Model-based evaluation of school- and non-school based public health measures on controlling the COVID-19 pandemic in the Netherlands

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Resumo:

Introduction: In autumn 2020, many countries, including the Netherlands, are experiencing a second wave of the COVID-19 pandemic. Health policymakers are struggling with choosing the right mix of measures to keep the COVID-19 case numbers under control, but still allow a minimum of social and economic activity. The priority to keep schools open is high, but the role of school-based contacts in the epidemiology of SARS-CoV-2 is incompletely understood. We used a transmission model to estimate the impact of school contacts on transmission of SARS-CoV-2 and to assess the effects of school-based measures, including school closure, at different time points during the pandemic.

Methods and Findings: The age-structured model was fitted to age-specific seroprevalence and hospital admission data from the Netherlands during spring 2020. Compared to adults older than 60 years, the estimated susceptibility was 23% for children aged 0 to 20 years and 61% for the age group of 20 to 60 years. The time points considered in the analyses were (i) August 2020 when the effective reproduction number (Re) was estimated to be 1.31 (95%CrI 1.15-2.07), schools just opened after the summer holidays and measures were reinforced with the aim to reduce Re to a value below 1, and (ii) November 2020 when measures had reduced Re to 1.00 (95%CrI 0.94-1.33). In this period schools remained open. Our model predicts that measures reducing contacts outside the school environment to the full lockdown levels of April 2020 could have reduced the effective reproduction number (Re) from 1.31 to 0.83 and prevented a second wave in autumn 2020, if they had been implemented in August 2020. Keeping schools closed after the summer holidays could have reduced Re by 10% only (from 1.31 to 1.18). In contrast, closing schools during the partial lockdown in November 2020 would be sufficient to achieve the control of the pandemic (Re = 0.84). Reductions in Re due to closing schools were 8% for 10 to 20 years old children, 5% for 5 to 10 years old children. Closing schools for 0

18 to 5 years old children has a negligible impact on controlling the pandemic. We used the Netherlands as a case example but our model code is freely available and can be readily adapted to other countries.

Conclusions:

Keeping schools closed after the summer holidays in 2020 would not have prevented the second wave of COVID-19 in the Netherlands. The impact of measures reducing school-based contacts,

including school closure, depends on the remaining opportunities to reduce non-school-based contacts. If opportunities to reduce Re with non-school-based measures are exhausted or undesired and Re is still close to 1, the additional benefit of school-based measures may be considerable, particularly among older school children.