

## **Outbreak of COVID-19 in a nursing home associated with aerosol transmission as a result of inadequate ventilation**

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Dear editor,

With great interest we read the appeal to address airborne transmission of COVID-19 by Morawska and Milton in your journal [1]. Recently, we were involved in an outbreak in a Dutch nursing home that was likely to be the result of aerosol transmission in a setting of inadequate ventilation. This outbreak therefore illustrates the risks for which the authors are warning us.

In total, 17 (81%) residents from one of the seven wards in a nursing home with psychogeriatric residents were diagnosed with COVID-19 as confirmed by RT-PCR (Figure 1) [2]. Subsequently, 17 (50%) healthcare workers (HCWs) of the same ward were also tested positive. In contrast, all tests of the 106 HCWs or 95 residents in the 6 other wards were negative. In the week of this outbreak a low prevalence of COVID-19 was reported, only 493 (0.77%) positive cases were detected in the Netherlands, whereas the weekly rate was 8391 (21.5%) during the national peak in April 2020 [3].

To prevent and control COVID-19 infections all HCWs in this nursing home had been assigned to specific wards and did wear surgical masks during patient contacts since April 26, 2020 [4]. HCWs did not wear masks during not patient related activities and breaks. Residents were housed in individual rooms and spend part of the day in shared living rooms, some residents were mobile. Therefore, contact and thus direct transmission between residents cannot be excluded.

Because of the remarkable increase of COVID-19 infections in a very short time period despite the use of surgical masks, the ventilation system of the outbreak ward was investigated in addition to routine source and contact tracing. This ward was renovated, including the installation of a CO<sub>2</sub> controlled energy-efficient ventilation system. In this

system, the indoor air was only refreshed with outside air based on real time CO<sub>2</sub> concentration measurements. If the CO<sub>2</sub> concentration did not exceed 1000 ppm, the ventilation cabinets recirculated indoor air back into the ward without filtration. In this situation, low CO<sub>2</sub> production by inactive nursing home patients might have limited the ventilation with outside air. Moreover, this ward was additionally cooled by two air conditioning units, which recirculated air through a 1 mm mesh dust filter. In contrast, the other six wards were ventilated with outside air. SARS-CoV-2 RNA was detected in dust present on the mesh of the living room air conditioners and in four block filters from three of the eight ventilation cabinets (see Supplementary).

Our data suggest that this outbreak is caused by aerosol transmission of COVID-19 in a situation of inadequate ventilation for several reasons. First, the near simultaneous detection of COVID-19 infections of almost all residents HCWs within a ward in which care was provided with surgical masks. Second, the limitation of the outbreak to this particular ward with a deviating ventilation system that recirculated unfiltered inside air in combination with the detection of COVID-19 on the filters of this system. Finally, the outbreak in this nursing home emerged in a period of low background prevalence of COVID-19 infections in the community. We advise that prevention of COVID-19 transmission should take into account the possibility of aerosol transmission in healthcare facilities and other buildings where ventilation systems recirculate unfiltered inside air.

**Conflicts of interest**

None to declare





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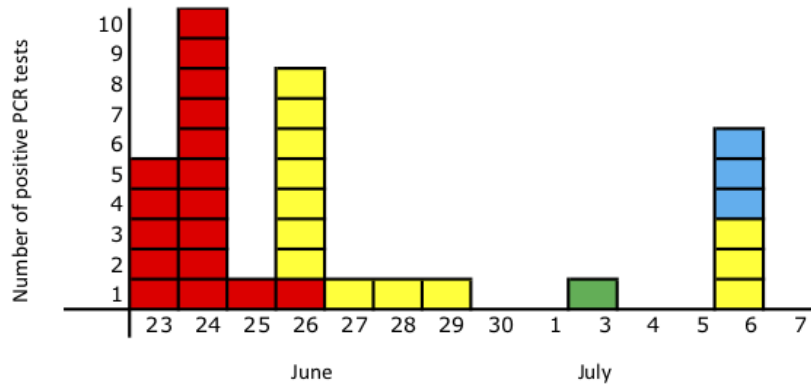
## Figure legends

Figure 1. Timeline of nursing home residents, healthcare workers and filters that were tested positive for SARS-CoV-2 RNA.

-  Nursing home residents (17 out of 21)
-  Healthcare workers (13 out of 34); of note, in addition 4 healthcare workers were tested positive in other laboratories and are not shown in this figure.
-  Dust filters from air conditioning units (1 out of 2); Ct value 43 (GeneXpert).
-  Ventilation cabinet dust filters (3 out of 8); Ct values range 37 -40 (GeneXpert).

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Figure 1



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