

ORIGINAL ARTICLE

Prevalence and Pattern of Congenital Malformations among Neonates in the Neonatal Unit of a Tertiary Care Hospital

ZABIT KHAN NAIBZAI¹, ABEERA AFZAL BUZDAR², MAHAM KHALID³, NAJMA FATIMA⁴, NIMRA KHALID⁵, ZARMAST KHAN⁶

¹Sheikh Zayed University, Medical Faculty, Pediatric department, Khost Afghanistan

²House Officer, Services Hospital, Lahore

³Senior House Officer, Radiology, Sheikh Zayed Hospital, Lahore

⁴Woman Medical Officer, BHU Pothhi Makwala, AJK

⁵House Officer, Shaikh Zayed Hospital, Lahore

⁶Associate Professor Pediatrics, Niazi Medical and Dental College, Sargodha

Corresponding author: Abeera Afzal Buzdar, Email: abiira1388@gmail.com

ABSTRACT

Background and Aim: Globally, congenital anomalies (CA) are a major contributing factor for neonate's admission in NICU causing neonatal morbidity and mortality particularly in developing countries. Congenital anomalies generally indicate the morphogenesis defect in an early neonate's life. The leading cause for perinatal mortality is congenital anomalies that arise with advancement of delivery and care for newborn babies. The present study aimed to evaluate the prevalence and pattern of congenital anomalies among neonates admitted to neonatal unit.

Methodology: This retrospective study was carried out on 1620 neonates (newborns to age 28 days) admitted to the neonatal unit of Services Hospital, Lahore from April 2020 to March 2022. The incidence, risk factors, and pattern of congenital anomalies were measured. Detailed examinations such as radiological, laboratory, ultrasonography, and echocardiography were recorded. Different outcomes such as hospital stay, morbidity, and mortality were determined with 95% confidence intervals. SPSS version 25 was used for data analysis.

Results: Of the total 1620 admitted neonates, the prevalence of neonates with congenital anomalies were 112 (6.9%). Out of 112 neonates diagnosed with congenital anomalies, 64 (57.1%) were male and 48 (42.9%) were females. The incidence of cesarean and other modes of delivery were 74 (66%) and 38 (34%) respectively. Cardiovascular system malformation was the most prevalent affected system in 36 (31.9%) neonates followed by central nerve system 28 (25%), genitourinary system 19 (17%), musculoskeletal system 16 (14.3%), gastrointestinal tract 6 (5.4%), digestive system 4 (3.6%), and syndromes and skin 3 (2.7%). Congenital anomalies were significantly increasing over time. The incidence of discharged, referred to higher centers for intervention, and expired babies were 77 (68.8%), 19 (16.7%), and 16 (14.3%) respectively.

Conclusion: The present study found that the prevalence of congenital anomalies was 6.9%. Cardiovascular system malformation was the most prevalent congenital anomaly followed by the central nerve system. The overall mortality rate was 14.3% caused by congenital anomalies. A better health care strategies and management must be developed in terms of early detection, supplementation facilitation, decreasing drug usage, and better antenatal care to prevent the impacts of congenital anomalies on neonates.

Keywords: Prevalence, Pattern, Congenital anomalies, neonates

INTRODUCTION

Congenital anomalies (CA) also referred to birth defects are functional, structural, metabolic, and behavioral maladies identified during birth, intrauterine life, prenatally, and later in infancy [1]. The World Health Organization (WHO) defined it as a structural defect during birth [2]. Congenital anomalies might be minor or major defects. The structural disorders during birth which have less impact on clinical function but cosmetic effect could be referred to as minor congenital anomalies. Cleft lip and septal defect of ventricular cause's major disorders affecting social acceptability function [3]. The study of abnormalities in human mechanisms is defined as dysmorphology. Adverse neonatal outcomes are mainly caused by infections, asphyxia, and prematurity whereas neonatal morbidity and mortality is significantly associated with congenital anomalies [4, 5]. The estimated rate of congenital anomalies among children is about to reach 8 million per year [6]. Congenital anomalies are the major cause of infant mortality (20-30%) and post-neonatal deaths (30-50%) [7]. Organ's morphogenesis mostly occurs in the first trimester particularly between 3rd and 8th gestational weeks. Any offence during the first trimester might lead to congenital abnormalities. However, preventive strategies decrease the possibility of developing congenital anomalies during this period [8]. Unfortunately, low and middle income countries (LMICs) account for more than 90% of congenital anomalies [9].

Birth defects are thought to be caused by a combination of factors, including multifactorial inheritance, micronutrient deficiencies, single gene defects, chromosomal disorders, and environmental teratogens. In addition, congenital anomalies are caused by maternal infectious diseases in terms of syphilis and rubella in developing countries [10]. The prevalence of congenital anomalies varied by country, Pakistan having 4.24% [11], India having 1.85% [12] and Ethiopia having 1.99% [13]. The

contributing factors for congenital anomalies are teratogens, maternal age, smoking, maternal illness, and drug use [14]. Cordocentesis, maternal serum marker, amniocentesis, ultrasonography, and chorionic villus sampling are various screening techniques for the detection of anomalies. Despite knowing the preventive strategies of anomalies such as folic acid intake, neonatal care at early stages, vaccination, and supplementation, only 2% pregnant women took proper supplementation in their first trimester against the neural tube defects (NTDs) which increase the incidence of congenital anomalies in developing world [15]. Therefore, the current study aimed to determine the prevalence and pattern of congenital anomalies in neonates admitted to neonatal unit of a tertiary care hospital.

METHODOLOGY

This retrospective study was carried out on 1620 neonates (newborns to age 28 days) admitted to the neonatal unit of Services Hospital, Lahore from April 2020 to March 2022. Prior to study conduction, ethical approval was taken from the institution research and ethical committee. Implied consent was taken from the parents of every newborn. All neonates (newborns to 28 days old) with complete medical records were enrolled. Neonates with partial or incomplete data were excluded. The incidence, risk factors, and pattern of congenital anomalies were measured. Detailed examinations such as radiological, laboratory, ultrasonography, and echocardiography were recorded. Different outcomes such as hospital stay, morbidity, and mortality were determined with 95% confidence intervals. The medical checklist of participants included gender, weight, medical record number, terms of pregnancy, delivery mode, diagnosis year, discharge status, and type of anomalies. Babies born before 37 weeks from

initial day of menstruation were considered as preterm or premature.

SPSS version 25 was used for data analysis. Numerical variables were expressed as mean and standard deviation. Categorical variables were described as frequency and percentage. The ratio of number of neonates with congenital anomalies divided by total neonates admitted to the neonatal unit determined the prevalence of congenital anomalies. Chi-square test was used for comparing the maternal demographic details and neonatal characteristics with congenital anomalies. Logistic regression was used for the evaluation of different risk factors for CA reported at 95% CI. All the descriptive statistics were done at 5% level of significance.

RESULTS

Of the total 1620 admitted neonates, the prevalence of neonates with congenital anomalies were 112 (6.9%). Out of 112 neonates diagnosed with congenital anomalies, 64 (57.1%) were male and 48 (42.9%) were females. The incidence of cesarean and other modes of delivery were 74 (66%) and 38 (34%) respectively. Cardiovascular system malformation was the most prevalent affected system in 36 (31.9%) neonates followed by central nerve system 28 (25%), genitourinary system 19 (17%), musculoskeletal system 16 (14.3%), gastrointestinal tract 6 (5.4%), digestive system 4 (3.6%), and syndromes and skin 3 (2.7%). Congenital anomalies were significantly increasing over time. The incidence of discharged, referred to higher centers for intervention, and expired babies were 77 (68.8%), 19 (16.7%), and 16 (14.3%) respectively. Figure-1 demonstrates the gender's distribution of neonates diagnosed with congenital anomalies. Mode of delivery is illustrated in Figure-2. Different congenital anomalies among neonates are depicted in Figure-3. The proportion of neonates discharged, expired, referred to higher center for intervention is shown in Figure-4.

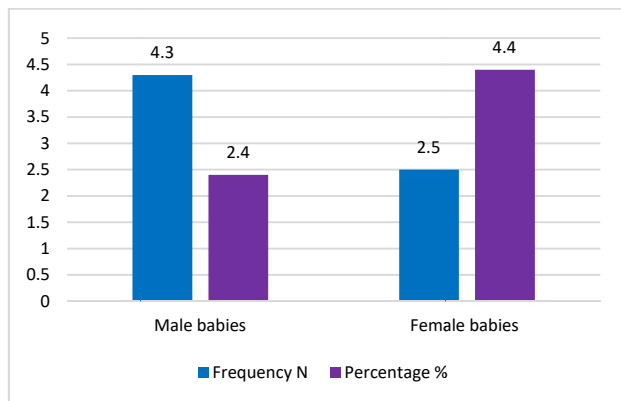


Figure-1: Gender's distribution of neonates (n=112)

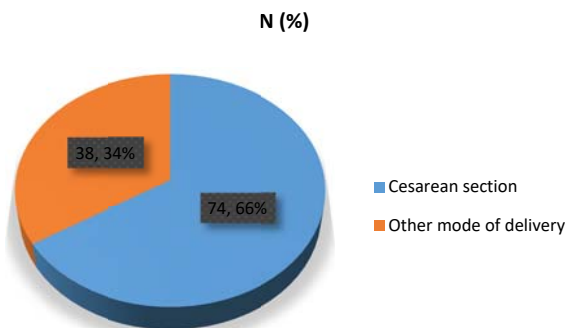


Figure-2: Incidence of cesarean section and other mode of delivery (n=112)

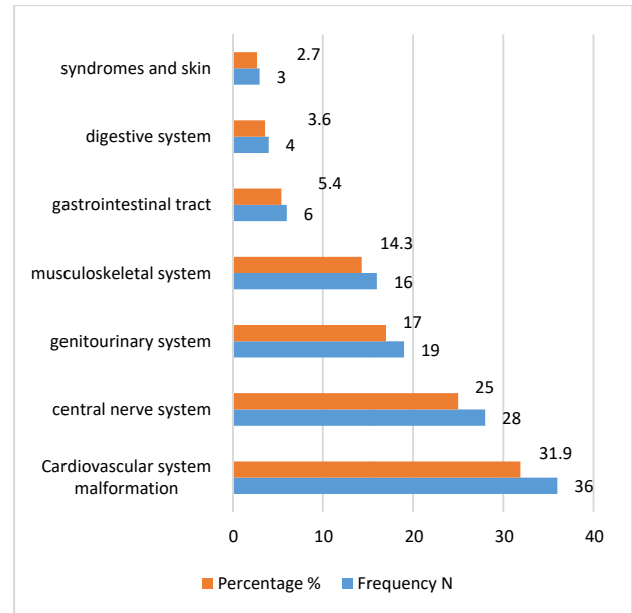


Figure-3: Prevalence of different congenital anomalies among neonates (n=112)

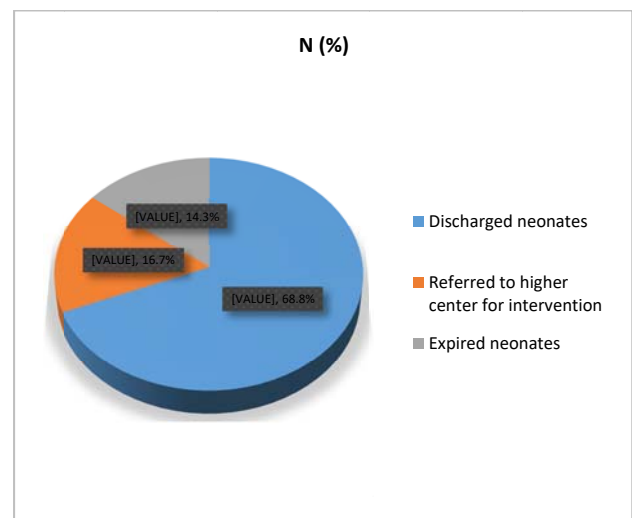


Figure-4: Proportion of neonates discharged, expired, referred to higher center for intervention

DISCUSSION

The present study focused on prevalence and pattern of congenital anomalies in neonates admitted to neonatal units and found the increasing prevalence of congenital anomalies over time. The congenital anomalies overall prevalence was 6.9% among 1620 neonates admitted to the neonatal unit of tertiary care hospital. It has been found that cardiovascular systems were the most prevalent anomalies followed by the central nerve system. Other anomalies were genitourinary, musculoskeletal system, digestive system, and skin syndrome among neonates. Newborns were mostly delivered through cesarean section. The mortality rate of neonates was 14.3%. In our study, the prevalence of congenital anomalies was similar to the prevalence 5.5% in Korea [16] and 6.3% in Nigeria [17]. A Tanzania-based study reported prevalence of congenital anomalies 8.4% which was higher than our findings [18]. Also, our reported incidence of CA was higher than 4.24% found in Pakistani-based study [19]. Sample size,

sociodemographic difference and study population were the main reasons for difference in prevalence of congenital anomalies.

Akinmoladun et al [20] reported 11.1% prevalence of congenital anomalies among neonates admitted to hospital in Nigeria. Similar to our study findings, Ped JC et al 6.9% [21]. However, other studies reported lower prevalence 2.8% and 0.4% [21, 22]. The reason for lower prevalence reported in different studies might be lower utilization of health care facilities for delivery and inadequate treatment and management. Due to the tertiary care facilities, mostly complicated cases are seen while lower complicated cases might be treated in other peripheral hospitals. In the present study, certain anomalies that did not need any hospitalization were not enrolled except those who required immediate hospitalization. Stillbirth and abortion cases were not included in this study. Previous studies showed higher incidence of congenital anomalies among abortion and stillbirths cases [23, 24].

In our study, the cardiovascular system was the most prevalent anomaly followed by the central nerve system. Various studies reported similar findings in their large cohort studies [25, 26]. Tankeu et al [27] found that the most contributing anomaly for perinatal death autopsies was the cardiovascular system. In contrast, other studies reported that gastrointestinal system and nerve system were the common affected system [28, 29]. Another study by Dixit et al [30] found that skeletal system was the predominant anomaly among neonates.

The current study found that male's babies were more susceptible to congenital anomalies than females (57.1% vs 42.9%). Similar findings were seen in a previous study where congenital anomalies were seen in male 52% and female 48% [31]. Another study conducted in the UK found that males were 26% more susceptible to congenital anomalies than female's babies [32]. According to their study, the prevalence of single and multiple anomalies were 85% and 15% respectively.

In the present study, the mortality rate was 14.3% higher than 10.4% reported in a similar study [33] but comparable to 16.9% found in a previous study by Sanchez et al [34]. CA associated mortality was 6.9% among neonates during the study period. Tinker et al [35] investigated the possible perinatal factors of neonatal mortality reported 3.1% impact of congenital abnormalities.

The current study did not find any significance relationship between congenital anomalies and different parameters such as parity, preterm delivery, maternal age, gestation types, and febrile illness. The overall mean of maternal age was 28.7±4.9 years which falls under the reproductive age. Various studies reported that with increase of maternal age, the prevalence of birth defects increases especially in women of maternal age > 35 years [35, 36]. A higher prevalence was seen in women <21 years and >35 years delivered babies with congenital anomalies. Chromosomal anomalies mostly related to disorders of the older maternal age were seen in lower proportion due to the small sample size. Birth defects have been linked to increased morbidity and mortality [37]. We compared the outcomes of neonates admitted for other conditions to those of congenital anomalies and their effect on neonatal mortality. The incidence of cesarean section was higher in the present study compared to other mode of delivery.

CONCLUSION

The present study found that the prevalence of congenital anomalies was 6.9%. Cardiovascular system malformation was the most prevalent congenital anomaly followed by the central nerve system. The overall mortality rate was 14.3% caused by congenital anomalies. A better health care strategies and management must be developed in terms of early detection, supplementation facilitation, decreasing drug usage, and better antenatal care to prevent the impacts of congenital anomalies on neonates.

REFERENCES

1. Padmanabhan R, Venkatasubramanian R, Heber A. Prevalence and Pattern of Congenital Malformations among Neonates in a Medical

- College Hospital - A Retrospective Study. *Int J Sci Stud* 2019;6(12):28-31.
2. WHO, Maternal and Child Epidemiology Estimation Group. Ethiopia – healthy newborn network [Internet]. 2018. Available from: <https://www.healthynetwork.org/country/ethiopia/>. Accessed February 12, 2021.
3. Taye M, Afework M, Fantaye W, Diro E, Worku A. Congenital anomalies prevalence in Addis Ababa and the Amhara region, Ethiopia: a descriptive cross-sectional study. *BMC Pediatr*. 2019;19(1):1–11. doi:10.1186/s12887-019-1596-2
4. Patel KG, Chaudhary C. Study of congenital malformations in newborns: A hospital based prospective study. *Int J Contemp Pediatr* 2017;4:1409-13.
5. Galina B, Tatiana C. Congenital anomaly in the structure of stillbirth and deaths of newborn children in chisinau: epidemiological study deleu raisa. *Ovidius Univ Ann Econ Sci Ser*. 2018;XVIII(2):251–256.
6. Heymann DL, Hodgson A, Sall AA, et al. Zika virus and microcephaly: why is this situation a PHEIC? *Lancet*. 2016;387(10020):719–721. doi:10.1016/S0140-6736(16)00320-2.
7. Taye M, Afework M, Fantaye W, Diro E, Worku A, Dastgiri S. Magnitude of birth defects in central and northwest Ethiopia from 2010–2014: a descriptive retrospective study. *PLoS One*. 2016;11(10):1–12. doi:10.1371/journal.pone.0161998
8. Ajao AE, Adeoye IA. Prevalence, risk factors and outcome of congenital anomalies among neonatal admissions in OGBOMOSO, Nigeria. *BMC Pediatr*. 2019;19(1):1–10. doi:10.1186/s12887-019-1471-1
9. Prashar N, Gupta S, Thakur R, Sharma P, Sharma G. A study of incidence of congenital anomalies in newborn: a hospital based study. *Int J Res Med Sci*. 2016;4(6):2050–2053. doi:10.18203/2320-6012.ijrms20161758.
10. Cherie N, Mebratu A. Adverse birth out comes and associated factors among delivered mothers in Dessie Referral Hospital, North East Ethiopia. *Womens Health Reprod Med*. 2018;1(July):1–6
11. Raza MZ, Sheikh A, Ahmed SS, Ali S, Naqvi SMA. Risk factors associated with birth defects at a tertiary care center in Pakistan. *Ital J Pediatr*. 2012;38(1):1–7. doi:10.1186/1824-7288-38-68.
12. Chowdhury P, Devi RP, Singh LB, Thakare AS, Tamang ZD, Debroy S, et al. Clinical study on congenital malformations at Birth in a tertiary level Hospital in North-East India. *IOSR J Dent Med Sci IOSR-JDMS*. 2017;1:24–7.
13. Yadassa Tesso F, Woldeesemayat LA, Birhanu Kebede D. Magnitude of substance use and associated factors among pregnant women attending jimma town public health facilities, Jimma Zone, Oromia Regional State Southwest Ethiopia. *Clin Mother Child Health*. 2017;14(4):1–5.
14. Dessie MA, Zeleke EG, Workie SB, Berihun AW. Folic acid usage and associated factors in the prevention of neural tube defects among pregnant women in Ethiopia: cross-sectional study. *BMC Pregnancy Childbirth*. 2017;17(1):1–8. doi:10.1186/s12884-017-1506-2
15. Lamichhane DK, Leem JH, Park M, et al. Increased prevalence of some birth defects in Korea, 2009–2010. *BMC Pregnancy Childbirth*. 2016;16(1):1–10. doi:10.1186/s12884-016-0841-z.
16. Santoro M, Minichilli F, Pierini A, et al. Congenital anomalies in contaminated sites: a multisite study in Italy. *Int J Environ Res Public Health*. 2017;14(3):1–10. doi:10.3390/ijerph14030292.
17. Zhao QM, Liu F, Wu L, Ma XJ, Niu C, Huang GY. Prevalence of congenital heart disease at live birth in China. *J Pediatr*. 2019; 204:53-8. doi:10.1016/j.jpeds.2018.08.040
18. Mashuda F, Zuechner A, Chalya PL, Kidenya BR, Manyama M. Pattern and factors associated with congenital anomalies among young infants admitted at Bugando medical centre, Mwanza, Tanzania. *BMC Res Notes*. 2014;7(1):1–7. doi:10.1186/1756-0500-7-195.
19. Rizvi SF, Mustafa G, Kundi A, Khan MA. Prevalence of congenital heart disease in rural communities of Pakistan. *J Ayub Med Coll Abbottabad*. 2015; 27:124-7.
20. Akinmoladun JA, Ogbale GI, Oluwasola O. Pattern and outcome of prenatally diagnosed major congenital anomalies at a Nigerian Tertiary Hospital. *Niger J Clin Pract*. 2018;21(5):560–565. doi:10.4103/njcp.njcp_210_17
21. Ped JC, Press I, Press I, et al. Determining the Risk Factors of Congenital Anomalies of Newborns in Hamadan Province. 2020.
22. Oloyede OA, Otaigbe BE, Opara PI. Prevalence and Pattern of Birth Defects in a Tertiary Health Facility in the Niger Delta Area of Nigeria. 2017:115–121.
23. Anyanwu L-JC, Danborn B, Hamman WO. Birth prevalence of overt congenital anomalies in Kano metropolis: overt congenital anomalies

- in the Kano. *Univers J Public Health*. 2015;3(2):89–96. doi:10.13189/ujph.2015.030206.
24. Lawal T, Adeleye AO, Ayede AI, Ogundoyin OO, Olulana D, Olusanya A, et al. Congenital paediatric surgical cases in Ibadan: patterns and associated malformations. *Afr J Med Med Sci*. 2017;46:49–55.
 25. Cosme HW, Lima LS, Barbosa LG. Prevalence of congenital anomalies and their associated factors in newborns in the city of Sao Paulo from 2010 to 2014. *Rev Paul Pediatr Orgao Of Soc Pediatr Sao Paulo*. 2017;35:33–8.
 26. Moore CA, Staples JE, Dobyns WB, et al. Characterizing the pattern of anomalies in congenital Zika syndrome for pediatric clinicians. *JAMA Pediatr* 2017;171:288–95. 10.1001/jamapediatrics.2016.3982.
 27. Tankeu AT, Bigna JJ, Nansseu JR, Aminde LN, Danwang C, Temgoua MN, Noubiap JJ: Prevalence and patterns of congenital heart diseases in Africa: a systematic review and meta-analysis protocol. *BMJ Open*. 2017, 7:e015633. 10.1136/bmjopen-2016-015633.
 28. Sun PF, Ding GC, Zhang MY, He SN, Gao Y, Wang JH: Prevalence of congenital heart disease among infants from 2012 to 2014 in Langfang, China. *Chin Med J (Engl)*. 2017, 130:1069-73. 10.4103/0366-6999.204923
 29. Zhao QM, Ma XJ, Jia B, Huang GY: Prevalence of congenital heart disease at live birth: an accurate assessment by echocardiographic screening. *Acta Paediatr*. 2013, 102:397-402. 10.1111/apa.12170
 30. Dixit R, Rai SK, Yadav AK, Lakhota S, Agrawal D, Kumar A, Mohapatra B: Epidemiology of congenital heart disease in India. *Congenit Heart Dis*. 2015, 10:437-46. 10.1111/chd.12220
 31. Saxena A, Mehta A, Sharma M, Salhan S, Kalaivani M, Ramakrishnan S, Juneja R: Birth prevalence of congenital heart disease: a cross-sectional observational study from North India. *Ann Pediatr Cardiol*. 2016, 9:205-9. 10.4103/0974-2069.189122
 32. Otaigbe BE, Tabansi PN: Congenital heart disease in the Niger Delta region of Nigeria: a four-year prospective echocardiographic analysis. *Cardiovasc J Afr*. 2014, 25:265-8. 10.5830/CVJA-2014-055
 33. Passias, P. G. et al. Incidence of congenital spinal abnormalities among pediatric patients and their association with scoliosis and systemic anomalies. *J. Pediatr. Orthop*. 39, e608–e613 (2019).
 34. Sanchez, M. L. N. et al. Birth defect co-occurrence patterns among infants with cleft lip and/or palate. *Cleft Palate Craniofac. J*. <https://doi.org/10.1177/10556656211010060> (2021).
 35. Tinker, S. C. et al. Challenges in studying modifiable risk factors for birth defects. *Curr. Epidemiol. Rep*. 2, 23–30 (2015).
 36. Agopian AJ, Evans JA, Lupo PJ. Analytic methods for evaluating patterns of multiple congenital anomalies in birth defect registries. *Birth Defects Res*. 2018;110(1):5–11.
 37. Dawson AL, Tinker SC, Jamieson DJ, Hobbs CA, Berry RJ, Rasmussen SA, Anderka M, Keppler-Noreuil KM, Lin AE, Reefhuis J, et al. Twinning and major birth defects, national birth defects prevention study, 1997-2007. *J Epidemiol Community Health*. 2016;70(11):1114–1121.