

Community SARS-CoV-2 Viral Load Dynamics and their use for Enhanced Public Health Surveillance

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Introduction

Asymptomatic COVID positive hotspots may be going undetected by public health surveillance systems. This study aimed to understand viral load dynamics of SARS-CoV-2 in the Dominican Republic using the Cycle threshold (Ct) value of RdRP gene amplification as a marker for the public health surveillance of undetected transmission pockets.

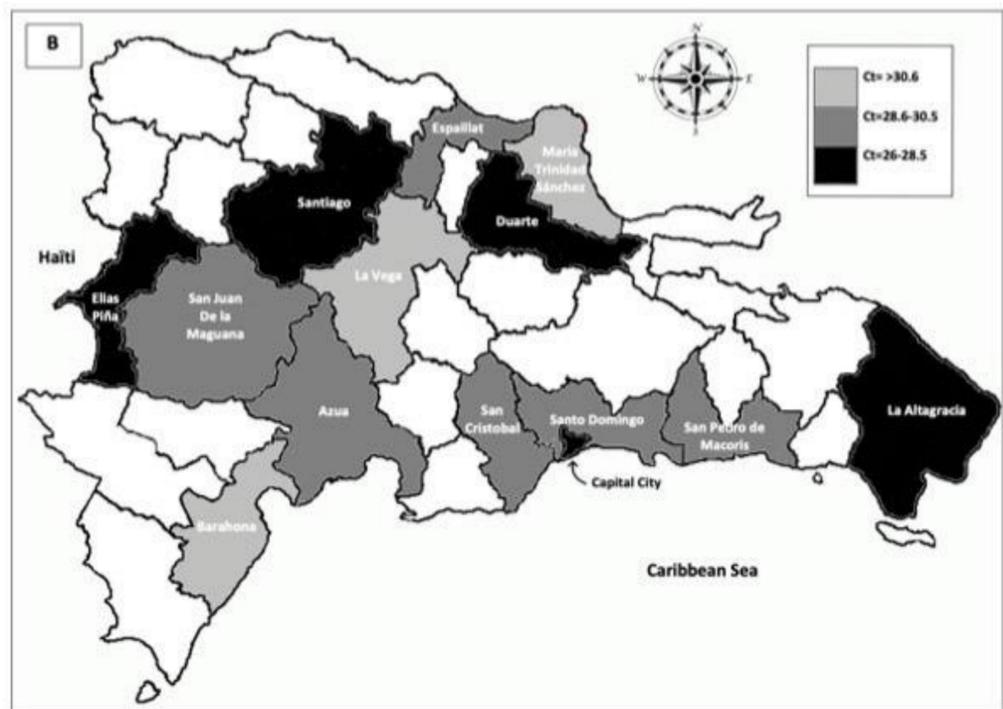
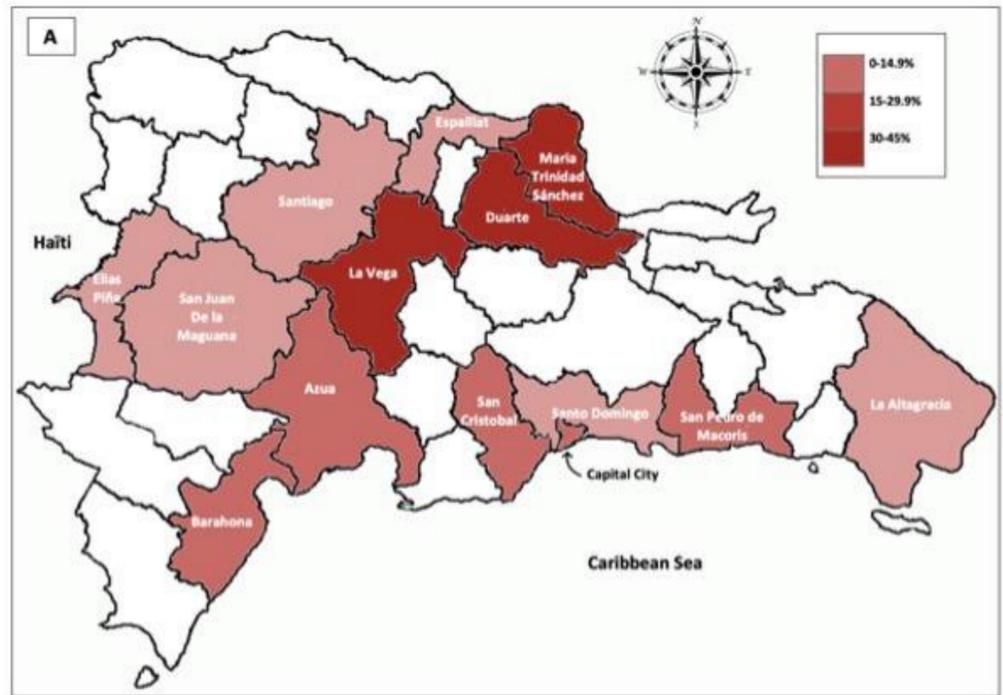
Methods

3,309 saliva samples were analyzed across 24 hospitals in the Dominican Republic and processed by automatic nucleic acid purification. Levels of viral RNA were determined by RT-qPCR. Results were considered "Detected" when Ct of the RdRP gene amplification was <37 and considered "Undetected" when the Ct was >37 or if no amplification curve was detected. Positivity rates were compared with RT-qPCR Ct values and were used as a proxy for viral load as it is inversely proportional to the sample's viral load.

Demographic Characteristics	Mean CT	n (%)
Age (yo)		
Mean Age: 39.8		
0-17	31.1	23 (5%)
18-34	29.7	174 (37.4%)
35-54	29.7	188 (40.4%)
55<	29.3	78 (16.8%)
Date of Symptom Onset		
Asymptomatic	29.0	85 (26.3%)
1-6 days	28.1	81 (25.1%)
7-13 days	29.2	119 (36.8%)
14 or more days	32.9	38 (11.8%)

Results

The samples yielded a positivity rate of 18.01%. Mean Ct was 29.3 ($r = -0.034$, $p=0.04$) and correlated significantly with community positivity rates. Mean age for positive samples was 39.8 years old (yo) [SD=15] with a distribution from 35-54 yo. There was no significant correlation identified between age groups [$F(19, 30)=0.65$, $p=0.5$] or between mean Ct by age groups and community positivity. No difference in viral load was found when comparing symptomatic and asymptomatic COVID-positive patients ($t(140)=0.52$, $p=0.6$). Mean Ct in the asymptomatic population was significantly and inversely correlated with the community positivity rate ($r=-0.43$, $R^2=0.181$, $p=0.0002$). Significant differences were found in Ct when comparing time elapsed from the date of onset of symptoms to the date of RT-qPCR test [$F(3, 319)=6.6$, $p=0.0002$].



Conclusions

Our findings indicate that viral loads are comparable between age groups and between symptomatic and asymptomatic presentations, thus widespread surveillance strategies should be implemented to detect younger and asymptomatic populations that could serve as community transmission pockets. The use of RT-qPCR Ct values to understand community viral load should be considered as a tool for public health surveillance especially in resource-limited countries such as the Dominican Republic.