

### Clusters and Transmission chains

1. Links (i.e., potential **edges** for a cluster / transmission chain) between reported cases (**nodes**) are formed in four ways, in order of decreasing reliability between how (directly or indirectly) two nodes are connected with each other:
  - a. When an index was reported for a case (*NCOVOsirisnr1*)
  - b. When a report number is listed in another variable of the report, for example, as a related case (*NCOVOsirisnrGerel*, *MELGGDEExtern*, *NCOVopsporingAnd*, *NCOVsettingClusOms*, *NCOVsettingcontoms1*, *NCOVinzAnders*, *NCOVClusterKenm*)
  - c. When reports indicate that the most likely location of transmission was a particular situation (*NCOVClusterKenm*)
  - d. When residents of the same nursing home are test positive during the same infected period of the nursing home. Nursing homes remain infected from the moment a resident first tests positive and is reported to the RIVM up to and including 28 days following the **symptom onset day of the last person to test positive [PM]**. Thereafter, a nursing home can enter a new infected period. For all reports of nursing home residents linked to an infected nursing home in this way, the setting *nursing home* is automatically included in the individual reports.
2. Edges (1b, c, d) are sorted such that directionality is based on the symptom onset day of the nodes (DUFS), and duplicates are removed. In the case that an edge is a duplicate, the more reliable edges are kept and the less reliable edges are discarded, with 1a being the most reliable edges and 1d being the least reliable edges.
3. Edges 1a and 1b are discarded if the symptom onset (DUFS) between the two nodes is >14 days or < -4 (based on the serial interval in Figure 1 and 95% catchment of these edges). Stronger criteria are possible. This removes around 1200 of the 45000 nodes (2.6%).
4. Settings of edges are defined as the potential setting of transmission between two nodes. All settings are assigned to a given edge that are reported for the node with the later symptom onset, allowing a potential index to be incorporated into a cluster with a setting different from his own settings.
5. The following (combined) settings are currently used:
  - a. Home (including partner with whom the case does not live)
  - b. Other family
  - c. Friend or acquaintance
  - d. Work
  - e. School (including child care)
  - f. Activities done in the case's free time, including sport
  - g. Church
  - h. Choir
  - i. Student activity
  - j. Party
  - k. Hospitality sector
  - l. Travel (national and international, including flights)
  - m. Family doctor
  - n. Hospital
  - o. Other health care
  - p. Nursing home (24-hour care)
  - q. Care home for persons with disabilities (24-hour care)
  - r. Day care for older persons and persons with disabilities
  - s. Hospice

t. Funeral

NB: Other, unknown, or unreported settings are not assigned to edges.

6. Transmission chains are formed using all edges, irrespective of the settings of the individual edges; clusters are formed by using only edges for a specified setting. Both require a minimum of 3 nodes.
7. Potential index cases of a cluster are defined as cases that are the likely source of infection for a given cluster. A potential index case is identified as a node that does not have the setting of the cluster and whose symptoms started within two days of the first symptom onset day in the cluster: a very probable index case was a node with symptom onset on the same day; probable was one day later; possible was two days later. These assumptions are based on the serial interval of edges 1a (when an index was reported for a case). The symptom onset for the vast majority of secondary cases occurs on the same day or after the index case (90%). Roughly 4% occur on the day prior to that of the index, and roughly 2% two days prior to that of the index (Figure 1). This can generate some interesting statistics, and example of which is presented in Table 3. Let's talk about what else we can report.

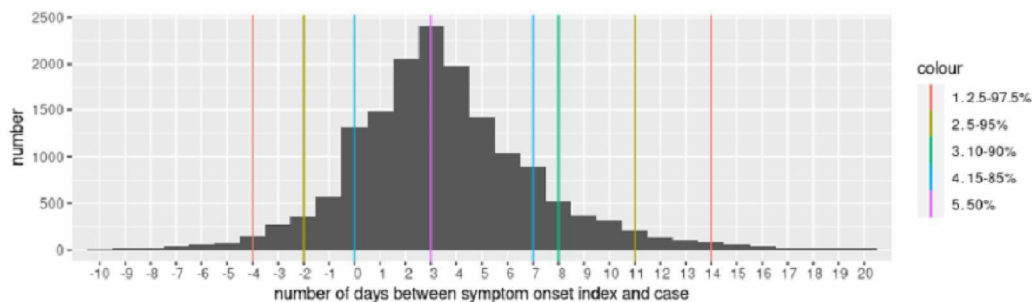


Figure 1: Serial interval calculated using reports where an index was reported for a case (edges 1a; 13-10-2020).

Tabel 1: Summary of the clusters using the old and new methods (13-10-2020). Note: in the new method some of the setting categories have been combined as indicated using different coloured shading.

	Oude methode		Nieuwe methode	
	vanaf 1 juni	actief *	vanaf 1 juni	actief *
Aantal clusters	5368	1161	4662	654
Aantal (op)nieuw actief clusters	-	80	-	35
Aantal clusters die niet meer actief zijn	-	154	-	447
Gemiddelde grootte	5.1	6.1	4.4	5
Mediaan	4	4	3	3
Range	3-448	3-448	3-371	3-80
Aantal personen totaal in een cluster	27392	7083	20301	3292
% personen in een cluster	19.2%	-	14.3%	-
Aantal personen in een cluster met reisgeschiedenis **	1877	108	1836	40
% van personen in cluster met reisgeschiedenis **	7.2%	1.6%	9.5%	1.2%
Personen via BCO opgespoord **	6819	1139	5435	484
% van personen via BCO **	26.3%	17.3%	28%	14.7%
Aantal clusters per setting:				
1e lijn gezondheidszorg / huisarts	13	2	7	0
2e lijn gezondheidszorg / ziekenhuis	33	11	36	11
Overige gezondheidszorg	26	8	22	9
Feest / verjaardag / borrel	76	10	97	5
Horeca	185	27	144	11
Kennissen en vrienden	378	41	264	15
Koor	5	2	3	0
Medereiziger / reis / vakantie	196	10	130	0
Thuisituatie (huisgenoten)	2146	422	2402	307
Partner, niet samenwonend	6	2		
Overige familie	247	32	598	50
Verpleeghuis	241	134	233	124
Woonzorgcentrum voor ouderen	32	10		
Dagopvang voor ouderen	3	1	10	2
Dagopvang voor verstandelijk beperkten	5	1		
Overige dagopvang	2	1		
Woonvoorziening voor verstandelijk beperkten	34	18	51	19
Overige woonvoorziening	9	2		
Religieuze bijeenkomsten	13	1	12	0
School en kinderopvang	203	82	116	32
Studentenvereniging/-activiteiten	28	4	38	1
Hospice	1	0	0	0
Uitvaart	10	3	5	1
Vrijtijdsbesteding, zoals sportclub	243	69	154	16
Werksituatie	753	170	340	51
Onbekend / Niet vermeld	343	79	nvt	nvt
Overig	137	19	nvt	nvt

Tabel 2: Summary of the average size of the clusters by setting using the old and new method (13-10-2020).

setting	Oude methode				Nieuwe methode			
	aantal clusters	gemiddeld cluster grootte (min - max)	aantal actieve clusters	gemiddeld actieve cluster grootte (min - max)	aantal clusters	gemiddeld cluster grootte (min - max)	aantal actieve clusters	gemiddeld actieve cluster grootte (min - max)
1e lijn gezondheidszorg / huisarts	13	6.8 (4-21)	2	6.5 (6-7)	7	4.4 (3-9)	0	-
2e lijn gezondheidszorg / ziekenhuis	33	5.5 (3-17)	11	6.4 (3-15)	36	3.9 (3-8)	11	4.5 (3-8)
Overige gezondheidszorg	26	5.3 (3-35)	8	7.8 (3-35)	22	4.4 (3-12)	9	4.3 (3-12)
Feest / verjaardag / borrel	76	6.6 (3-23)	10	4.8 (3-8)	97	4.2 (3-13)	5	3.4 (3-4)
Horeca	185	10.4 (3-448)	27	27.7 (3-448)	144	6.1 (3-73)	11	5.7 (3-22)
Kennissen en vrienden	378	5.1 (3-34)	41	5.1 (3-11)	264	3.8 (3-14)	15	3.9 (3-14)
Koor	5	7.8 (3-20)	2	6.0 (3-9)	3	5.0 (3-9)	0	-
Medereiziger / reis / vakantie	196	7.4 (3-308)	10	6.3 (3-26)	130	5.0 (3-78)	0	-
Thuisituatie (huisgenoten)	2146	3.7 (3-19)	422	3.7 (3-11)	2402	3.9 (3-67)	307	3.6 (3-26)
Partner, niet samenwonend	6	5.0 (3-10)	2	3.5 (3-4)				
Overige familie	247	4.0 (3-17)	32	3.6 (3-6)	598	3.9 (3-16)	50	3.5 (3-9)
Verpleeghuis	241	10.3 (3-133)	134	11.8 (3-133)	233	9.0 (3-80)	124	9.8 (3-80)
Woonzorgcentrum voor ouderen	32	7.7 (3-44)	10	9.1 (3-32)				
Dagopvang voor ouderen	3	12.7 (5-26)	1	7.0 (7-7)	10	4.3 (3-13)	2	3.0 (3-3)
Dagopvang voor verstandelijk beperkten	5	5.2 (3-8)	1	5.0 (5-5)				
Overige dagopvang	2	5.0 (3-7)	1	7.0 (7-7)				
Woonvoorziening voor verstandelijk beperkten	34	5.9 (3-16)	18	7.2 (3-16)	51	4.6 (3-15)	19	5.7 (3-12)
Overige woonvoorziening	9	4.1 (3-5)	2	4.5 (4-5)				
Religieuze bijeenkomsten	13	9.2 (3-28)	1	6.0 (6-6)	12	3.8 (3-8)	0	-
School en kinderopvang	203	5.8 (3-33)	82	6.0 (3-33)	116	4.4 (3-19)	32	5.3 (3-19)
Studentenvereniging/-activiteiten	28	15.0 (3-101)	4	27.0 (3-70)	38	7.9 (3-80)	1	4.0 (4-4)
Hospice	1	6.0 (6-6)	0	-				
Uitvaart	10	6.3 (3-10)	3	4.3 (3-6)	5	4.2 (3-9)	1	3.0 (3-3)
Vrijtijdsbesteding, zoals sportclub	243	6.3 (3-39)	69	6.3 (3-39)	154	4.6 (3-27)	16	4.3 (3-12)
Werk situatie	753	5.2 (3-45)	170	5.4 (3-31)	340	4.2 (3-24)	51	4.2 (3-10)
Onbekend	17	3.4 (3-7)	3	3.0 (3-3)	nvt	nvt	nvt	nvt
Setting niet vermeld	326	3.2 (3-6)	76	3.2 (3-5)	nvt	nvt	nvt	nvt
Overig	137	5.3 (3-39)	19	6.9 (3-19)	nvt	nvt	nvt	nvt

Table 3: The number of nodes per setting that are a potential sources of clusters, by cluster setting (13-10-2020). The table is to be interpreted as follows: 17 nodes with setting "vrijetijd" were potential sources for school clusters and 119 nodes with setting work were potential sources for household clusters.

cluster setting	number of clusters	Settings of potential sources (very probable)																			NA	all without NA		
		Daarvang_c	Familie	Feest	Horeca	Hospice	Huisarts	Kennis	Kerk	Koor	OverigZorg	Reis_c	School	Student	Thuis_c	Uitvaart	Verpleeghuis_c	Vrijetijd	Werk	Woon_GH7_c			Ziekenhuis	
Dagopvang_c	10	0	1	0	0	0	0	0	0	0	0	0	0	5	0	2	0	3	0	0	6	11	1:	
Familie	664	1	0	6	16	0	1	18	0	0	1	9	4	1	184	0	12	4	38	0	2	363	297	6:
Feest	97	0	9	0	13	0	0	17	0	0	0	7	2	1	17	1	0	2	3	0	0	47	72	1:
Horeca	144	0	11	4	0	0	0	11	0	0	0	6	0	4	25	0	1	1	12	0	0	89	75	1:
Huisarts	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	1	0	0	4	4	8	4:
Kennis	266	0	13	7	27	0	0	0	1	0	0	23	2	4	49	1	1	7	11	0	0	159	146	3:
Kerk	14	0	0	0	0	0	0	3	0	0	0	0	2	0	5	0	0	0	2	0	1	5	13	1:
Koor	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3:
OverigZorg	144	0	3	0	1	0	1	1	1	0	0	0	0	0	14	1	94	0	2	1	0	7	119	1:
Reis_c	131	0	0	3	4	0	0	10	0	1	0	0	0	2	15	0	0	0	1	0	0	76	36	1:
School	117	0	3	0	4	0	0	2	0	0	0	2	0	0	21	0	0	17	8	1	1	65	59	1:
Student	38	0	0	0	2	0	0	2	0	0	0	6	1	0	7	0	0	2	0	0	0	22	20	4:
Thuis_c	2612	3	150	21	38	1	3	65	3	0	18	32	30	14	0	2	113	39	119	5	8	1556	664	2:
Uitvaart	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	5	2	7:
Verpleeghuis_c	876	0	6	1	0	0	3	0	0	0	5	1	1	1	18	0	0	0	8	2	2	38	48	8:
Vrijetijd	157	0	6	0	14	0	0	6	0	0	1	3	16	1	31	0	0	0	7	0	0	94	85	1:
Werk	356	2	15	6	10	0	1	4	0	0	6	1	9	3	60	1	25	6	0	3	6	184	158	3:

Woon_GHZ_c	62	2	2	2	1	0	0	0	0	0	2	0	0	1	5	0	13	1	6	0	0	33	35
Ziekenhuis	39	0	1	0	0	0	0	1	0	0	0	0	0	5	0	3	1	5	0	0	0	17	16
	5743	8	<b>220</b>	50	<b>130</b>	1	9	<b>140</b>	5	1	33	90	67	32	<b>462</b>	6	<b>267</b>	80	<b>227</b>	12	20	2773	

68

38



Figure 2: Print screen of a transmission chain containing many different clusters. Edges within clusters are represented using a thick line, edges within a transmission chain are represented using a thin line. The source of evidence used for the edge is indicated by the colour of the edge. Edges spanning longer than 10 days are indicated using the number of days in red font. (Not visible in this screen shot.) The colour of the nodes indicate to which cluster setting individuals belong. The size of the nodes indicates whether a person was one of the first (first two days: 0,1,2) in the cluster or transmission chain to become symptomatic. Hovering over a node provides additional information on the node. Clicking on the node allows one to see the edges of which the node is a member. Selection by cluster occurs in the top left of the screen. Selection can also be done by node setting, but we can only have one drop down menu. Demo to come on Thursday.

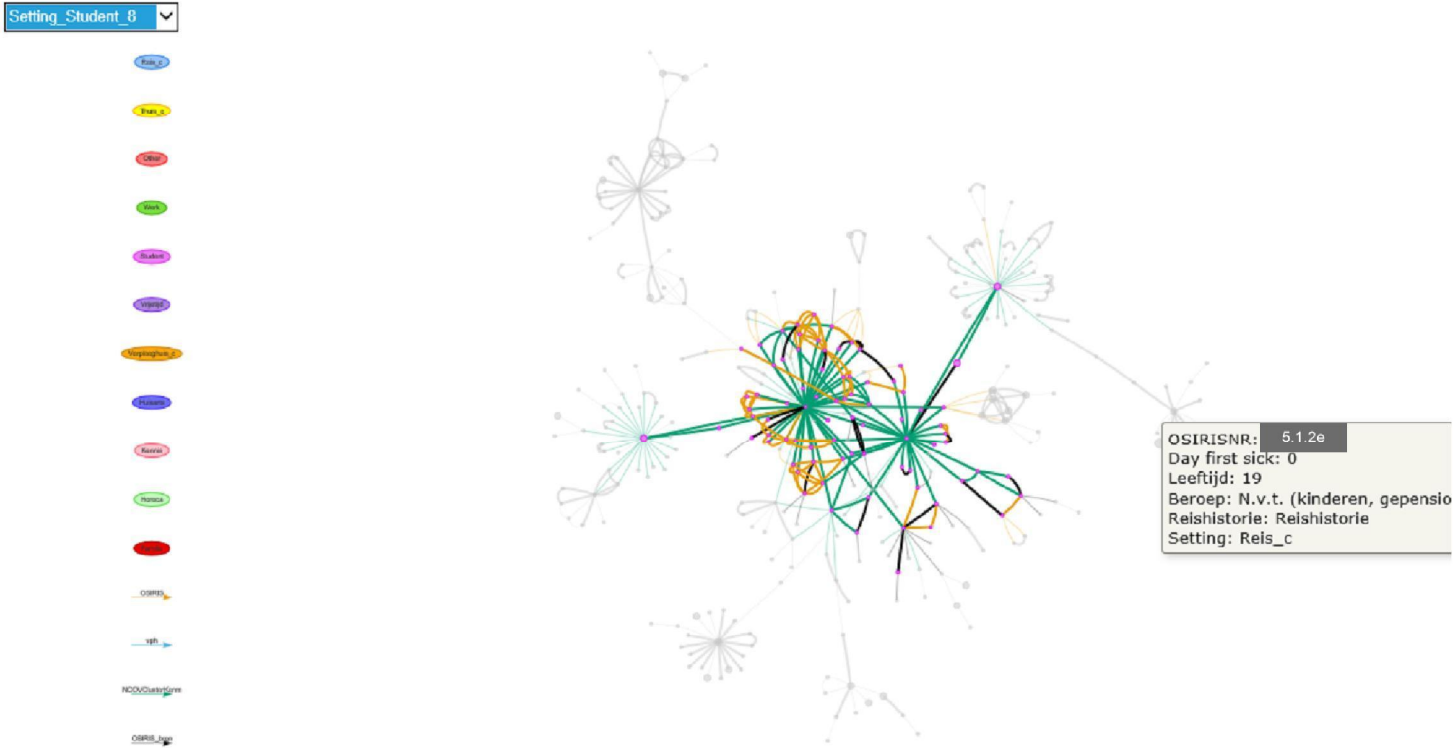


Figure 3: Another transmission chain. See details of nodes and edges in Figure 2. Here, one cluster (a student cluster) has been selected. The mouse is hovering over a node that is not part of the student cluster, but that is a potential source of the transmission chain (the symptom onset day is day 0 for the timeline of the transmission chain).

Open questions:

For the situation names that have been extracted, should we assign settings, where the situation name is sufficiently specific? We do this for nursing home clusters, and assign to all persons in a nursing home cluster the setting "nursing home". Implication is that we should update the number of reports for which a related case is reported and then one of these individuals incorrectly has the wrong added to their list of settings setting... 5.1.2e you mean to overwrite the setting with situation, if different? This would imply a lot of manual work I assume?

Which cutoff should we use? Currently -4 to 14.

5.1.2e I would propose to at least explore using the P10 and P90 interval so -2 to 11 days, to be more specific.