenous immunoglobulin transfusions for persistent thrombocytopenia. He underwent left antecubital venous cutdown for access and was started on penicillin G, amikacin and piperacillin, and tazobactam for neonatal pneumonia. Due to cardiomegaly on CXR, a 2D Echo was done showing a patent foramen ovale, right atrial and ventricular enlargement, right and left ventricular hypertrophy, PDA, and pulmonary hypertension which he was started on sildenafil and magnesium sulfate for.

On day 9, he was extubated, discontinued from phenytoin, magnesium sulfate, and dobutamine but was started on furosemide and clonidine for systemic hypertension. He was

Table 3. Expenses of Case 3 from the management of the clinical manifestations attributed to CRS

Item	Philippine Health Insurance Corporation	Medical Social Service	Out-of-Pocket	Total
Postnatal	-	-	-	-
Cardiac	-	-	₱6,900.00	₱6,900.00
Eyes	₱32,000.00	₱26,263.75	₱19,835.00	₱78,098.75
Ears	-	-	₱3,700.00	₱3,700.00
Rubella IgM/IgG test	-	-	₱3,500.00	₱3,500.00
Total	₱32,000.00	₱26,263.75	₱34,035.00	₱92,299.00

Table 4. Expenses of Case 4 from the management of the clinical manifestations attributed to CRS

Details	Philippine Health Insurance Corporation	Medical Social Service	Out-of-Pocket	Total
Postnatal	₱19850.00	₱50,868.32	₱13,600.00	₱84,318.32
Cardiac	-	₱89,951.91	₱30,126.25	₱120,078.16
Ophthalmological	₱69,000.00	₱19,184.56	₱82,735.00	₱170,919.56
Audiological	-	-	-	-
Rubella IgM/IgG test	-	-	₱3,360.00	₱3,360.00
Total	₱88,850.00	₱160,004.79	₱129,821.25	₱378,676.04

Table 5. Expenses of Case 5 from the management of the clinical manifestations attributed to CRS

Details	Philippine Health Insurance Corporation	Medical Social Service	Out-of-Pocket	Total
Postnatal	₱10,850.00	₱234,522.90	₱60,000.00	₱305,372.90
Cardiac	-	₱132,340.00	₱40,000.00	₱172,340.00
Ophthalmological	-	₱21,658.76	₱8,780.00	₱75,438.76
Audiological	-	-	-	-
Rubella IgM/IgG test	-	-	-	-
Total	₱55,850.00	₱388,521.66	₱108,780.00	₱553,151.66

Table 6. Summary of the expenses of the five CRS case studies

Details	Case 1	Case 2	Case 3	Case 4	Case 5	Total	%
PHIC	₱56,000.00	₱66,170.00	₱32,000.00	₱88,850.00	₱55,850.00	₱298,870.00	14
MSS	₱43,419.24	₱33,318.53	₱26,263.75	₱160,004.79	₱388,521.66	₱651,527.97	32
NGO	₱590,000.00	-	-	-	-	₱590,000.00	29
OOP	₱144,095.00	₱91,574.87	₱34,035.00	₱129,821.25	₱108,780.00	₱364,211.12	25
Total	₱833,514.24	₱191,063.40	₱92,299.00	₱378,676.04	₱553,151.66	₱2,048,704.34	100

PHIC - Philippine Health Insurance Corporation

MSS - Medical Social Service

NGO - Non-governmental organization

OOP - Out-of-pocket

Table 7. Average patient expenses per complication

Details	1	2	3	4	5	Average
Postnatal	0	₱28,774.12	0	₱84,318.32	₱305,372.90	₱83,693.07
Cardiac	₱713,055.00	₱16,900.00	₱6,900.00	₱120,078.16	₱172,340.00	₱205,854.63
Ophthalmological	₱120,019.24	₱141,889.28	₱78,098.75	₱170,919.56	₱75,438.76	₱117,273.12
Audiological	₱440.00	₱3,500.00	₱3,700.00	0	0	₱1,528.00
TORCH test	0	0	₱3,500.00	₱3,360.00	0	₱1372.00
Total	₱833,514.24	₱191,063.40	₱92,299.00	₱378,676.04	₱553,151.66	₱409,740.84

shifted to meropenem for 14 days for progression of lung densities diagnosed as healthcare-associated pneumonia. On day 39, his hearing screening revealed abnormal results and a retest was recommended after a month. He was admitted for 44 days which amounted to ₱377,712.00, where ₱10,850.00 was covered by PHIC while the rest was covered by MSS. The mother also claimed that NRME amounted to ₱100,000.00.

The patient was referred to the ophthalmology department for bilateral cataracts that were noted after 2 months. He was first admitted for cataract surgery and anterior vitrectomy of his left eye which amounted to ₱45,000.00 covered by PHIC. NRME was ₱3,000.00. He was then readmitted for the cataract surgery of the right eye amounting to ₱21,658.76 covered by MSS. NRME was ₱700.00. They also spent ₱2,280.00 for topical medication refills on follow-up consultations and ₱2,800.00 for the aphakic glasses. The patient is still for repeat auditory testing and secondary IOL implantation. The patient also has not undergone rubella serology testing. As of the last follow-up, the total expenses for Case 5 amounted to ₱553,151.66 (Table 5).

DISCUSSION

This is the first study in the country which determined the costs of CRS management and care. These case studies series of five patients showed that the financial burden of CRS is high even just in the early months to years of life not only to the parents but also to the hospital's MSS and PHIC (Table 6). A significant portion of the expenses came from OOP (25%). However, 46% of the costs were covered by MSS and PHIC.

Most expenses were from the treatment of cardiac complications at 42%. It also had the highest average at ₱205,854.63 (Table 7). The average amount spent for CRS in the patients' early years of life (mean age of patients was 16±14 months) was ₱409,740.84. When this amount is multiplied by the estimated incidence of 31 cases per 100,000 live births or 527 based on the live births registered in 2019 of 1.7 million, the financial burden amounts to ₱215.9 million annually.^{1,12}

Given that the cost is high for CRS management and care, cost-effective programs should be considered to address this. An option is to extend RCV coverage in the Expanded

Program on Immunization in the Philippines to women of up to 14 years of age, given that it is ensured that they are not pregnant, similar to what was done in Vietnam.¹³ However, it is hard to estimate the cost to do this since RCV prices in the market significantly varies. The amount can be more than the computed cost for CRS management and care of P215.9 million. However, the amount computed for CRS in this study was only those incurred in the first years of the patients' lives and did not include future costs such as hearing aids and regular changes in glasses. It also did not include data on indirect costs such as the amount of lost income by the relatives while accompanying the patients in the hospital and the loss of probable income from the disabilities incurred by the patients when they grow older. The incidence of CRS used for computing the amount was also based only on the incidence in four tertiary Philippine government hospitals and as such, may be underestimated.

It may also be significantly cheaper to extend RCV coverage when the cost of rubella antibody testing, which is recommended for women planning to conceive, is added to the over-all cost of CRS management and care. Extending RCV coverage can also be beneficial two-fold since it will increase the titers of those who were already vaccinated but with low antibody titers and also immunize those who have not received RCV during childhood.

This study is limited by its retrospective nature. Although most hospital bills were retrieved for better estimation of cost, some from other hospitals were not retrieved. Data on NRME were also dependent on the parents' recall with some of them being rough estimates. Indirect costs were also not determined. And the costs determined were only those in the early years of the CRS patients' lives.

CONCLUSION

The financial cost of CRS in the early years of life was high to the parents, PHIC, hospital's MSS, and NGO. The cost may be higher compared to when RCV coverage is extended to up to 12-year-old Filipino girls for better protection. However, doing this is cheaper than recommending that rubella antibody testing be done for women planning to get pregnant and for the other financial costs not accounted for in this study.

Statement of Authorship

Both authors contributed in the conceptualization of work, acquisition and analysis of data, drafting and revising and approved the final version submitted.

Author Disclosure

Both authors declared no conflicts of interest.

Funding Source

The study has no funding support.

REFERENCES

1. Lopez A, Raguindin P, del Rosario J, Najarro R, Du E, Aldaba J, et al. The burden of congenital rubella syndrome in the Philippines: results from a retrospective assessment. *Western Pac Surveill Response J*. 2017; 8(2):17-24.
2. Ackerson B, Sy L, Glenn S, Qian L, Park C, Riewerts R, et al. Pediatric Vaccination During the COVID-19 Pandemic. *Pediatrics*. 2021; 148(1):e2020047092.
3. Kotlar B, Gerson E, Petrillo S, Langer A, Tiemeier H. The impact of the COVID-19 pandemic on maternal and perinatal health: a scoping review. *Reprod Health*. 2021; 18(1).
4. Shukla S, Maraqa NF, Congenital rubella [Internet]. 2020 [cited 2021 Aug]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507879/#_NBK507879_pubdet_.
5. Sense, Rubella and sensory impairment [Internet]. no date [cited 2021 Aug]. Available from: <https://www.sense.org.uk/get-support/information-and-advice/conditions/rubella/>
6. The World Bank, Out-of-pocket expenditure (% of Current Health Expenditure) - Philippines [Internet]. 2018 [cited 2021 Aug]. Available from: <https://data.worldbank.org/indicator/SH.XPD.OOPC.CH.ZS?locations=PH>
7. Lasco G, Nuevo C, Nolasco M, Famoloan F, Bundoc J, Capili D, et al. "It's as if I'm the one suffering": narratives of parents of children with disability in the Philippines. *Acta Med Philipp*. 2021. doi: 10.47895/amp.vi0.658
8. Sugishita Y, Akiba T, Sumitomo M, Hayata N, Hasegawa M, Tsunoda T, et al. Shedding of rubella virus among infants with congenital rubella syndrome born in Tokyo, Japan, 2013-2014. *Jpn J Infect Dis*. 2016 Sep 21; 69(5):418-23. doi: 10.7883/yoken.JJID.2015.316. Epub 2015 Nov 13. PMID: 26567831.
9. Centers for Disease Control and Prevention, Type and Duration of Precautions Recommended for Selected Infections and Conditions [Internet]. 2018 [cited 2021 Aug]. Available from: <https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/type-duration-precautions.html#R>.
10. Guevarra J, Antonio C, Cochon K, Bermudez A, Garcia Jr. F, Manalo J, et al. Financial assistance for the treatment of schizophrenia in select institutions in the Philippines. *Acta Med Philipp*. 2021. doi: 10.47895/amp.vi0.3376
11. World Health Organization. Vaccines and biologicals: WHO-recommended standards for surveillance of selected vaccine-preventable diseases [Internet]. 2008 [cited 2021 Aug]. Available from: http://apps.who.int/iris/bitstream/10665/68334/1/WHO_V-B_03.01_eng.pdf
12. Philippine Statistics Authority, Registered Live Births in the Philippines, 2019 [Internet]. 2020 [cited 2021 Aug]. Available from: <https://psa.gov.ph/vital-statistics/id/163858>
13. Do TTT, Nguyen AN, Le XTT, Pongsakul A, Nguyen QN, Nguyen TV, et al. Rubella vaccination coverage among women of childbearing age in Vietnam. *Int J Environ Res Public Health*. 2019 May 16; 16(10):1741. doi: 10.3390/ijerph16101741. PMID: 31100981; PMCID: PMC6572083.