# COVID Infections Analysis

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# Introduction

This report summarises the spread of COVID-19. It is based on all tests carried at the GGD in the period 1st June 2020 to 31st-Aug-2021[1]. The analysis considers educational staff and their risk of infection over the course of the pandemic. Educational staff are defined as people employed at a school at the beginning of the period of observation. Educational staff were disproportionally affected by the virus, with 15.5% of primary and secondary school teachers testing positive. Our analysis shows that parents tend to test positive *before* children do, which may point to a limited transmission at schools compared with work and other environments, or to a lower infectivity of children to parent as opposed to parent to children.

# Infections in Education

For the period for which data is available, **15.5%** of educational staff tested positive for COVID-19. In the same period, 9.5% of adults (excluding educational staff) living in the Netherlands tested positive. The difference could be explained by a larger spread of COVID amongst educational staff, and/or by the larger number of tests conducted. 5.1% of the 12,477,680 tests conducted by GGD's were carried out on educational staff, who represent 2.5% of the population. The positivity rate in educational staff was 8.0%, compared with 10.5% in adults

*Table 1 - Descriptive statistics of the infections*

| | *Educational Staff* | *Adult population (excl. Educational Staff* |
|---|---|---|
| *Population Size* | *332,274* | *13,146,930* |
| *Positive Tests* | *51,578* | *1,244,046* |
| *Number of Tests* | *641,351* | *11,836,329* |
| *Percentage Positive* | *15.5%* | *9.5%* |
| *Positivity Rate* | *8.0%* | *10.5%* |

The trend by week is similar for educational staff and the wider adult population. Educational staff were infected in four waves. While the percentage of educational staff infected was higher than the percentage of the wider adult population (Figure 1A), more tests were conducted on educational staff and the positivity rate was lower (Figure 1B). Educational staff were specially affected in the second wave, where the test positivity rate exceeded the test positivity rate of other adults (Figure 1B).

[1] For questions, please contact the authors via [redacted]@uu.nl or [redacted]@odissei-data.nl

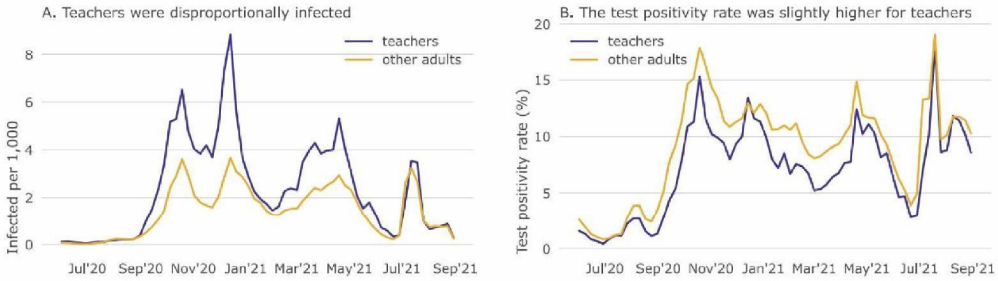



*Figure 1 - Infection rate and Positivity Rate from July 2020 to August 2021*

The percentage of infected educational staff was largest in WPO (16.6%) and WVO (15.6%), and lower in AOC, WEB and 'other' (13.7, 12.7 and 12.2% respectively). The positivity rate was similar for different types of education (7.5%–8.7%). In the first two waves, infections were identical in WPO and WVO and lower in WEB. In the third wave however, the infections in primary education were higher, while the infection rates for secondary and vocational education were lower. In the same period, the positivity rate was similar for different types of education.

*Table 2 – Descriptive statistics of Infections amongst educational staff by school type*

| | POSITIVE TESTS | NUMBER TESTS | POP SIZE | PERC POSITIVE % | POSITIVITY RATE % |
|---|---|---|---|---|---|
| WPO | 28,326 | 372,273 | 170,788 | 16.6 | 7.6 |
| WVO | 15,660 | 178,439 | 100,481 | 15.6 | 8.8 |
| AOC | 763 | 9,300 | 5,539 | 13.8 | 8.2 |
| O | 916 | 12,195 | 7,200 | 12.7 | 7.5 |
| WEB | 5,913 | 69,144 | 48,266 | 12.3 | 8.6 |
| NOT SCHOOL | 1,244,046 | 11,836,329 | 13,146,930 | 9.5 | 10.5 |

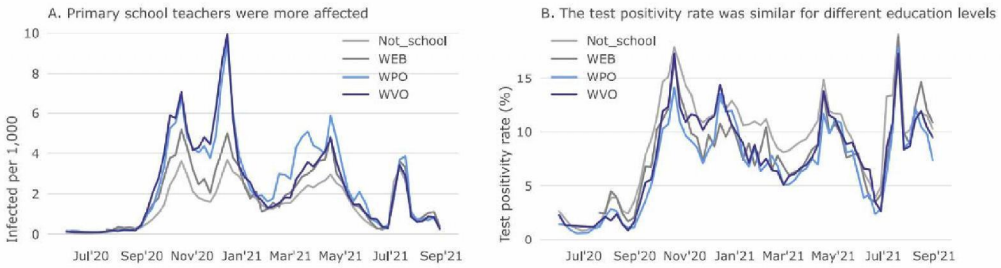



*Figure 2 - Infections and Positivity Rate amongst teachers between July 2020 and August 2021*

## Intergenerational Spread

**There is a strong temporal correlation between the infection of children and parents.** 43% of the parents of infected children under 18 test positive in the same fortnight as the children. Of those, 17.6% test positive 1-7 days before the children do, 11% test positive in the same day as the children, and 9% test positive after the children. This asymmetry (where parents tend to test positive *before* the children) may point to a higher transmission from parents to children or from a common source to both parents and children.

**The transmission from grandchildren to grandparents appears limited.** In the case of grandparents, 4.6% test positive in the same fortnight as the children. Of those, 2.3% test positive 1-7 days before the children do, 0.6% test positive in the same day, and 1.6% test positive 1-7 days after the children.

The following plots show the probability of co-infection within a period (in the plots below the period is set to 3 days, but other periods give similar results), compared with the reference group (e.g. for the network "501 – klasgenoot basis" the reference group will be all pairs of students in elementary education.

Next, for each person who tested positive, we looked at the share of neighbors who got tested (neighbors tested / total neighbors), and at the positivity rate (neighbors tested positive / neighbors tested). Since we are only interested in detecting correlations and given the high degree of interdependencies in the network, we calculate these measures for each person who tested positive using a 14 day period, spanning 7 days prior to the date of the positive test to 7 days prior after that date. (e.g., if I test positive today and my brother got tested 3 days ago, he would be counted in the measures).

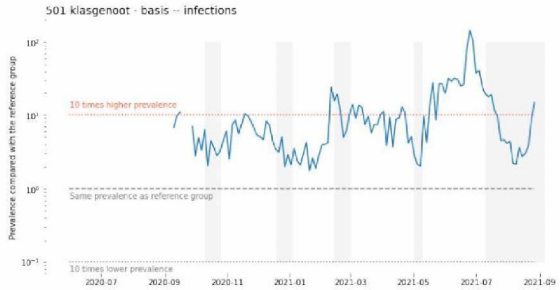
We find very high positivity rates (around 20-30%) for school and work neighbors, and a very high test-positivity rate (40-80%) for all family networks except for the aunt/uncle and cousins' networks.

Assuming people test if they have symptoms, the share of neighbors tested can be thought as a proxy for the extent to which the network captures close contacts between people. We find that the family networks exhibit the highest degree, with up to 50% of parents getting tested if their partner was infected. For school networks, only elementary education exceeds 10%.

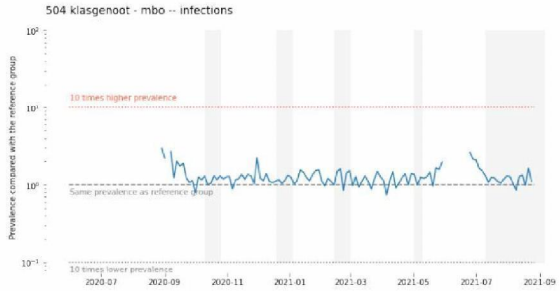
The subsequent figures also visualize another measure, the "pseudo-R" value (in the left axis), which is defined as the average number of neighbors co-infected per person in the network.

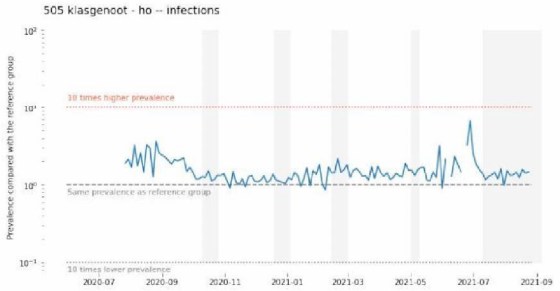
## Figures on probability of co-infection

*School Networks*

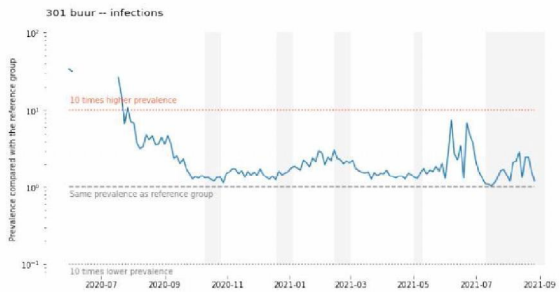


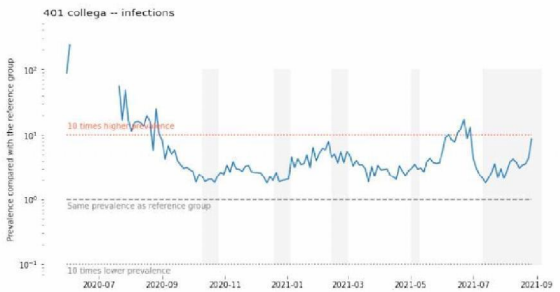




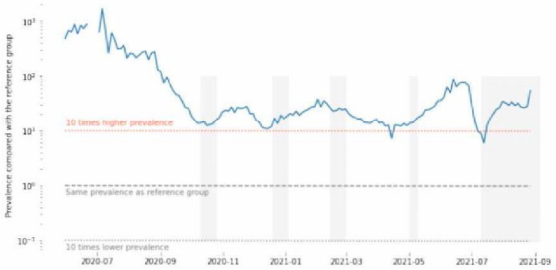

*Colleagues and neighbors*



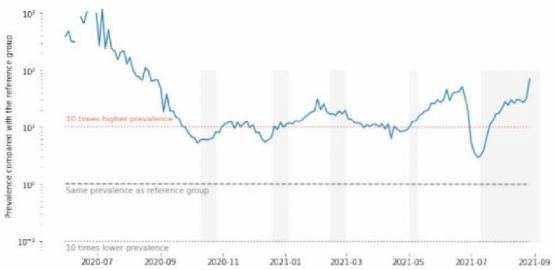



*Family Networks*

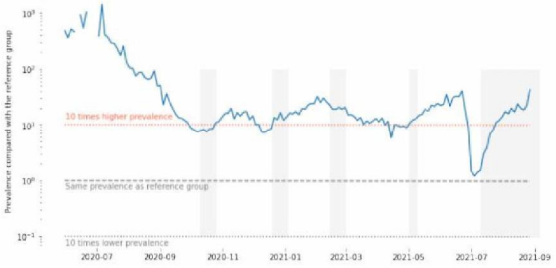
102 co-ouder -- infections



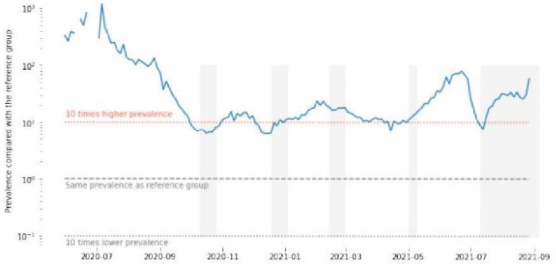

103 zus/broer - vol -- infections



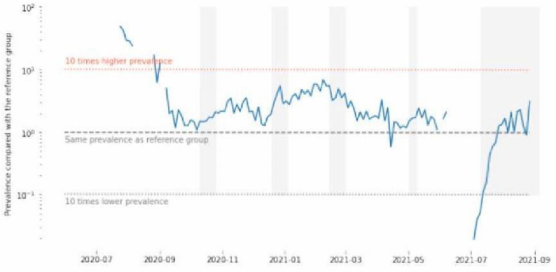

104 ouder -- infections



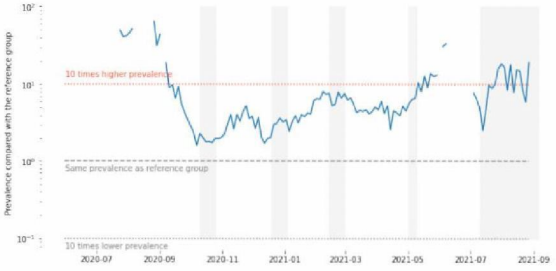

107 kind -- infections



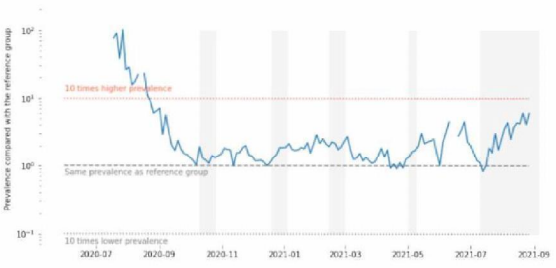

110 grootouder -- infections



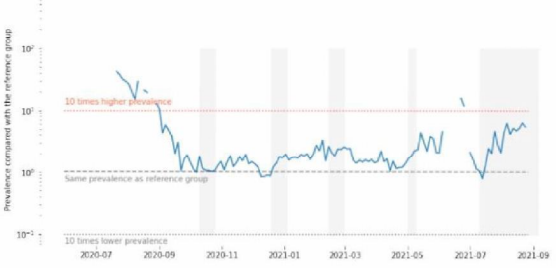

108 kleinkind -- infections

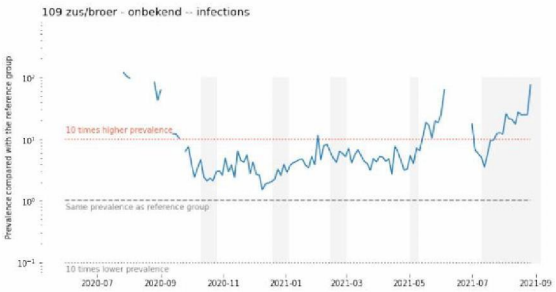


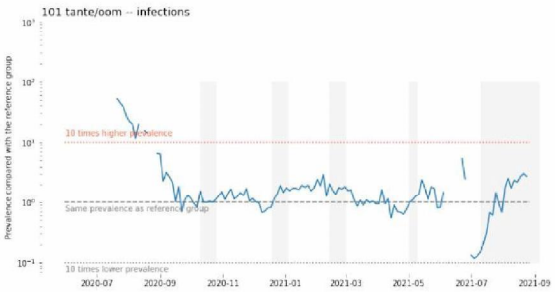

105 volle nicht/neef -- infections




106 nicht/neef -- infections




109 zus/broer - onbekend -- infections
Prevalence compared with the reference group
10 times higher prevalence
Same prevalence as reference group
10 times lower prevalence
2020-07
2020-09
2020-11
2021-01
2021-03
2021-05
2021-07
2021-09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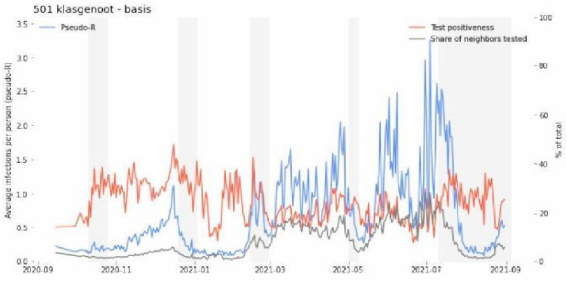
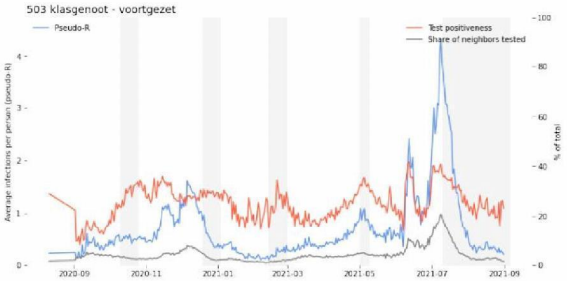
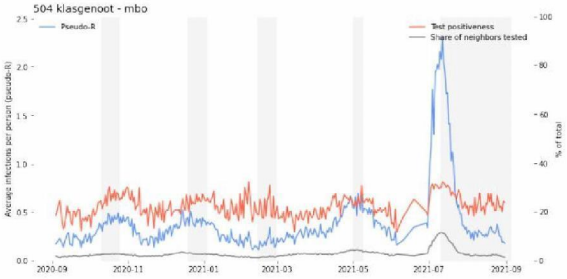
2021-09

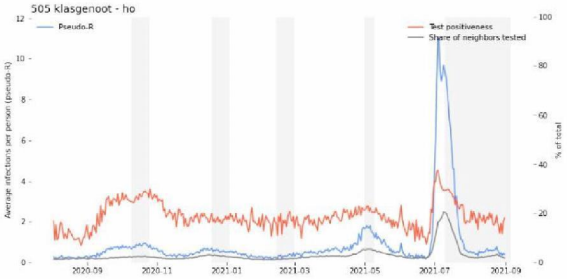
## Figures on probability of testing and test positivity of network neighbours of infected individuals

*School networks:*

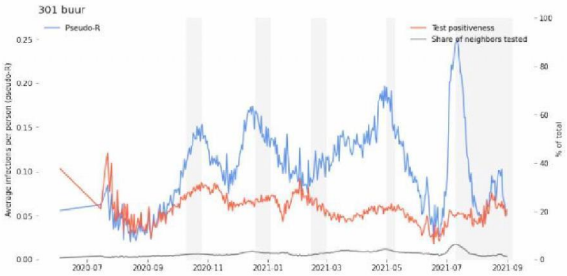


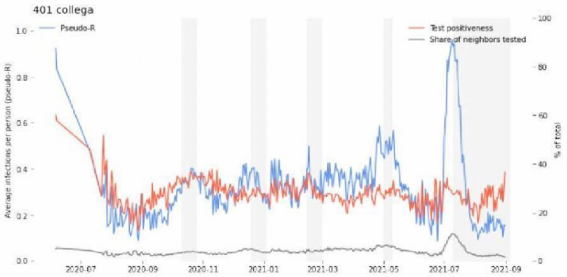




*Colleagues and neighbors:*



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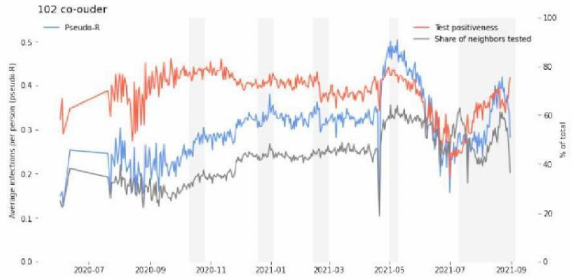
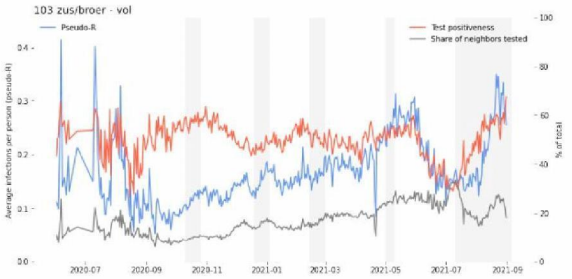
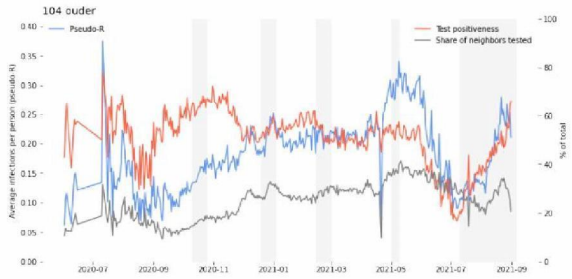
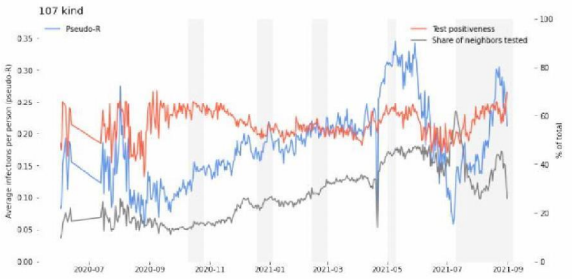
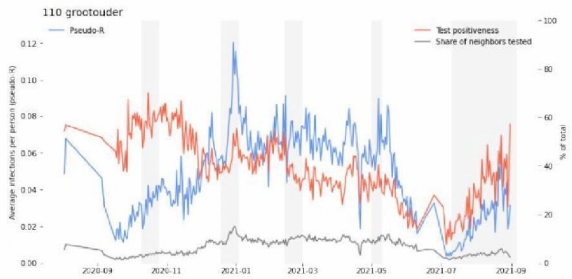
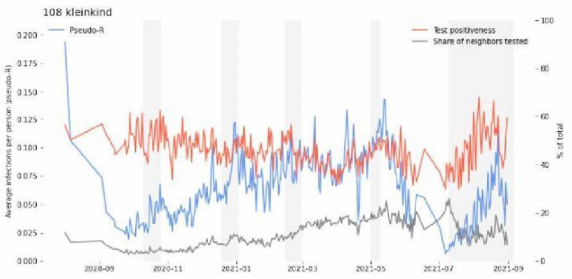


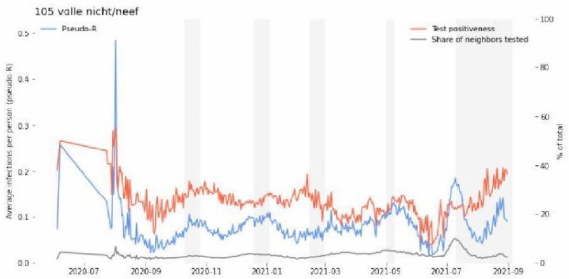



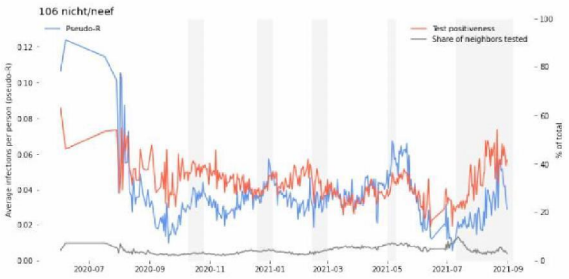




105 volle nicht/neef
Pseudo-R
Test positiveness
Share of neighbors tested
Average infections per person (pseudo R)
% of total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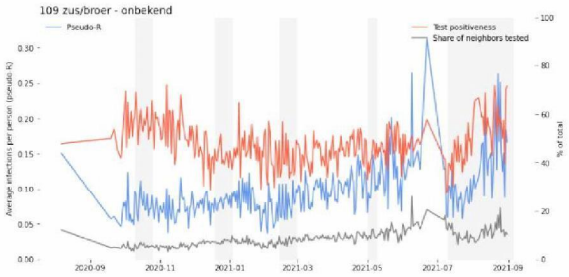
109 zus/broer - onbekend
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101 tante/oom
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