VACCINE RATE COVERAGE FORECAST IN BRAZIL: IS IT POSSIBLE TO KEEP POLIO ERADICATED?

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OBJECTIVES:

Brazil's annual vaccination coverage rate (AVCR) for Polio has risen to alarming levels in recent years. Given the imminent possibility of the return of the disease eradicated 32 years ago in Brazil[1], the objective was to assess the historical data of AVCR and foresee the Brazilian performance in the next five years.

METHODS:

We apply a classic linear forecasting model Holt Winter (HW)[2], composed of a forecasting equation and three corresponding smoothing equations α, β, and γ. The Polio AVCR between 1994 and 2022 was collected from the National Immunization Program[3] and was evaluated in two stages using the R software[4] involving (i) analysis of data, (ii) application of the HW using least squares adjustment.

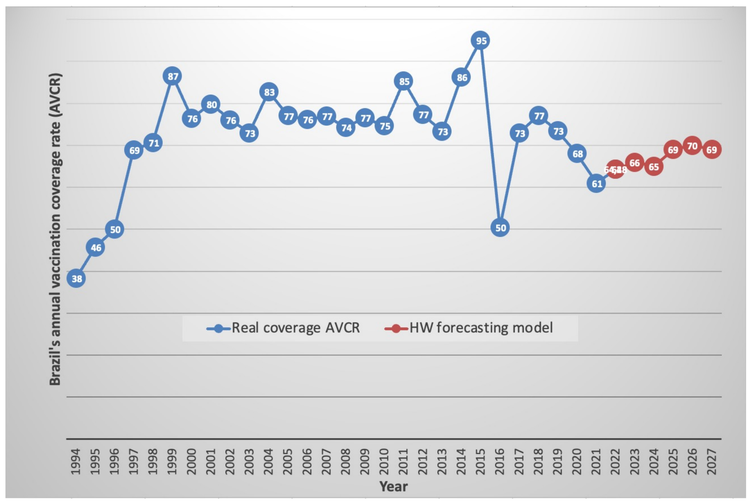


Figure 1 - AVCR and HW forecasting

RESULTS:

The AVCR showed a growing trend between 1994 (38%) and 1999 (86%). From 2000 to 2015, the average AVCR was 78.72%, with the best coverage in 2015 (95.07%). Between 2016 and 2022, the AVCR was 66.75%, with a tendency to reduce over time. Between 2020 and 2022, AVCR had its lower result (64.44%), which can be explained by the postponement of Polio vaccination due to the COVID-19 pandemic. The best adjustment of smoothing α, β and γ was achieved (0.67, 0, 0) by HW. The forecast showed positive results in the average AVCR, with a growth of 16.71% in the next five years and with an AVCR projection of just 75.89%, in the case of no public health action is endowed by the country. To reach the best AVCR achieved in 2015, it is necessary to expand it by 48.5%. Figure 2 presents the result of the demand forecast carried out by the HW model with a projection for the next five years if no public policy action is taken. In general, it can be said that the HW model is a sophisticated extension of the exponential smoothing methodology, as it generalizes this model to deal with trend and seasonality. For that, it considers α,γ,δ as the three smoothing parameters, and *p* denotes the number of observations per seasonal cycle.

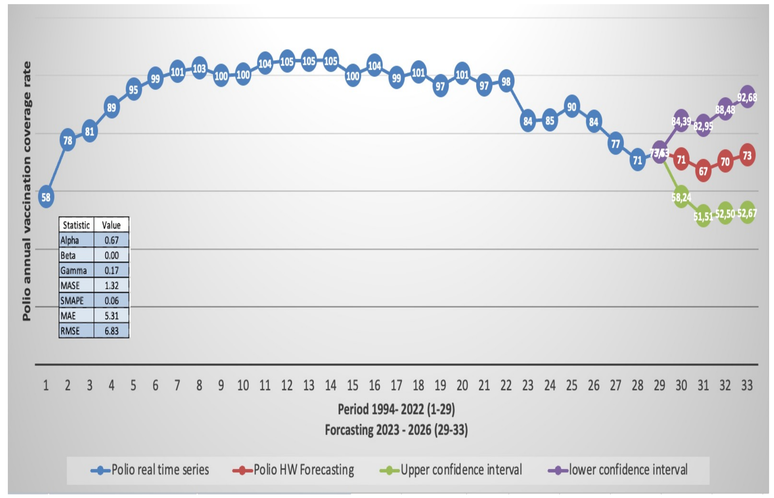


Figure 2: HW Forecasting model Applied to Polio AVCR

CONCLUSIONS:

Forecasts using HW are recommended for public health monitoring5, helping managers make decisions with limited resources. The results indicate that it is necessary to develop a strategic plan to expand AVCR to eradicate Polio from Brazil, mainly due to disease gravity and treatment unavailability. Demand forecasting is essential in of health and can generate benefits for organizations. In addition, this study reveals that a simple demand forecasting model achieved accurate results that can help policymakers in decision-making.

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