



Multiple non-patient related SARS

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MD PhD

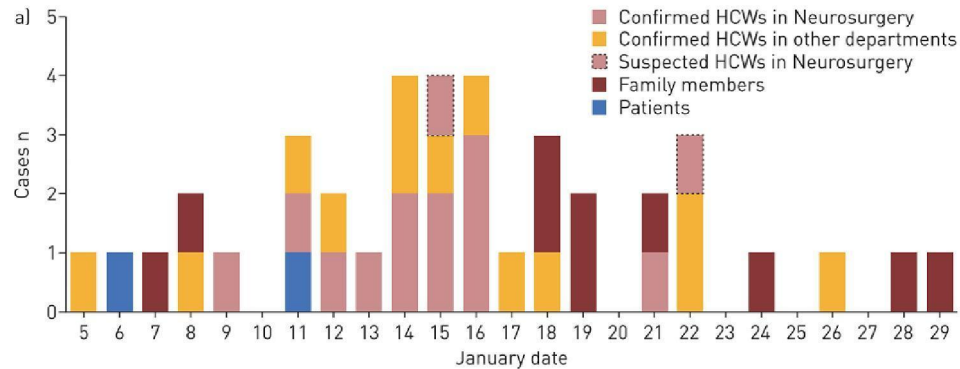
AIOS MMB AUMC / RIVM IDS

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Nosocomial infections are common for other coronaviruses

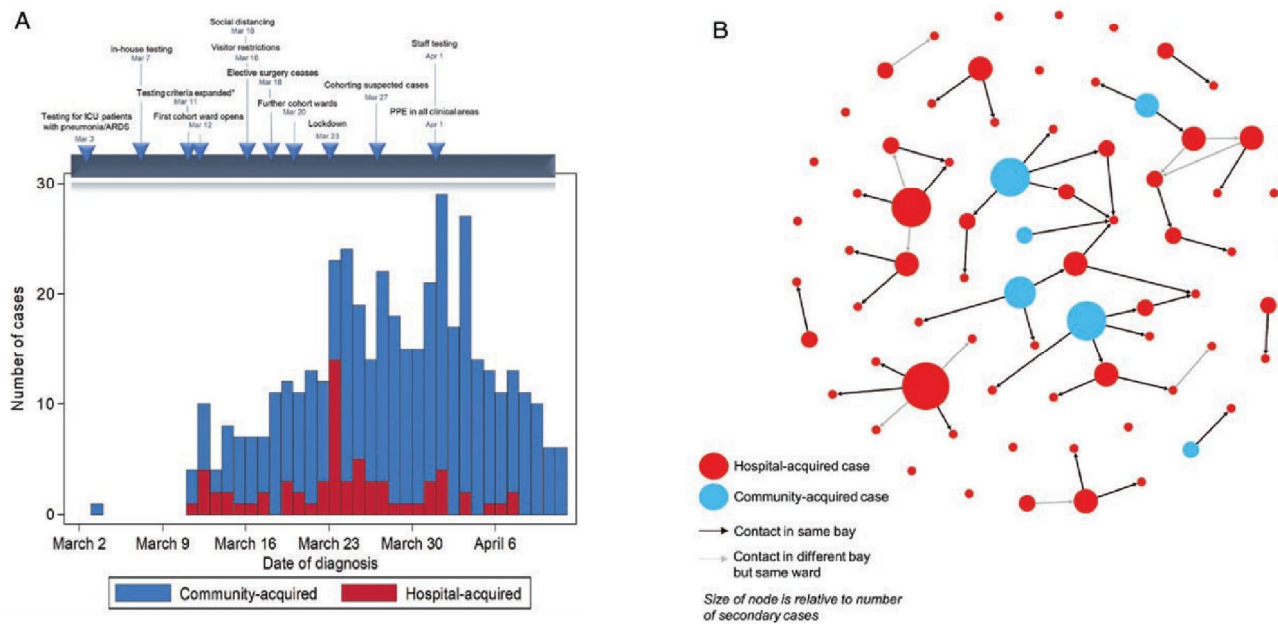
- In MERS-CoV nearly 50% of new cases was due to nosocomial spread.
- Also described in January 2020 in Wuhan, China for SARS-CoV-2 including spread to family members



Wang et al. Nosocomial outbreak of COVID-19 pneumonia in Wuhan, China Eur Respir J 2020; 55: 2000544



Nosocomial transmission in teaching hospital in England



Nearly 15% of cases were due to nosocomial transmission

Rickman et al. Nosocomial Transmission of Coronavirus Disease 2019: A Retrospective Study of 66 Hospital-acquired Cases in a London Teaching Hospital CID 2020;XX(XX):1-4



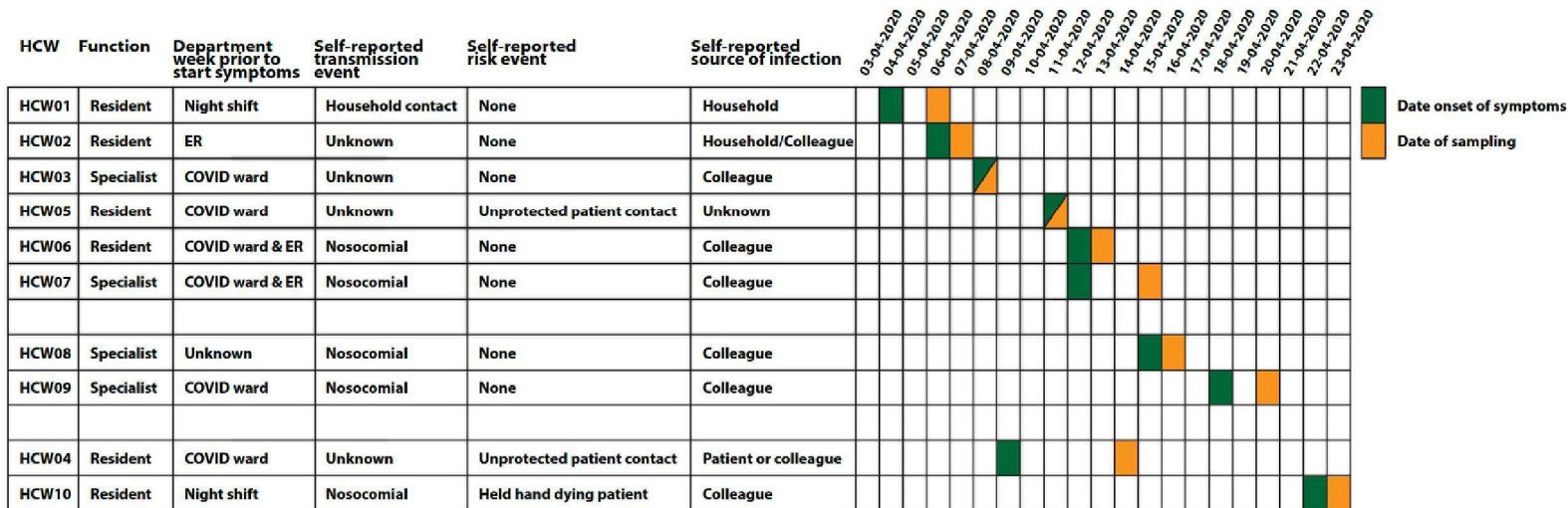
OLVG, located in Amsterdam

- During the first pandemic wave, OLVG was the regional SARS-CoV-2 treatment center.
- At the peak of the first wave: 5 COVID wards and 3 ICU units.
- During April 2020 several internal medicine residents and medical specialists fell ill. All had worked on ER/COVID wards. Testing showed: SARS-CoV-2 positive.
- In total 10 residents/doctors sick.



Epidemiological analysis

- Investigated by infection prevention department. Included review of work schedules, contact patients/colleagues and personal interviews with infected HCWs to identify potential (unknown) risks.

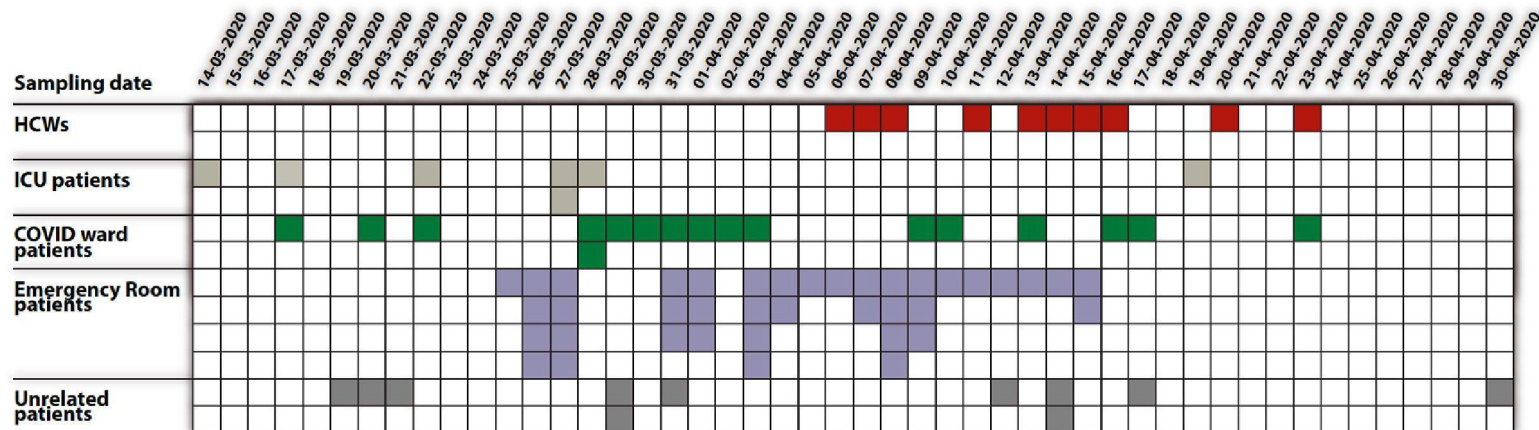




Timeline and selection of samples for sequencing

Subselection of samples based on:

- 1) CT-value <30,
- 2) sampling 2 weeks prior to onset of symptoms of HCW01 and >1 week post onset of symptoms HCW10
- 3) department of sampling





Phylogenetic analysis

From GISAID selected 2484 available Dutch SARS-CoV-2 sequences on October 17th.

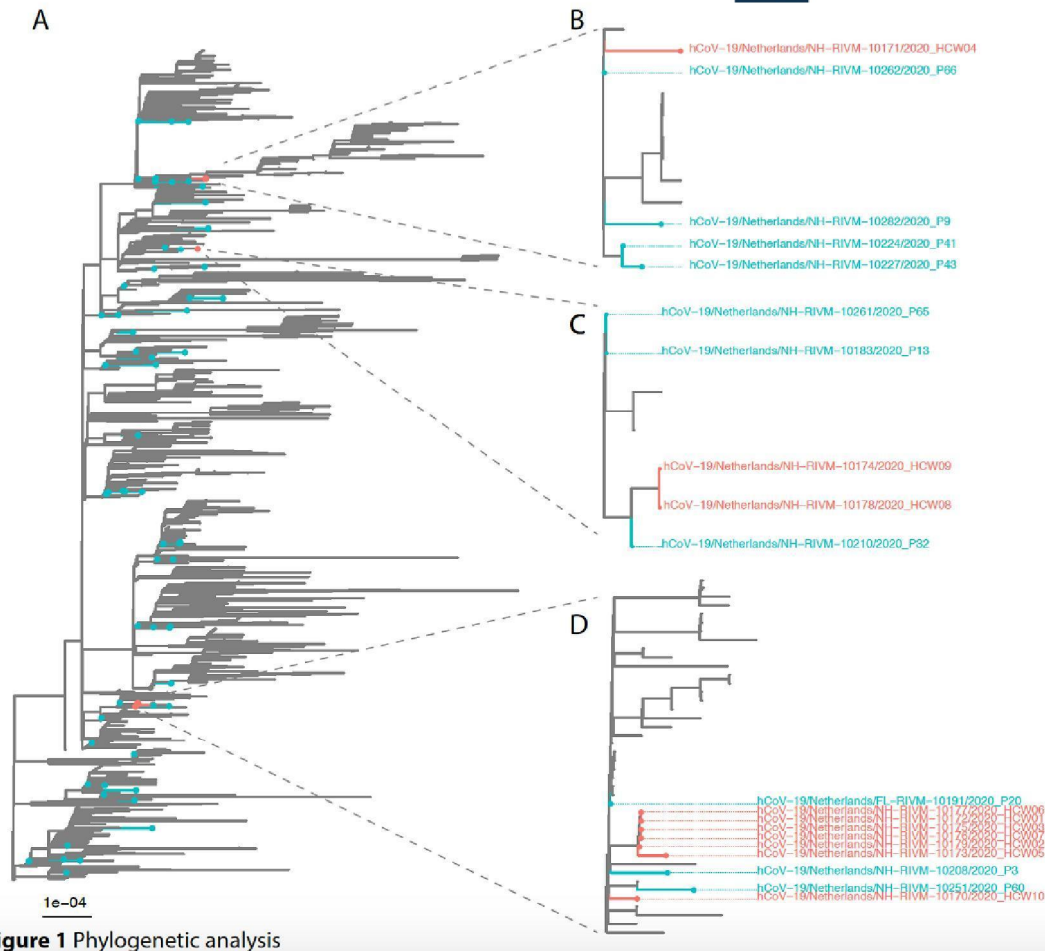
Genetic distance = measure of difference/divergence between 2 genetic sequences

For instance:

Seq1: ATCGT Genetic distance = $1/5 = 0,2$ nt/site

Seq2: GTCGT

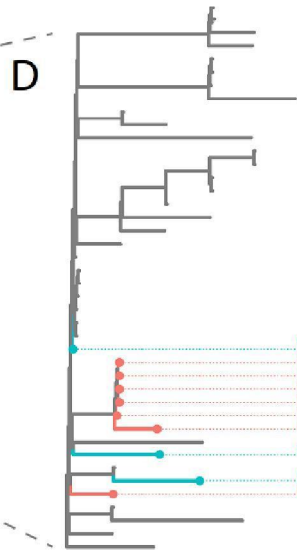
The average evolutionary rate for SARS-CoV-2 is 1 nucleotide change per 2 weeks → $GD=0,000034$ ($3,4 \times 10^{-5}$)



- Diverse set of sequences among patients and HCWs: good representation of total variation in the Netherlands
- 4 separate introductions within the hospital
- 2 clusters with forward transmission among HCW and 2 singleton infections
- No observed transmission from HCWs to patients



Cluster 1: 6 HCW



HCW	Function	Department week prior to start symptoms	Self-reported transmission event	Self-reported risk event	Self-reported source of infection	03-04-2020	04-04-2020	05-04-2020	06-04-2020	07-04-2020	08-04-2020	09-04-2020	10-04-2020	11-04-2020	12-04-2020	13-04-2020	14-04-2020	15-04-2020	16-04-2020	17-04-2020	18-04-2020	19-04-2020	20-04-2020	21-04-2020	22-04-2020	23-04-2020	Date onset of symptoms	Date of sampling
HCW01	Resident	Night shift	Household contact	None	Household																							
HCW02	Resident	ER	Unknown	None	Household/Colleague																							
HCW03	Specialist	COVID ward	Unknown	None	Colleague																							
HCW05	Resident	COVID ward	Unknown	Unprotected patient contact	Unknown																							
HCW06	Resident	COVID ward & ER	Nosocomial	None	Colleague																							
HCW07	Specialist	COVID ward & ER	Nosocomial	None	Colleague																							
HCW08	Specialist	Unknown	Nosocomial	None	Colleague																							
HCW09	Specialist	COVID ward	Nosocomial	None	Colleague																							
HCW04	Resident	COVID ward	Unknown	Unprotected patient contact	Patient or colleague																							
HCW10	Resident	Night shift	Nosocomial	Held hand dying patient	Colleague																							

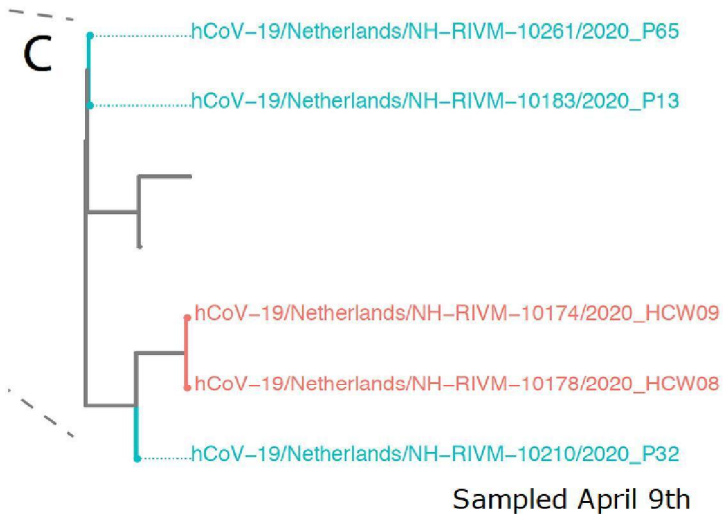
Unrelated → local hospital

Sampled COVID ward: 23rd of April (same day admittance)
 Sampled ER: 21st of May

All HCWs had close contact with one another during prolonged shift handover meetings without PPE or social distancing.



Cluster 2: 2 HCW



3 days between onset of symptoms of HCWs.

1 nucleotide difference between P32 and both HCW.

However, no direct contact between patient P32 and HCWs.

Possibly transmission via unsampled (asymptotically) infected HCW.

Again, both HCWs had contact during prolonged work shift meetings.

HCW	Function	Department week prior to start symptoms	Self-reported transmission event	Self-reported risk event	Self-reported source of infection	03-04-2020	04-04-2020	05-04-2020	06-04-2020	07-04-2020	08-04-2020	09-04-2020	10-04-2020	11-04-2020	12-04-2020	13-04-2020	14-04-2020	15-04-2020	16-04-2020	17-04-2020	18-04-2020	19-04-2020	20-04-2020	21-04-2020	22-04-2020	23-04-2020
HCW08	Specialist	Unknown	Nosocomial	None	Colleague																					
HCW09	Specialist	COVID ward	Nosocomial	None	Colleague																					



Conclusion

4 separate introductions in the HCWs, 2 resulting in forward nosocomial transmission clusters

- Large cluster (n=6) possibly initiated from household contact, no relation to any patient sample
- Small cluster (n=2) most likely initiated by a patient followed by HCW to HCW transmission possibly via an unsampled (asymptomatic) HCW

Transmission among HCWs most likely due to prolonged shift change handover meetings in confined spaces without PPE or social distancing

Changes were made in policy: advocated early and rapid testing of HCWs and promote strict adherence to social distancing measures within the hospital among HCWs.



Acknowledgements

OLVG

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RIVM IDS / Nationale kiemsurveillance

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- All submitting and originating laboratories providing data to GISAID

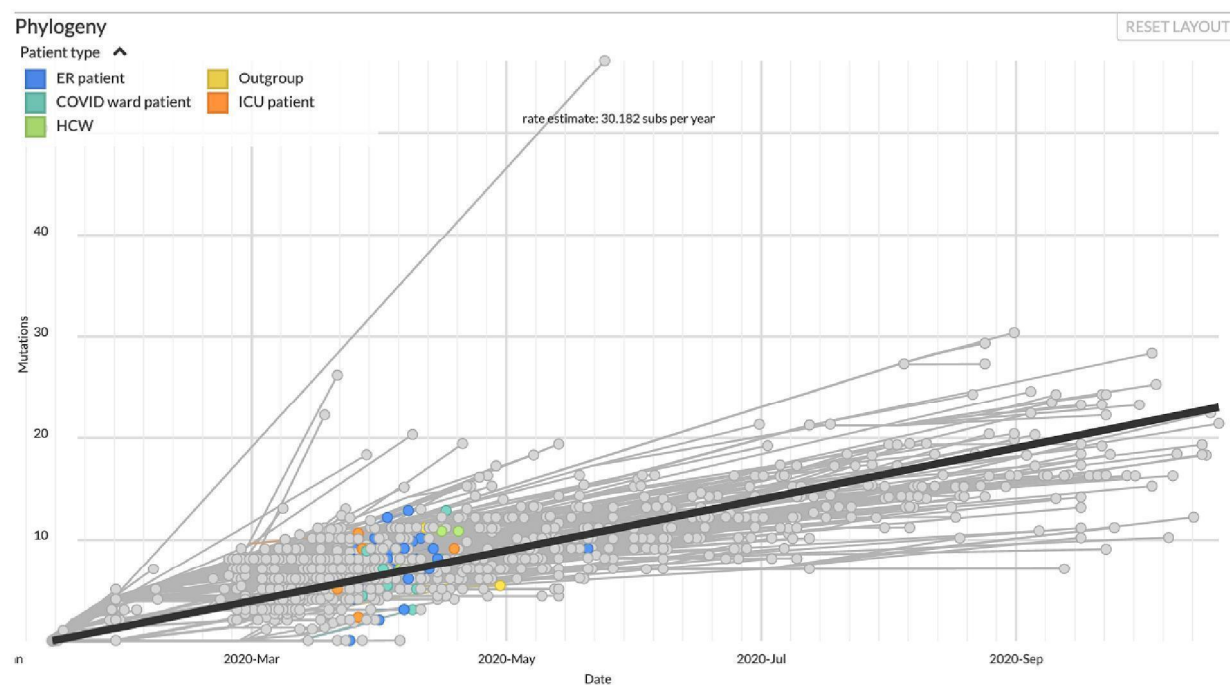


Questions?





Molecular clock time-based tree



Average 10 mutations compared to Wuhan-1 reference. All sequences match contemporary variants from the first pandemic wave.



Nosocomial transmission

WHO definition

"An infection acquired in hospital by a patient who was admitted for a reason other than that infection (1). An infection occurring in a patient in a hospital or other healthcare facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility (2)."

<https://www.who.int/csr/resources/publications/drugresist/en/whocdscsreph200212.pdf>