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Percentage positivity and determinants of cytomegalovirus infection and immunity in the public sector of south africa, 2007–2021: a time series analysis

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ABSTRACT

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Cytomegalovirus Percentage Positivity, Its Determinants and Immunity in the Public Sector of South Africa, 2007‑2021: A Time Series Analysis

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Abstract

Cytomegalovirus (CMV) infection is common in all age groups but is more prevalent in women of childbearing age and neonates. If left untreated, CMV can cause birth defects, recurrent infections, and death. Understanding the burden of CMV disease and its risk factors is important to instigate preventive measures. Despite global research conducted on CMV, there is still a paucity of studies conducted in South Africa that focus on CMV current infection and its determinants as well as immunity to CMV. The goal of this study was to determine the prevalence of CMV infection and immunity and the factors that influence them in South Africa's public sector between 2007 and 2021.

Methods: An analytical cross-sectional study was conducted using the results of CMV tests carried out on patient samples. The included test results were obtained from the National Health Laboratory Services and included results from all South African provinces from 2007 to 2021. The data were extracted from the National Health Laboratory Services Corporate Data Warehouse. Records of participants of all age groups whose data were available at the National Health Laboratory Services Corporate Data Warehouse were obtained. Patient demographic details and laboratory results were extracted into data collection tables. Data was cleaned and analysed using Stata 17. The CMV results considered in the analysis were serological (immunoglobulin M [IgM] and Immunoglobulin G [IgG] and molecular polymerase chain reaction tests carried out for routine CMV diagnosis. Immunoglobulin M,

polymerase chain reaction, and IgG seroconversion are markers of current CMV infection. A positive IgG antibody result is a marker of immunity (previous infection). A current CMV infection was defined as a positive CMV immunoglobulin M result, a CMV IgG seroconversion from negative to positive within three months of testing, or a positive CMV polymerase chain reaction result. Descriptive statistical analysis along with multivariable logistic regression analyses was used using age, sex, province, year and HIV.

Results: A total of 432,170 records were analysed for CMV infection from 2007 to 2021. Among those with available CMV IgG test results, 97.84% (190,933/197,157) tested positive. For those with available CMV immunoglobulin M test results, 5.85% (16,850/288,267) tested positive. Overall, 4.40% (19,006/432,170) of records had evidence of a current CMV infection. Stratified analysis by sex showed similar proportions of current CMV infection for men (4.48%; 7,534/155,515) and women (4.08%; 10,649/261,310). Individuals aged 0–1 year had the highest proportion of current CMV infection at 7.35% (7,682/104,510), while those aged 2–15 years had the lowest proportion at 2.74% (979/35,686). Limpopo had the highest proportion of current CMV infections with 5.23%, (1,586/30,340), and the Western Cape had the lowest CMV current infection with 2.24% (788/35,114). In adjusted analysis, age and province were significantly associated with current CMV infection. Using individuals 0–1 year as the reference, all other age groups were less likely to test positive for CMV; the age group 2–15 years had the lowest CMV current infection (AOR = 0.34; 95% CI = 0.32–0.36). Limpopo (AOR = 1.91; 95%CI = 1.76–2.0; p = <0.0018) had the highest odds of current CMV infection while Western Cape had the lowest odds (AOR = 0.66; 95%CI = 0.60–0.73; p = <0.001). HIV infection, sex, and season were not associated with current CMV infection in the adjusted analysis.

Regarding CMV immunity, the age group 26–35 years had the highest number of individuals who were IgG positive (99.18%; 45,845/46,223). The Northern Cape province had the highest concentration of IgG-positive individuals (98.81%; 407/4,460), and the year 2012 had the largest percentage of IgG-positive individuals (98.29%; 11,607/11,809).

Conclusion: Age and place of residence (province) were associated with current CMV infection. Cytomegalovirus seroprevalence did not differ by gender. We found that a significant proportion of children are not susceptible to CMV infection. More recent

data would be useful to evaluate CMV infection in the South African populace and to give a clearer idea of the epidemiology of CMV infection. Meantime, without an effective CMV vaccine, the major preventive measure is educating people about CMV risk mitigation measures. Cytomegalovirus infection vaccines are still in the early phases of development, and our study contributes to identifying a potential target age for vaccination.