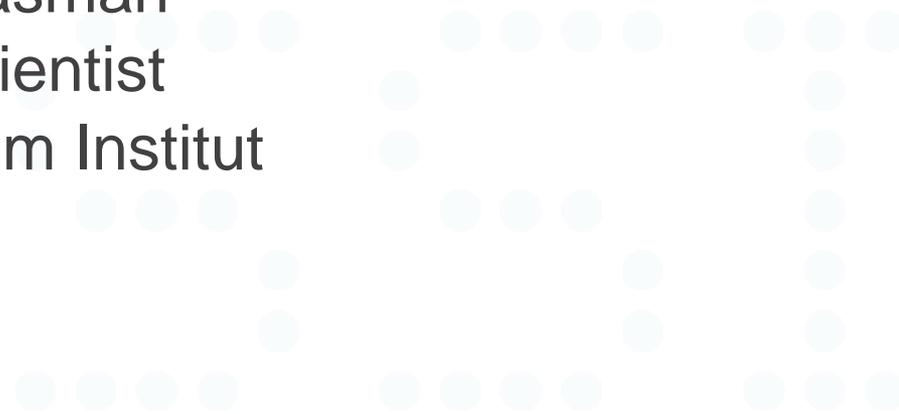




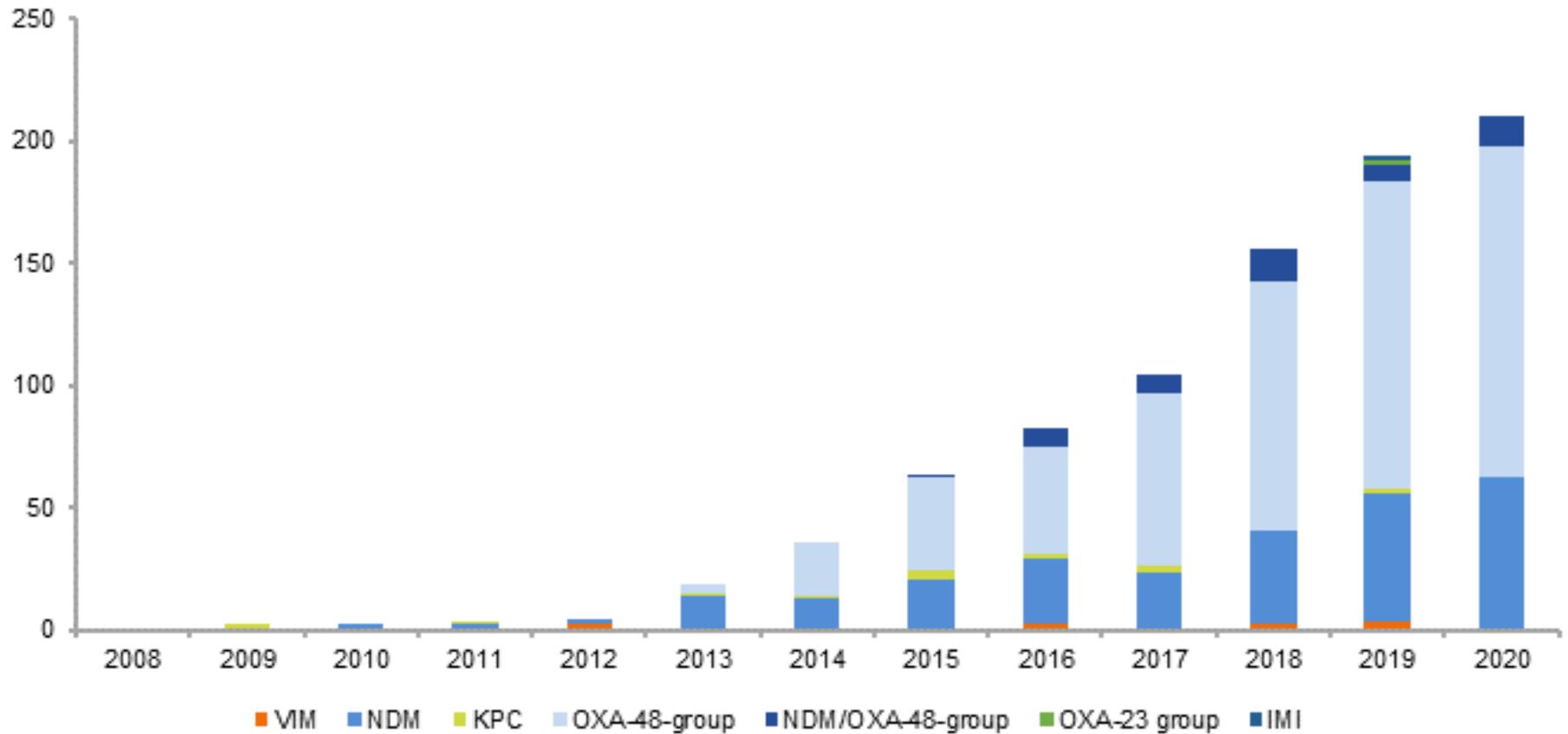
CPE

MOLECULAR EPIDEMIOLOGY AND WGS INVESTIGATIONS OF HOSPITAL OUTBREAKS IN DENMARK

Henrik Hasman
Senior scientist
Statens Serum Institut



CPO IN DENMARK



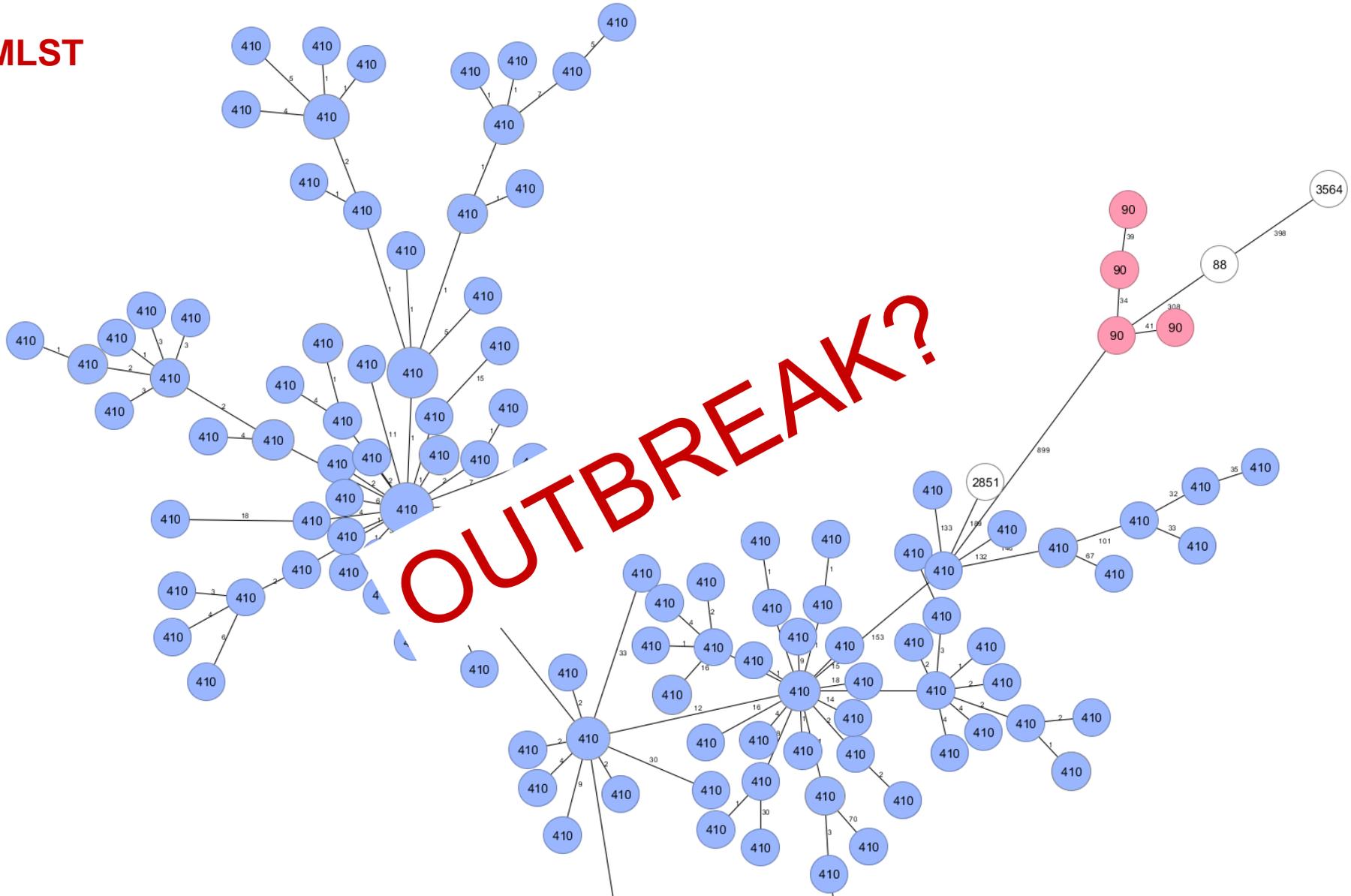
CPO IN DENMARK – E. COLI 2014-2022

cgMLST



CPO IN DENMARK – E. COLI ST410

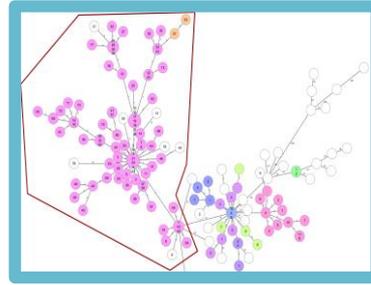
MLST



NOSOCOMIAL OUTBREAKS



Epidemiology

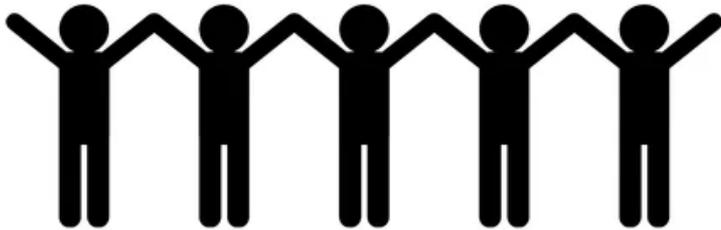


Molecular typing



Evasive action

Central dogma of (hospital) epidemiology

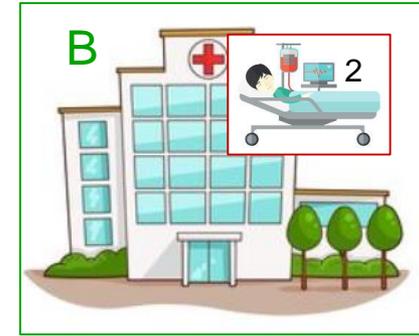
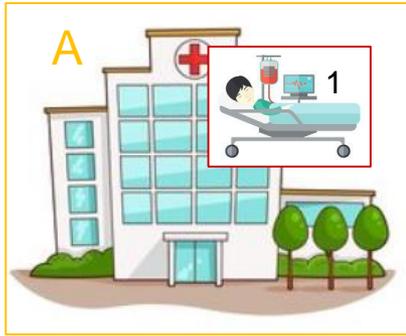


Direct chain of transmission



Indirect chain of transmission

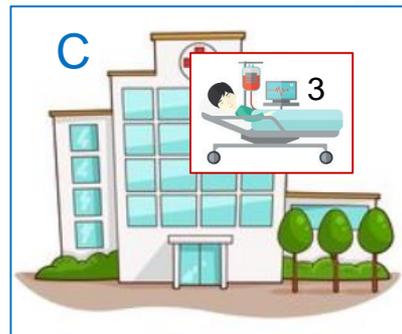
THE COMPLICATED OUTBREAK SITUATION



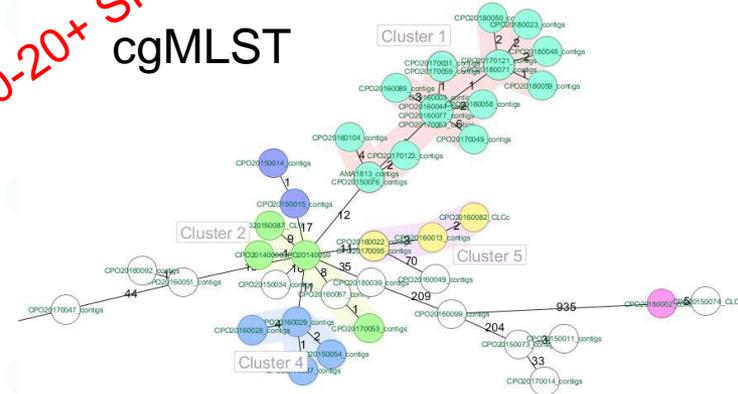
E. coli
NDM+



E. coli
ST1 (CT1)
*bla*NDM-1



~0-20+ SNPs/alleles
cgMLST





EPILINX

AN SOFTWARE TOOL TO
ANALYZE PATIENT NETWORKS

Applications for infection
control

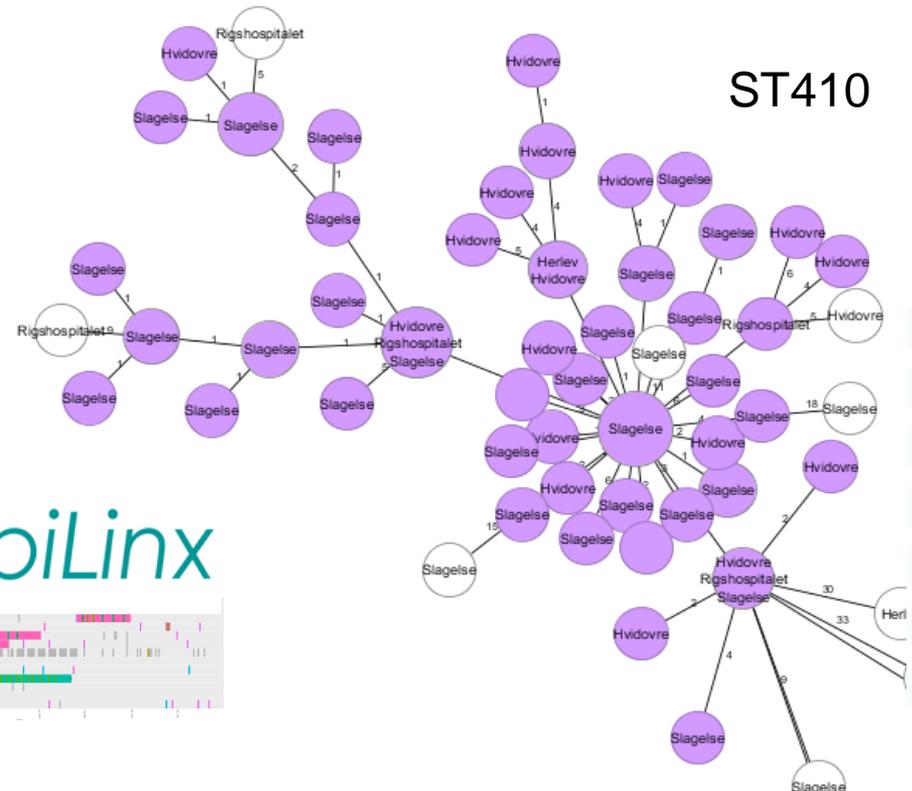


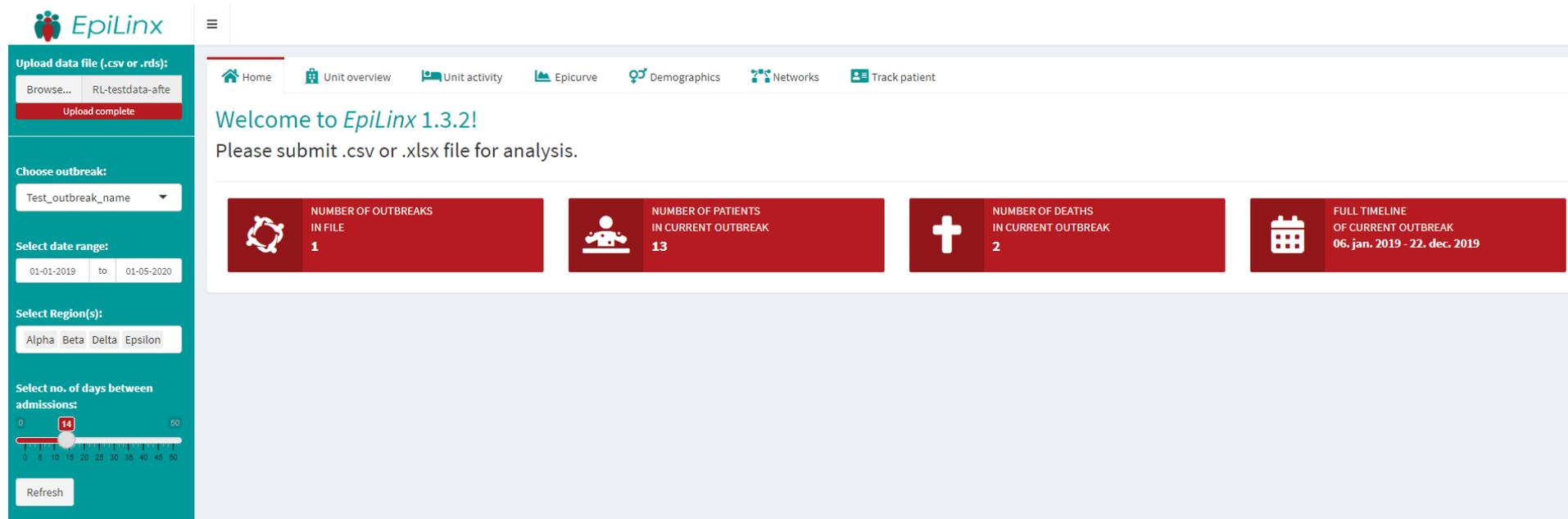
Available information

- Submitting Clinical lab (Regional)
- Submitting department (Hospital)
- Travel history (sometimes..)
- Clonal link (WGS based cgMLST/SNP)

Requirements for (timely) national outbreak detection

- Fast(er) typing information
- Updated patient movement information
- Ability to process data fast
- Ability to communicate fast





EpiLinx

Upload data file (.csv or .rds):
Browse... RL-testdata-afta
Upload complete

Choose outbreak:
Test_outbreak_name

Select date range:
01-01-2019 to 01-05-2020

Select Region(s):
Alpha Beta Delta Epsilon

Select no. of days between admissions:
0 14 50

Refresh

Home Unit overview Unit activity Epicurve Demographics Networks Track patient

Welcome to *EpiLinx* 1.3.2!
Please submit .csv or .xlsx file for analysis.

NUMBER OF OUTBREAKS IN FILE: 1

NUMBER OF PATIENTS IN CURRENT OUTBREAK: 13

NUMBER OF DEATHS IN CURRENT OUTBREAK: 2

FULL TIMELINE OF CURRENT OUTBREAK: 06. jan. 2019 - 22. dec. 2019

Generic “*base R*” software tool (“*Shiny*” tool package)
(*Under development*)



Input:

- Selected data based on typing (MLST/cgMLST)
- Patient hospitalization information (National or local)
- Other epidemiological data (sample date, death ect..)

Anna Emilie Henius
Statens Serum Institut

PATIENT TRANSFER NETWORKS – THE EXCEL EXPERIENCE

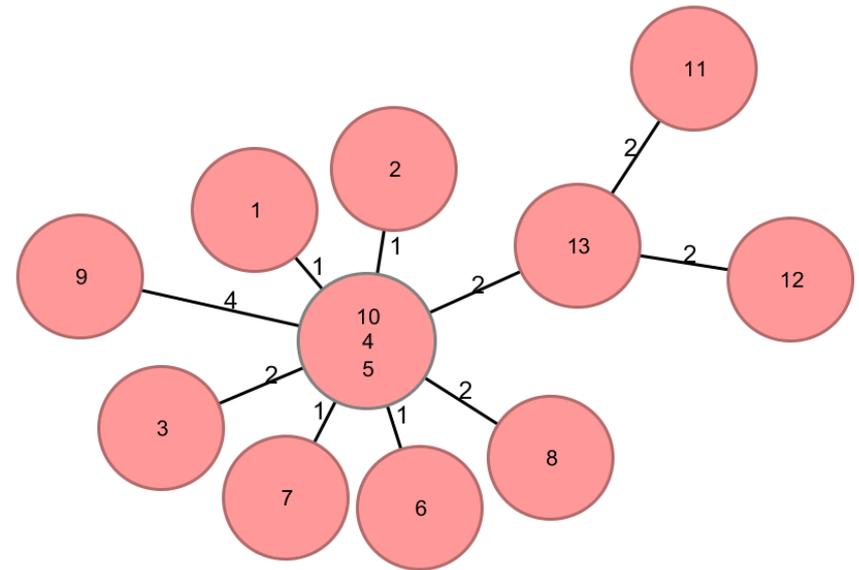
	A	B	C	D	E	F	G	H	I
1	Patient	CPR	Hospital	Department	In-date	Out-date	Sample date	Age	Gender
2	1	010101-0101	D	D1	01-jan-18	10-jan-18	15-jan-19	18	M
3	1	010101-0101	D	D1	01-mar-18	10-mar-18	15-jan-19	18	M
4	1	010101-0101	D	D2	01-jun-18	10-jun-18	15-jan-19	18	M
5	1	010101-0101	D	D2	01-aug-18	10-aug-18	15-jan-19	18	M
6	1	010101-0101	D	D1	01-okt-18	10-okt-18	15-jan-19	18	M
7	1	010101-0101	A	A1	01-jan-19	01-jan-19	15-jan-19	18	M
8	1	010101-0101	B	B1	03-jan-19	03-jan-19	15-jan-19	18	M
9	1	010101-0101	A	A2	06-jan-19	06-jan-19	15-jan-19	18	M
10	1	010101-0101	A	A1	07-jan-19	08-jan-19	15-jan-19	18	M
11	1	010101-0101	B	B1	14-jan-19	15-jan-19	15-jan-19	18	M
12	1	010101-0101	D	D1	01-feb-19	10-feb-19	15-jan-19	18	M
13	2	020202-0202	E	E1	02-feb-18	12-feb-18	11-jan-19	16	F
14	2	020202-0202	E	E2	02-apr-18	12-apr-18	11-jan-19	16	F
15	2	020202-0202	E	E3	02-maj-18	12-maj-18	11-jan-19	16	F
16	2	020202-0202	E	E4	02-sep-18	12-sep-18	11-jan-19	16	F
17	2	020202-0202	C	C1	01-jan-19	01-jan-19	11-jan-19	16	F
18	2	020202-0202	C	C2	02-jan-19	02-jan-19	11-jan-19	16	F
19	2	020202-0202	A	A1	08-jan-19	10-jan-19	11-jan-19	16	F
20	2	020202-0202	C	C2	11-jan-19	11-jan-19	11-jan-19	16	F
21	2	020202-0202	C	C1	15-jan-19	15-jan-19	11-jan-19	16	F
22	2	020202-0202	E	E4	02-feb-19	12-feb-19	11-jan-19	16	F
23	3	030303-0303	F	F1	03-mar-18	13-mar-18	15-jan-19	15	M
24	3	030303-0303	F	F1	03-jul-18	13-jul-18	15-jan-19	15	M
25	3	030303-0303	B	B2	02-jan-19	02-jan-19	15-jan-19	15	M
26	3	030303-0303	A	A1	10-jan-19	11-jan-19	15-jan-19	15	M
27	3	030303-0303	B	B2	15-jan-19	15-jan-19	15-jan-19	15	M
28	4	040404-0404	G	G1	04-apr-18	14-apr-18	12-jan-19	14	F
29	4	040404-0404	B	B1	02-jan-19	03-jan-19	12-jan-19	14	F
30	4	040404-0404	B	B2	04-jan-19	04-jan-19	12-jan-19	14	F
31	4	040404-0404	B	B3	10-jan-19	11-jan-19	12-jan-19	14	F
32	4	040404-0404	B	B4	12-jan-19	13-jan-19	12-jan-19	14	F
33	4	040404-0404	G	G1	04-feb-19	14-feb-19	12-jan-19	14	F
34	5	050505-0505	H	H1	05-maj-18	15-maj-18	08-jan-19	13	M
35	5	050505-0505	A	A1	06-jan-19	08-jan-19	08-jan-19	13	M
36	5	050505-0505	C	C2	13-jan-19	14-jan-19	08-jan-19	13	M

WGS-based data (cgMLST)

13 patients with the same cgMLST type

0-5 alleles difference between isolates

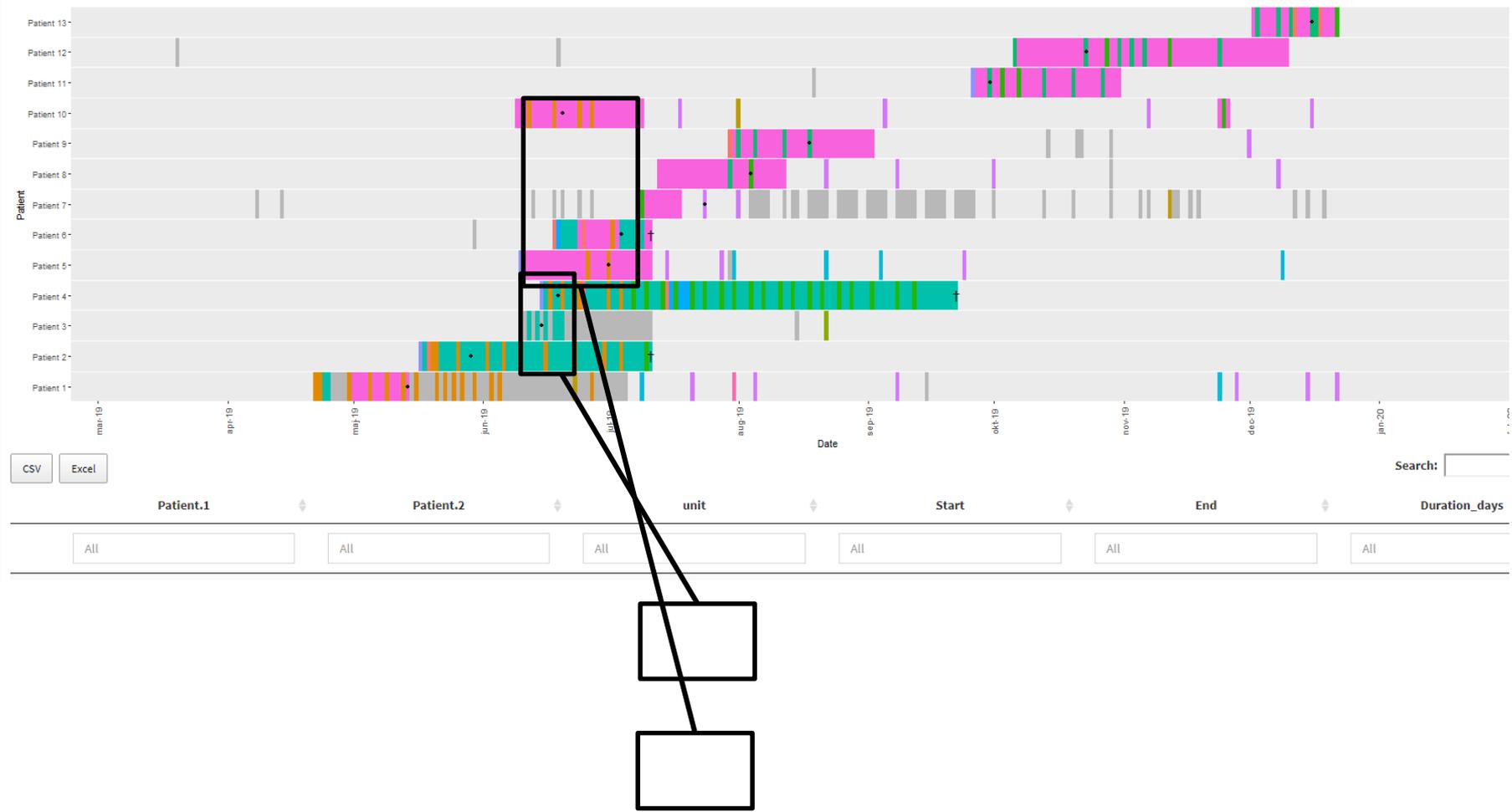
A maximum of 8 alleles in total



cgMLST

EPIINX – OVERVIEW TAB

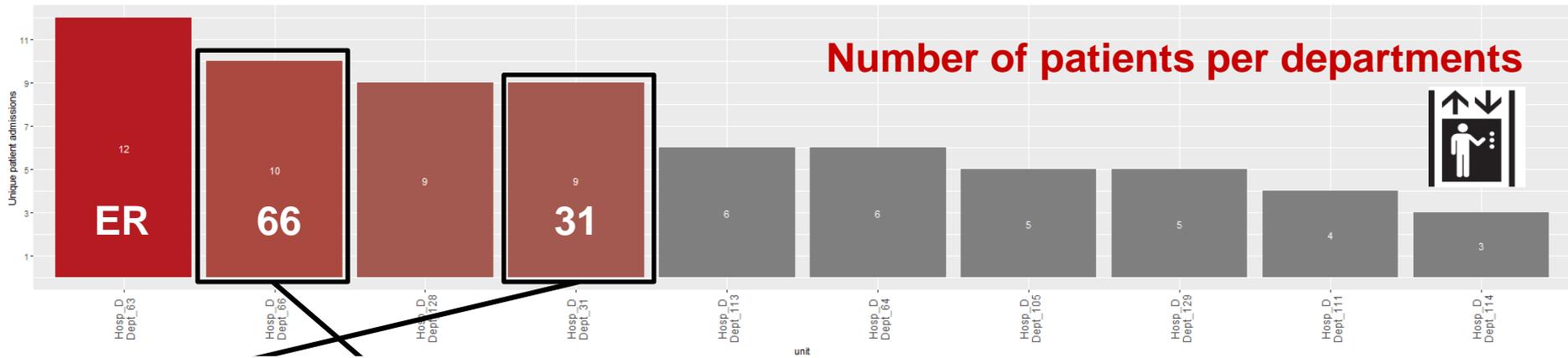
Mouse over datapoint in plot to show values of patient ID, date and unit respectively!



ACTIVITY PER UNIT

Activity per unit

 Events per unit  Data for selected unit

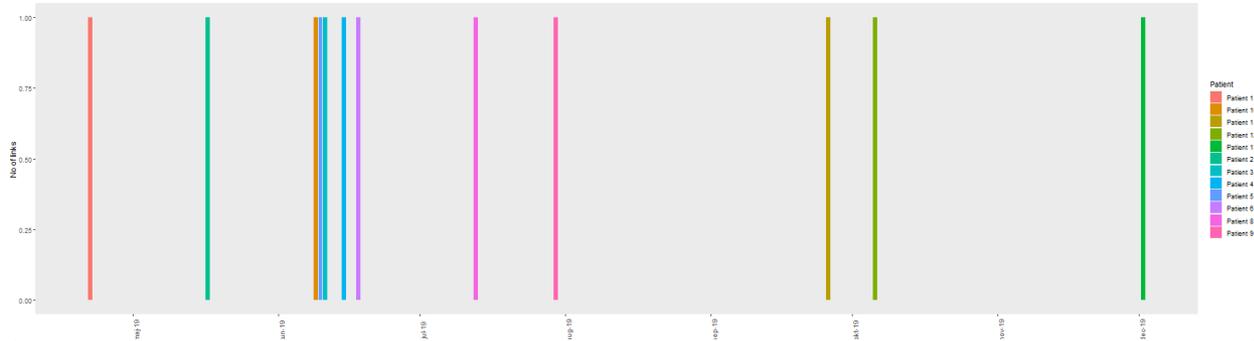


PATIENT VISITS PER DEPARTMENT

ER

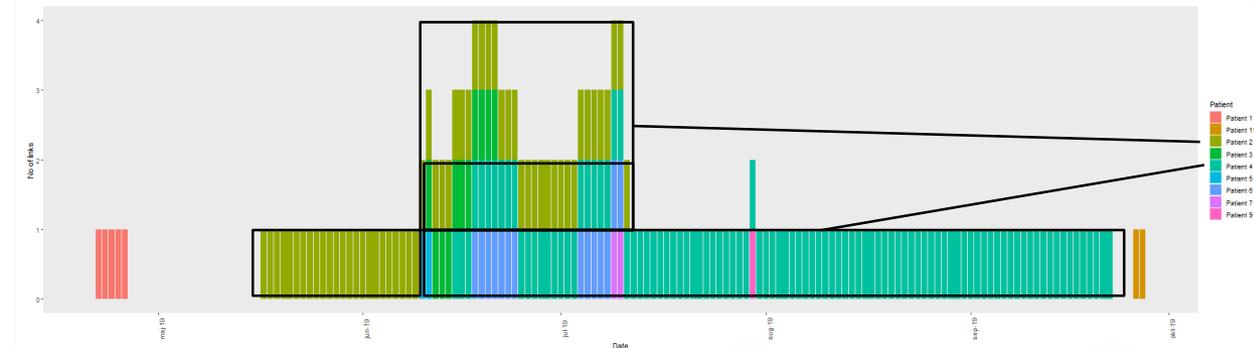
Select unit:

Dept_63



Dept_31

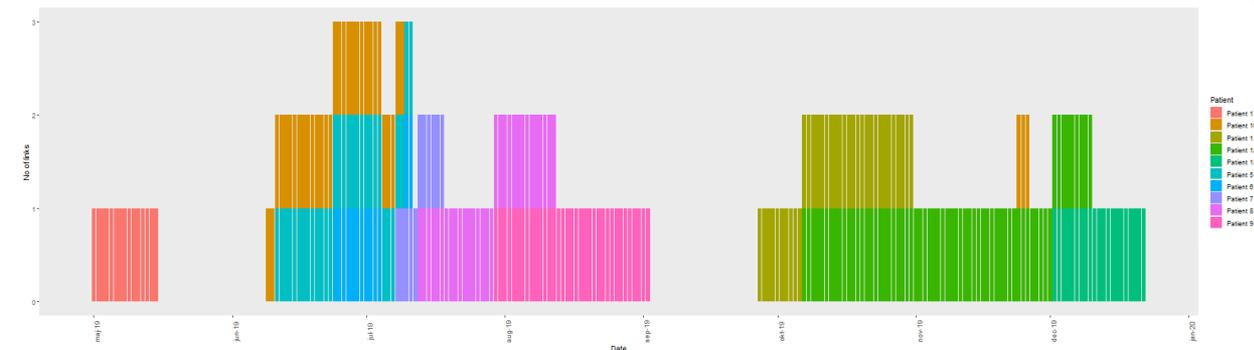
Dept_31



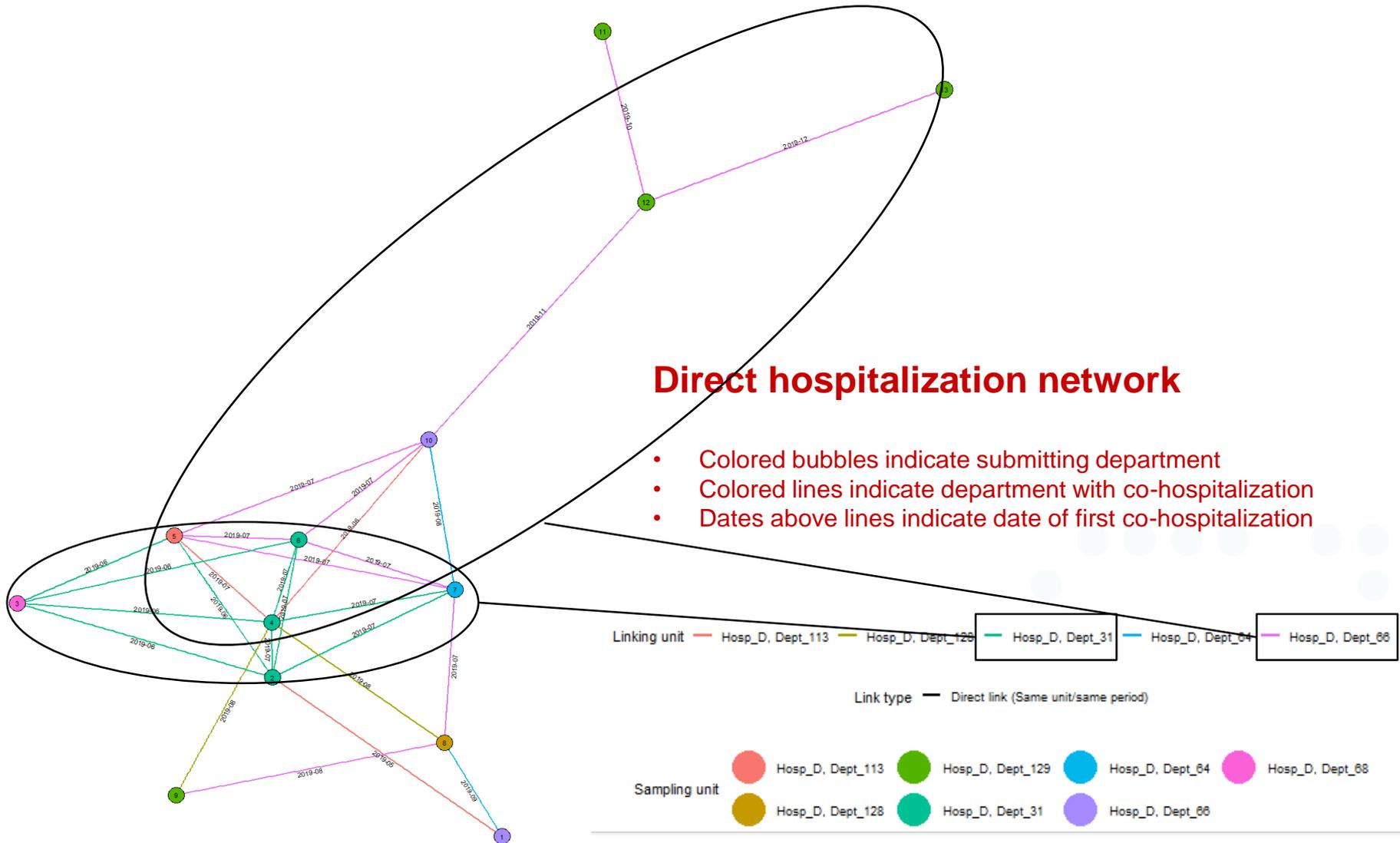
Patient 2
Patient 4

Dept_66

Dept_66

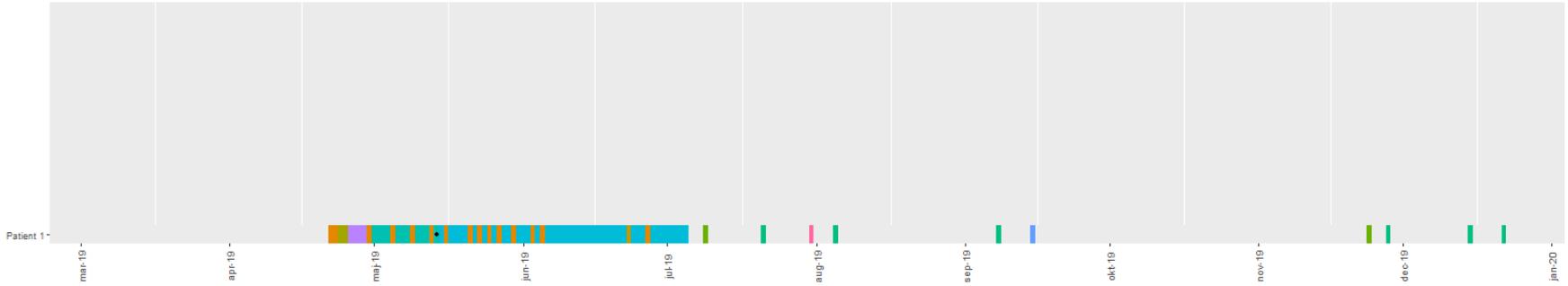


Direct unit links Indirect unit links Hospital links



Select patient:

Patient 1



Patient 1's network

Select linktypes:

- Direct unit links
- Indirect unit links
- Hospital links

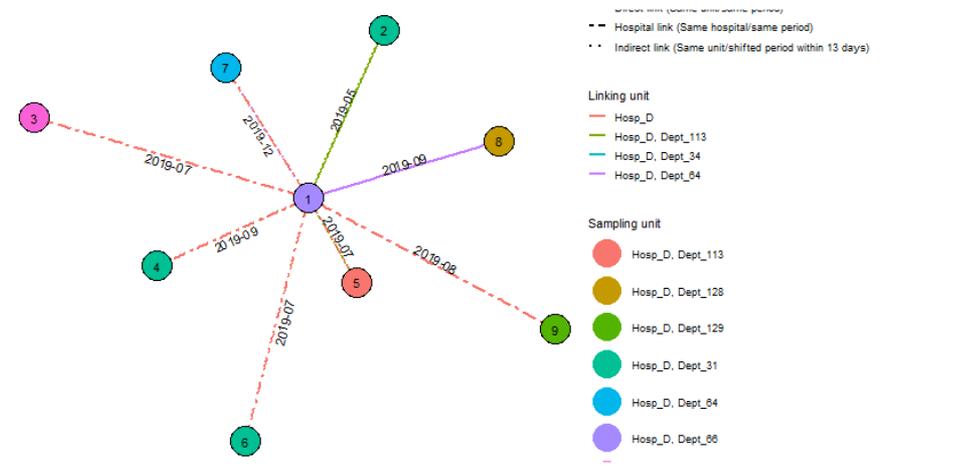


Table of admissions

CSV Excel Search:

	Patient	Date	unit
1	Patient 1	2019-12-22	Hosp_D, Dept_64
2	Patient 1	2019-12-15	Hosp_D, Dept_64
3	Patient 1	2019-11-28	Hosp_D, Dept_64
4	Patient 1	2019-11-24	Hosp_D, Dept_34
5	Patient 1	2019-09-15	Hosp_D, Dept_79
6	Patient 1	2019-09-08	Hosp_D, Dept_64
7	Patient 1	2019-08-05	Hosp_D, Dept_64
8	Patient 1	2019-07-31	Hosp_S, Dept_91
9	Patient 1	2019-07-21	Hosp_D, Dept_64
10	Patient 1	2019-07-09	Hosp_D, Dept_34

Showing 1 to 10 of 91 entries



Upload data file (xlsx):

Browse... No file selected

Department Hospital Buffer time Infection loads Demographics Networks

https://nrar.shinyapps.io/epilinx_web/

Being developed to handle patient contact data

- National data
- Regional/local hospital data

Inclusion criteria

- Whole Genome Sequence typing (cgMLST, wgMLST, SNP ect)
- Locally available phenotypic data (AST, MALDI-TOF, Rapid diagnostic kits..)

Welcome to *EpiLinx* 1.3.2!
Please submit .csv or .xlsx file for analysis.

	NUMBER OF OU... IN FILE 2		NUMBER OF PATI... IN CURRENT OU...
---	---------------------------------	---	---------------------------------------

Choose outbreak:
Network02
Drain01
Network02
01-01-2017 to 23-05-2022

Select Region(s):
Capital region




CELEBRATING 25 year

DANMAP 2020

Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark

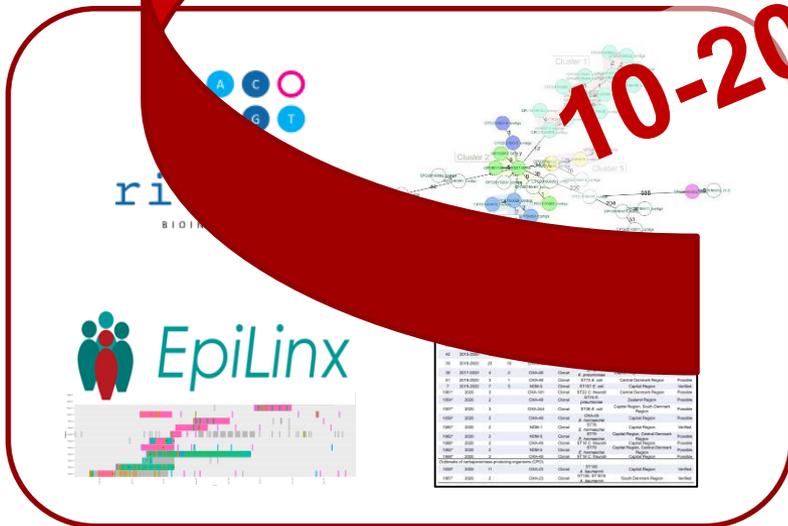
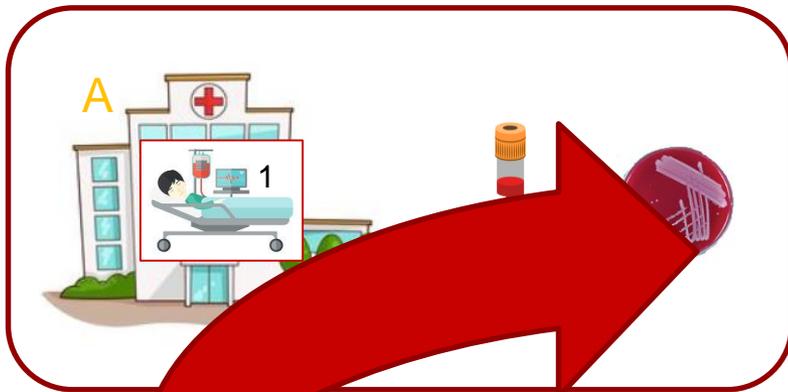


Statens Serum Institut
National Food Institute, Technical University of Denmark

Table 8.10 Outbreaks of carbapenemase-producing Enterobacterales (CPE) and carbapenemase-producing organisms (CPO) during 2020, n=20, Denmark DANMAP 2020

Outbreak ID	Year	Patients total	Patients 2020	Carbapenemase	Type of Outbreak	Species (clonal spread)	Regions	Status
Outbreaks of carbapenemase-producing Enterobacterales (CPE)								
41	2012-2020	52	13	NDM-1	Clonal/plasmid	ST18 <i>C. freundii</i>	Capital Region/Central Denmark Region/North Denmark Region	Verified
48	2013-2020	23	4	OXA-436/OXA-48	Clonal/plasmid	ST90 <i>E. cloacae</i> / ST22 <i>C. freundii</i>	Capital Region/South Denmark Region/Zealand Region	Verified
24	2014-2020	10	1	OXA-181	Clonal	ST410 <i>E. coli</i>	Capital Region	Verified
25	2014-2020	7	1	OXA-48	Clonal	ST38 <i>E. coli</i>	Capital Region/Zealand Region	Verified
21	2015-2020	60	19	NDM-5/OXA-181	Clonal	ST410 <i>E. coli</i>	Capital Region/Zealand Region	Verified
22	2015-2020	6	1	OXA-181	Clonal	ST440 <i>E. coli</i>	Capital Region/Central Denmark Region	Possible
42	2015-2020	9	2	OXA-48	Clonal	ST65 <i>C. freundii</i>	Capital Region/North Denmark Region/Zealand Region	Verified
33	2016-2020	23	16	OXA-232	Clonal	ST231 <i>K. pneumoniae</i>	Central Denmark Region	Verified
35	2017-2020	4	2	OXA-48	Clonal	ST15 <i>K. pneumoniae</i>	Capital Region/Zealand Region	Possible
51	2018-2020	3	1	OXA-48	Clonal	ST73 <i>E. coli</i>	Central Denmark Region	Possible
7	2019-2020	7	5	NDM-5	Clonal	ST167 <i>E. coli</i>	Capital Region	Verified
1061*	2020	3		OXA-181	Clonal	ST22 <i>C. freundii</i>	Central Denmark Region	Possible
1054*	2020	2		OXA-48	Clonal	ST16 <i>K. pneumoniae</i>	Zealand Region	Possible
1057*	2020	3		OXA-244	Clonal	ST38 <i>E. coli</i>	Capital Region, South Denmark Region	Possible
1059*	2020	2		OXA-48	Clonal	OXA-48 <i>E. hormaechei</i>	Capital Region	Possible
1060*	2020	2		NDM-1	Clonal	<i>E. hormaechei</i> ST78	Capital Region	Verified
1062*	2020	2		NDM-5	Clonal	<i>E. hormaechei</i> ST79	Capital Region, Central Denmark Region	Possible
1068*	2020	2		OXA-48	Clonal	ST18 <i>C. freundii</i> ST79	Capital Region	Possible
1062*	2020	2		NDM-5	Clonal	<i>E. hormaechei</i> ST18 <i>C. freundii</i>	Capital Region, Central Denmark Region	Possible
1068*	2020	2		OXA-48	Clonal	ST18 <i>C. freundii</i>	Capital Region	Possible
Outbreaks of carbapenemase-producing organisms (CPO)								
1058*	2020	11		OXA-23	Clonal	ST195 <i>A. baumannii</i>	Capital Region	Verified
1067*	2020	2		OXA-23	Clonal	ST195, ST1816 <i>A. baumannii</i>	South Denmark Region	Verified

INTEGRATED NATIONAL WORKFLOW



10-20 days



QUESTIONS PLEASE?

ANY
QUESTIONS
?

