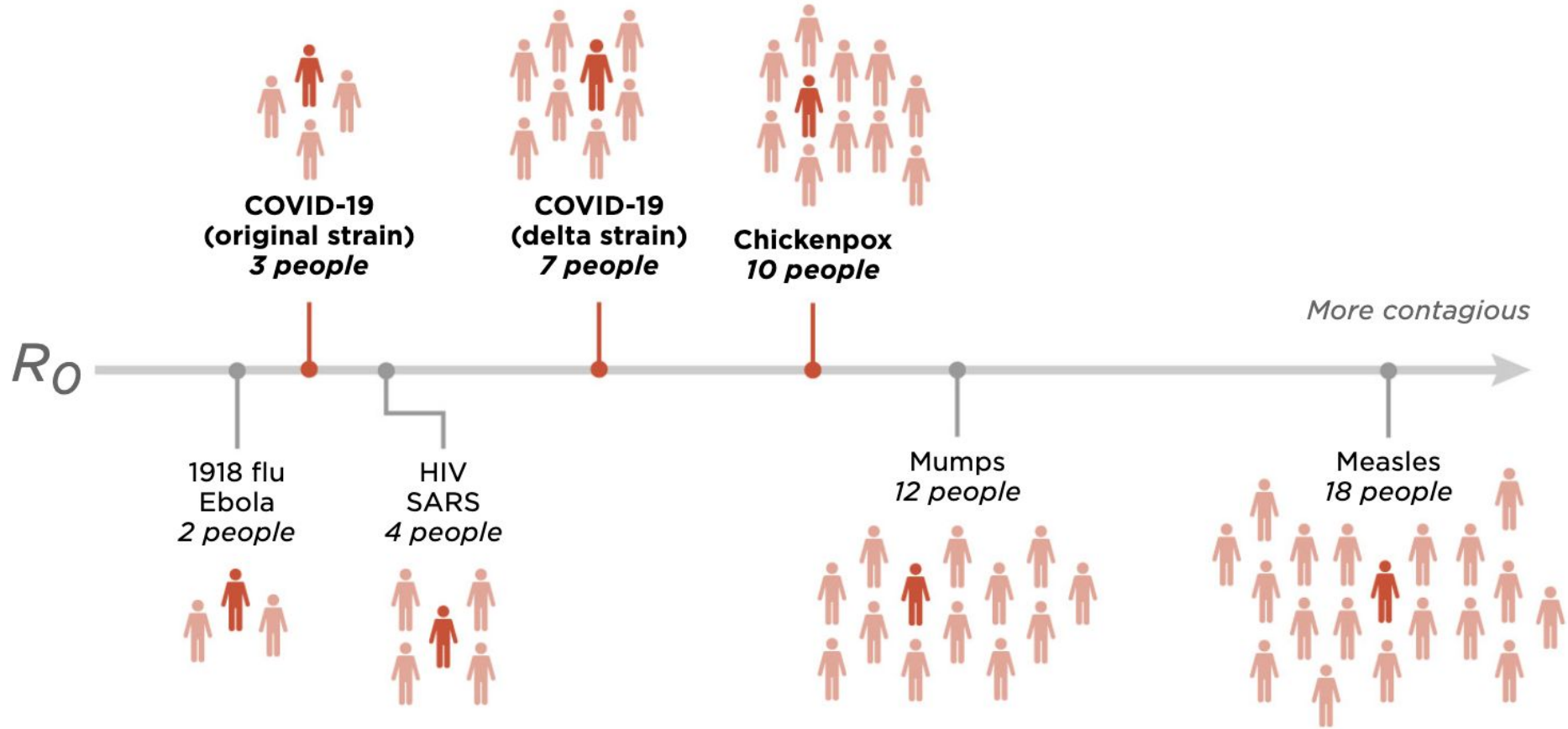
KUI SUUR PEAB OLEMA VAKTSINEERITUTE OSAKAAL POPULATSIOONI IMMUUNSUSE TEKKEKS?

The number of **people** that **one sick person** will infect (on average) is called R_0.
Here are the maximum R_0 values for a few viruses.

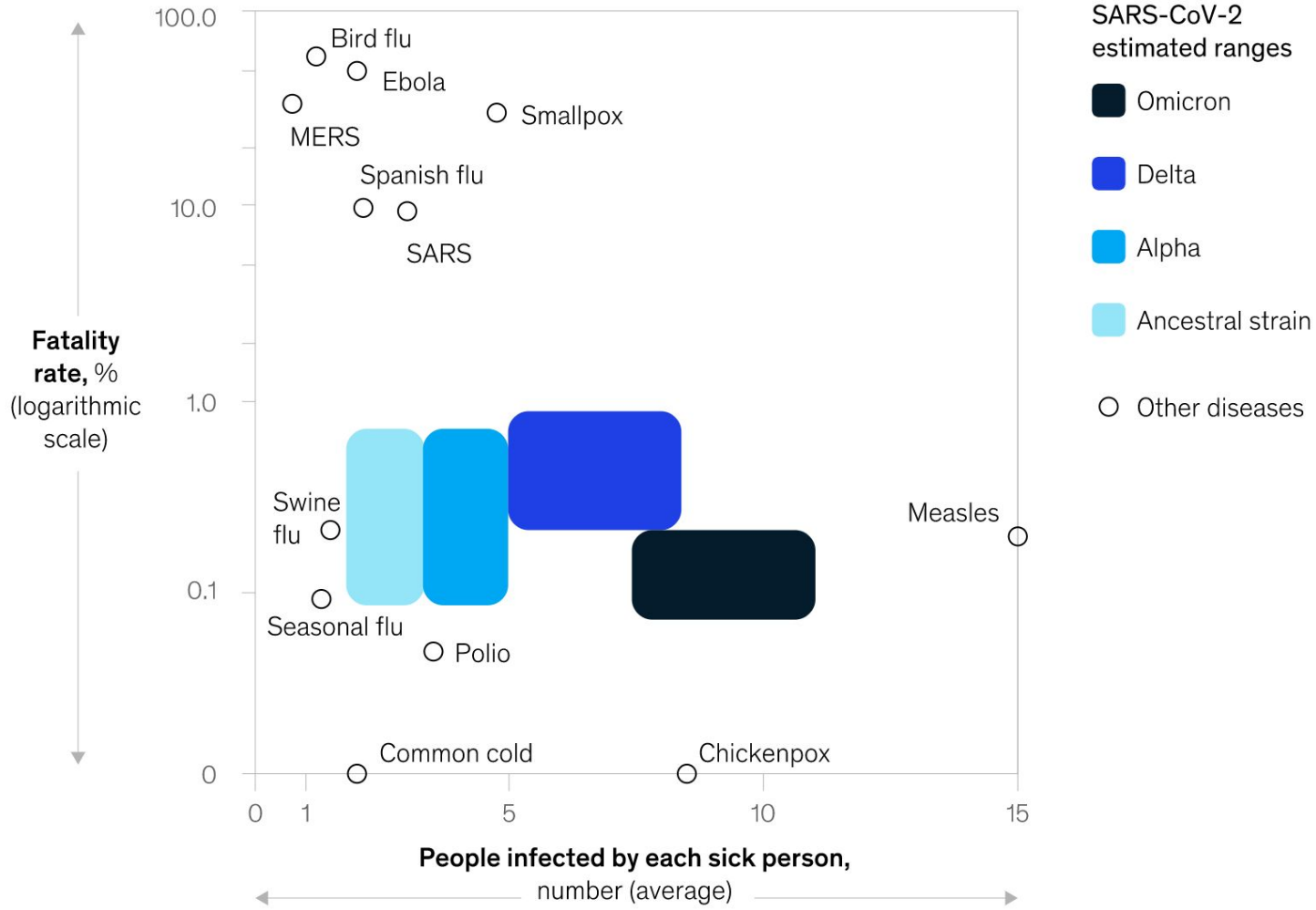


Source: The Lancet (1918 flu, SARS), University of Michigan School of Public Health (COVID-19, ebola, measles), Johns Hopkins University School of Public Health (chickenpox), Proceedings of the National Academy of Sciences (HIV), Tom Wenseleers at the University of Leuven (COVID-19 delta variant), Australian Government Department of Health (mumps)

Credit: Michaeleen Doucleff, Alyson Hurt and Adam Cole/NPR. Icon by Gerard Higgins/The Noun Project.

Omicron is more infectious than other common viruses, and less fatal than Delta.

Disease fatality and infection rates[1]



[1]Average case-fatality rates and transmission numbers are shown. Estimates of case-fatality rates can vary. The preliminary estimates for the new coronavirus are shown in the SARS-CoV-2 ancestral-strain area.
Source: *New York Times*, Ancestral, Alpha, Delta, Omicron CFR, Omicron RO

McKinsey & Company

Populatsiooniimmuunsuseks vajalik vaktsineerituse tase = $1-1/R_0$

WHO:

Leetrite puhul peaks olema 95% populatsioonist vaktsineeritud R_0=16…18

Lastehalvatus – 80% R_0=4...6

COVID-19 ??? R_0=2…2,5

Delta variant R_0=6-8

Omikron R_0>10

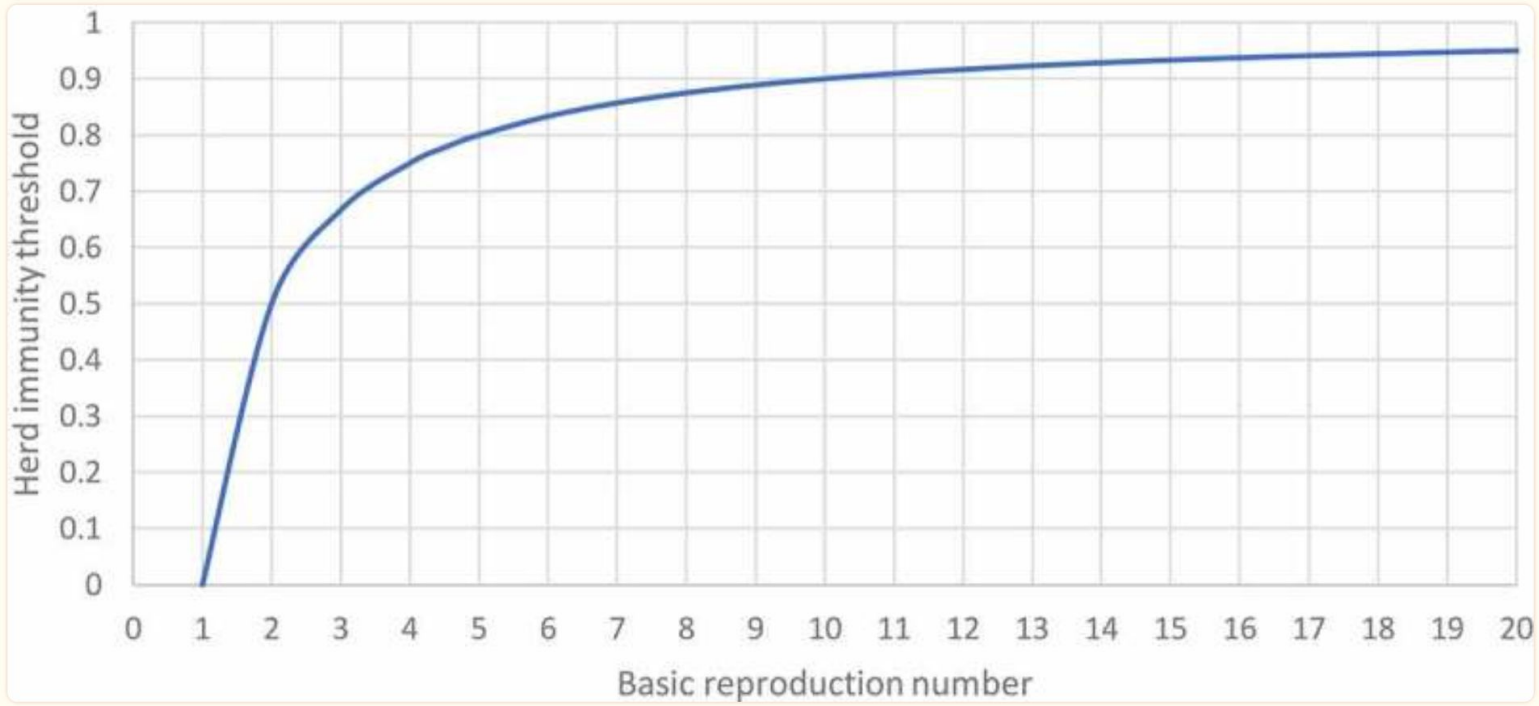


Figure 1.

The curve shows the relation between the basic reproduction number and herd immunity threshold.

Elsaid et al (2021)

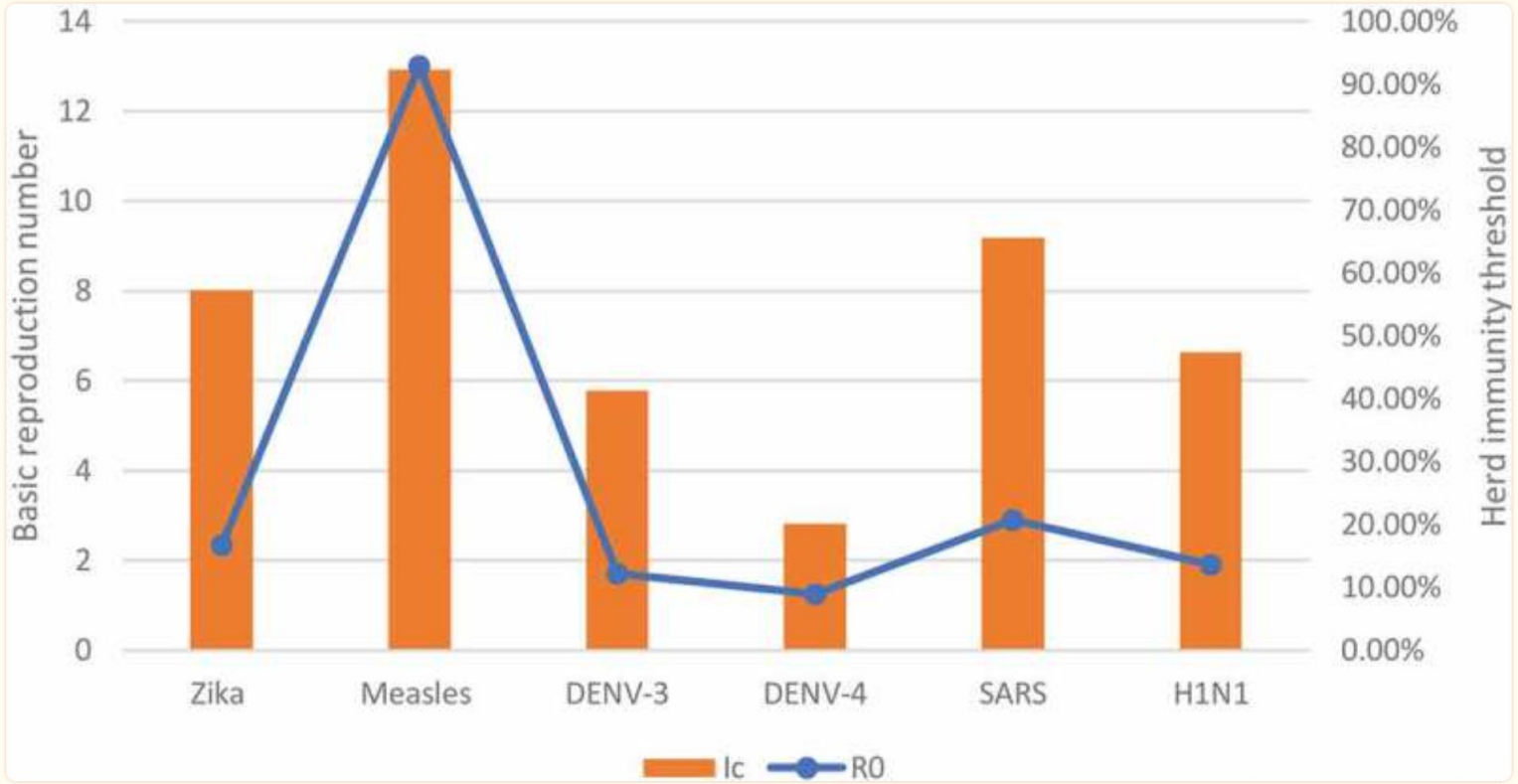
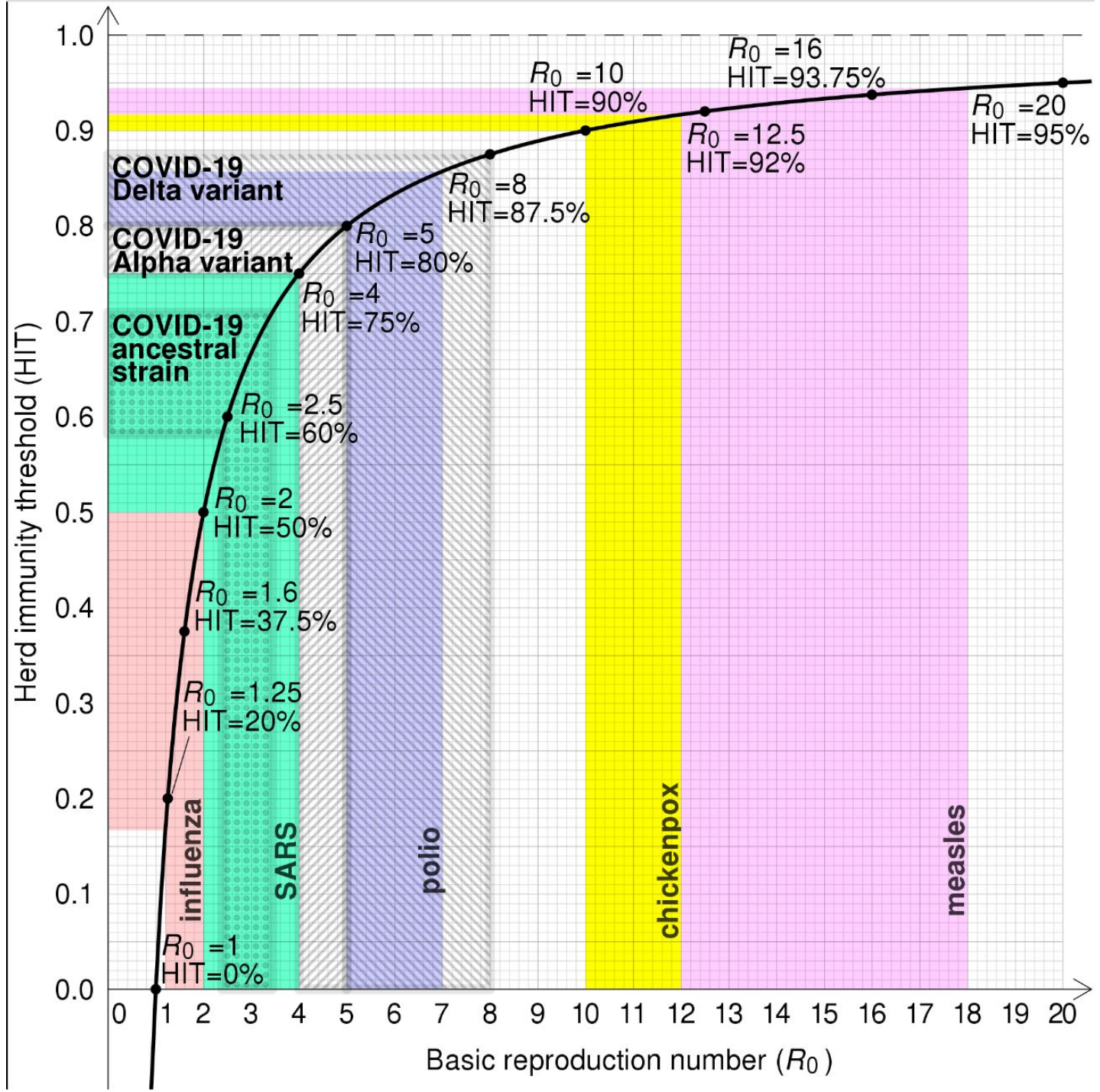


Figure 2.

Herd immunity threshold (Ic) of the disease according to the basic reproduction number (R0).

- Measles – 12-18
- Chickenpox – 10-12
- Polio – 10-12
- HIV/AIDS – 2-5
- SARS – 0.19-1.08
- MERS – 0.3-0.8
- Common Cold – 2-3
- Ebola – 1.56-1.9
- Seasonal Influenza – 0.9-2.1
- 1918 Influenza Pandemic – 1.4-2.8
- 2009 Influenza Pandemic – 1.4.1.6
- COVID19 – 0.4-5.7* (*current estimates vary; see below for more discussion)

https://www.news-medical.net/health/What-is-R0.aspx


Herd immunity threshold (HIT)
Basic reproduction number (R_0)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
COVID-19 Delta variant
COVID-19 Alpha variant
COVID-19 ancestral strain
R_0 =1 HIT=0%
R_0 =1.25 HIT=20%
R_0 =1.6 HIT=37.5%
R_0 =2 HIT=50%
R_0 =2.5 HIT=60%
R_0 =4 HIT=75%
R_0 =5 HIT=80%
R_0 =8 HIT=87.5%
R_0 =10 HIT=90%
R_0 =12.5 HIT=92%
R_0 =16 HIT=93.75%
R_0 =20 HIT=95%
influenza
SARS
polio
chickenpox
measles

Values of R_0 and herd immunity thresholds (HITs) of infectious diseases prior to intervention

Disease	Transmission	R_0	HIT[a]
Measles	Aerosol	12–18[40][7]	92–94%
Chickenpox (varicella)	Aerosol	10–12[41]	90–92%
Mumps	Respiratory droplets	10–12[42]	90–92%
Rubella	Respiratory droplets	6–7[b]	83–86%
Polio	Fecal–oral route	5–7[b]	80–86%
Pertussis	Respiratory droplets	5.5[47]	82%
Smallpox	Respiratory droplets	3.5–6.0[48]	71–83%
HIV/AIDS	Body fluids	2–5[49]	50–80%
COVID-19 (ancestral strain)	Respiratory droplets and aerosol[50]	2.9 (2.4–3.4)[51]	65% (58–71%)
SARS	Respiratory droplets	2–4[52]	50–75%
Diphtheria	Saliva	2.6 (1.7–4.3)[53]	62% (41–77%)
Common cold (e.g., rhinovirus)	Respiratory droplets	2–3[54][*medical citation needed*]	50–67%
Mpox	Physical contact, body fluids, respiratory droplets	2.1 (1.5–2.7)[55]	53% (31–63%)
2022–2023 mpox outbreak	Physical contact, body fluids, respiratory droplets, Sexual (MSM)	1.2810 (1.0714–1.5508)[56]	21.94%
Ebola (2014 outbreak)	Body fluids	1.8 (1.4–1.8)[57]	44% (31–44%)
Influenza (seasonal strains)	Respiratory droplets	1.3 (1.2–1.4)[58]	23% (17–29%)
Andes hantavirus	Respiratory droplets and body fluids	1.2 (0.8–1.6)[59]	16% (0–36%)[c]
Nipah virus	Body fluids	0.5[60]	0%[c]
MERS	Respiratory droplets	0.5 (0.3–0.8)[61]	0%[c]

Values of R_0 and herd immunity thresholds (HITs) for specific influenza strains

Disease	Transmission	R_0	HIT[a]
Influenza (1918 pandemic strain)	Respiratory droplets	2[62]	50%
Influenza (2009 pandemic strain)	Respiratory droplets	1.6 (1.3–2.0)[2]	37% (25–51%)
Influenza (seasonal strains)	Respiratory droplets	1.3 (1.2–1.4)[58]	23% (17–29%)

Estimates for variants of SARS-CoV-2.

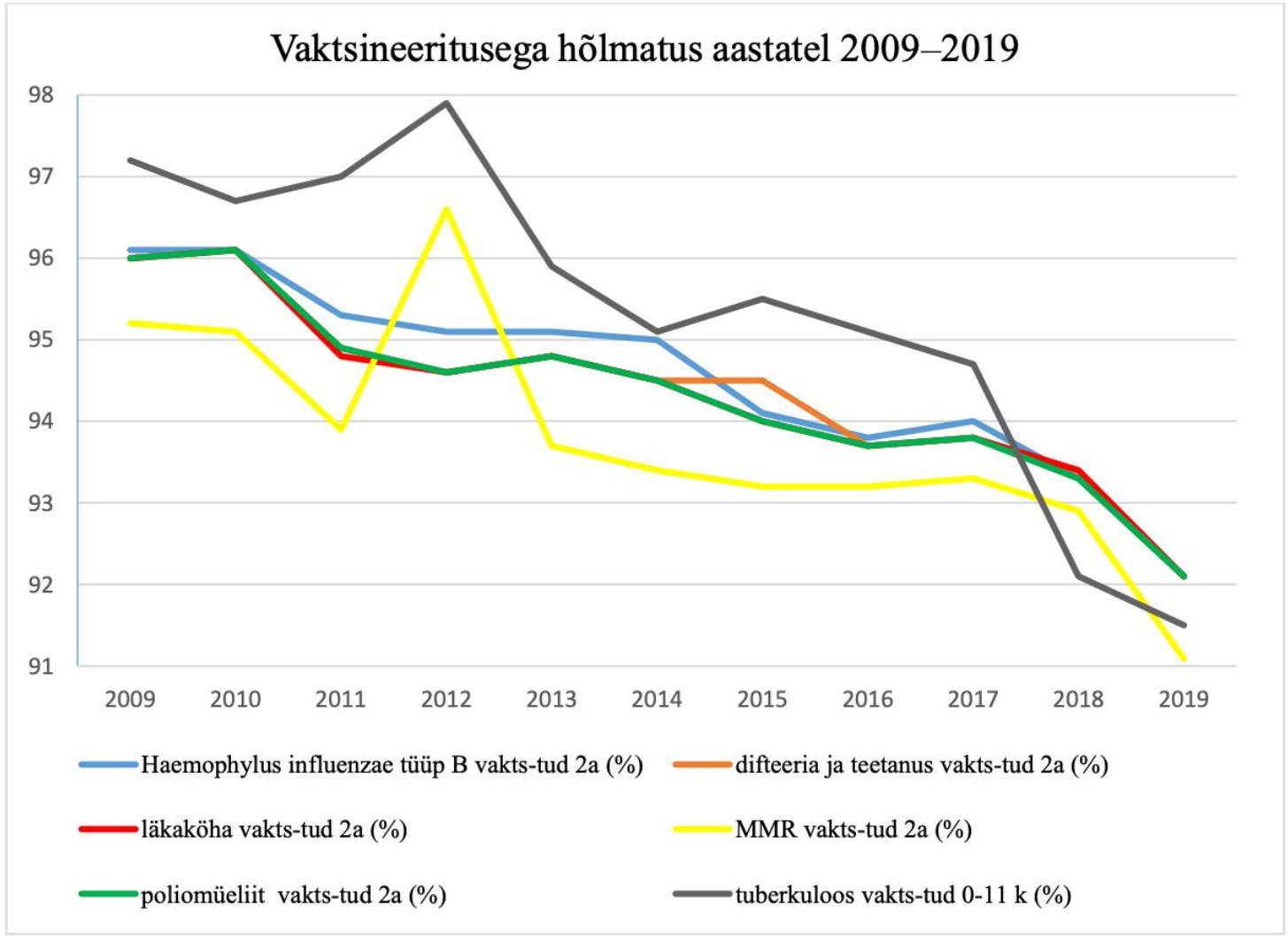
Values of R_0 and herd immunity thresholds (HITs) for variants of SARS-CoV-2

Disease	Transmission	R_0	HIT[a]
COVID-19 (Omicron variant)	Respiratory droplets and aerosol	9.5[63]	89%
COVID-19 (Delta variant)	Respiratory droplets and aerosol	5.1[64]	80%
COVID-19 (Alpha variant)	Respiratory droplets and aerosol	4–5[65][*medical citation needed*]	75–80%
COVID-19 (ancestral strain)	Respiratory droplets and aerosol[50]	2.9 (2.4–3.4)[51]	65% (58–71%)

KUI SUUR ON TÄNA EESTIS VAKTSINEERIMINE ERINEVATE NAKKUSHAIGUSTE VASTU?

$1-1/R_0$

Joonis 2. Vaktsineeritusega hõlmatus kaheaastastel (tuberkuloosi puhul kuni 11 kuu vanustel) lastel aastatel 2009–2019[46]



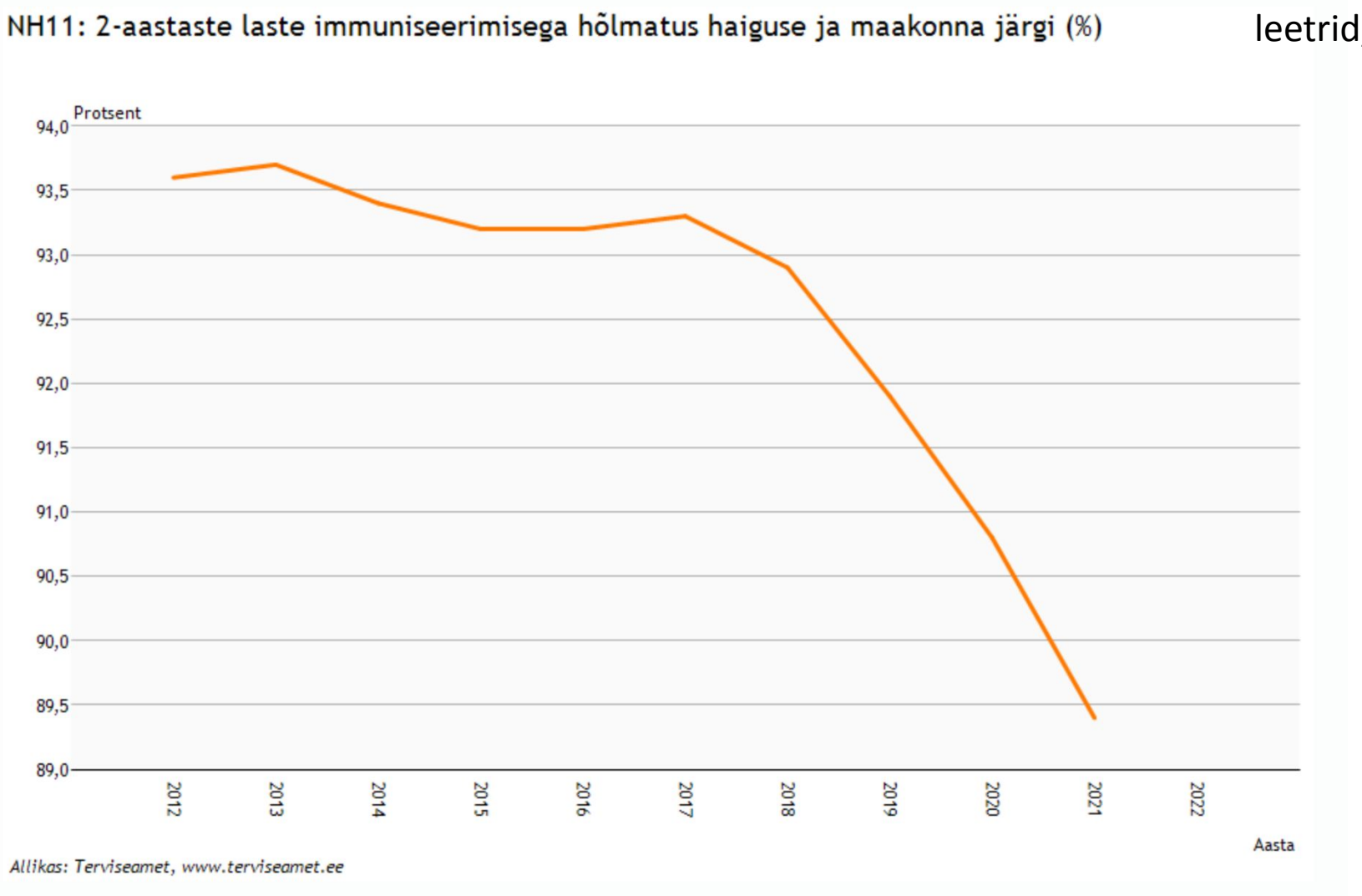
Allikas: Terviseameti statistika (autori joonis)

WHO soovitus kõigil 95%
(läkaköha 90%)

Rene Kärner

leetrid, mumps, punetised (MMR)

leetrid
R_o=12-18
95%



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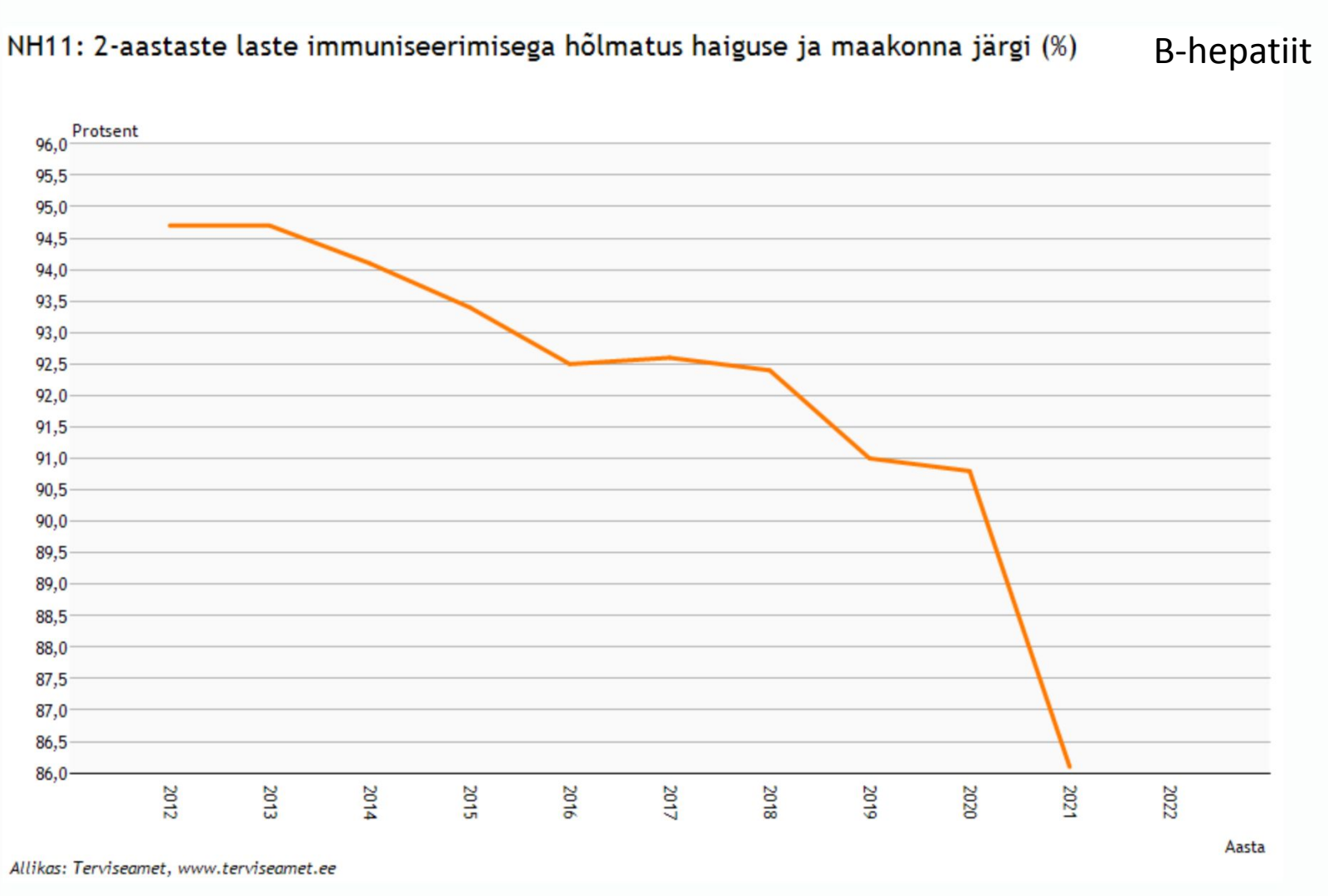
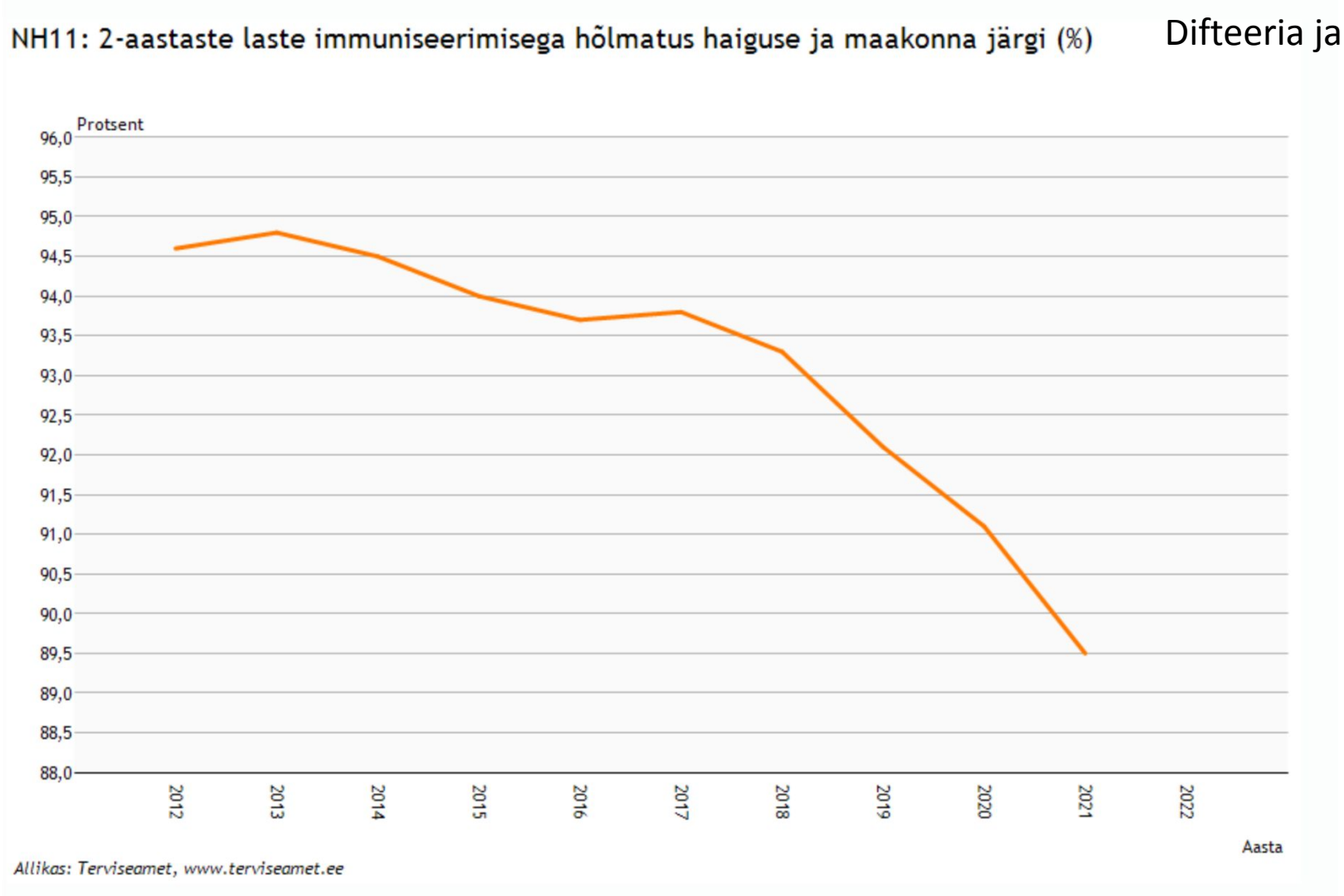
B-hepatiit


NH11: 2-aastaste laste immuniseerimisega hõlmatus haiguse ja maakonna järgi (%)
Protsent
96,0
95,5
95,0
94,5
94,0
93,5
93,0
92,5
92,0
91,5
91,0
90,5
90,0
89,5
89,0
88,5
88,0
87,5
87,0
86,5
86,0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Aasta
Allikas: Terviseamet, www.terviseamet.ee

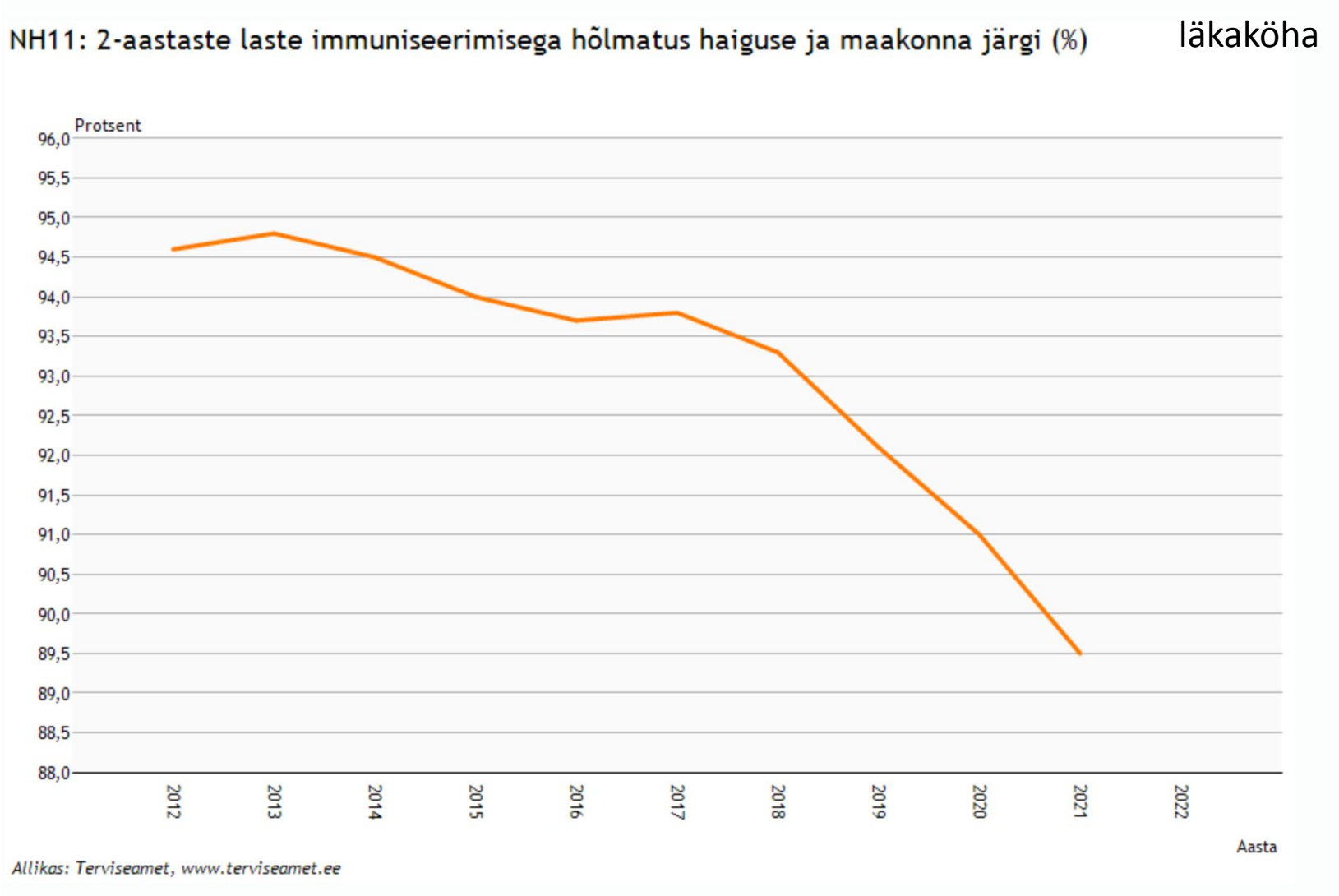
Difteeria ja teetanus



Diphtheria	Saliva	2.6 (1.7–4.3)[53]	62% (41–77%)

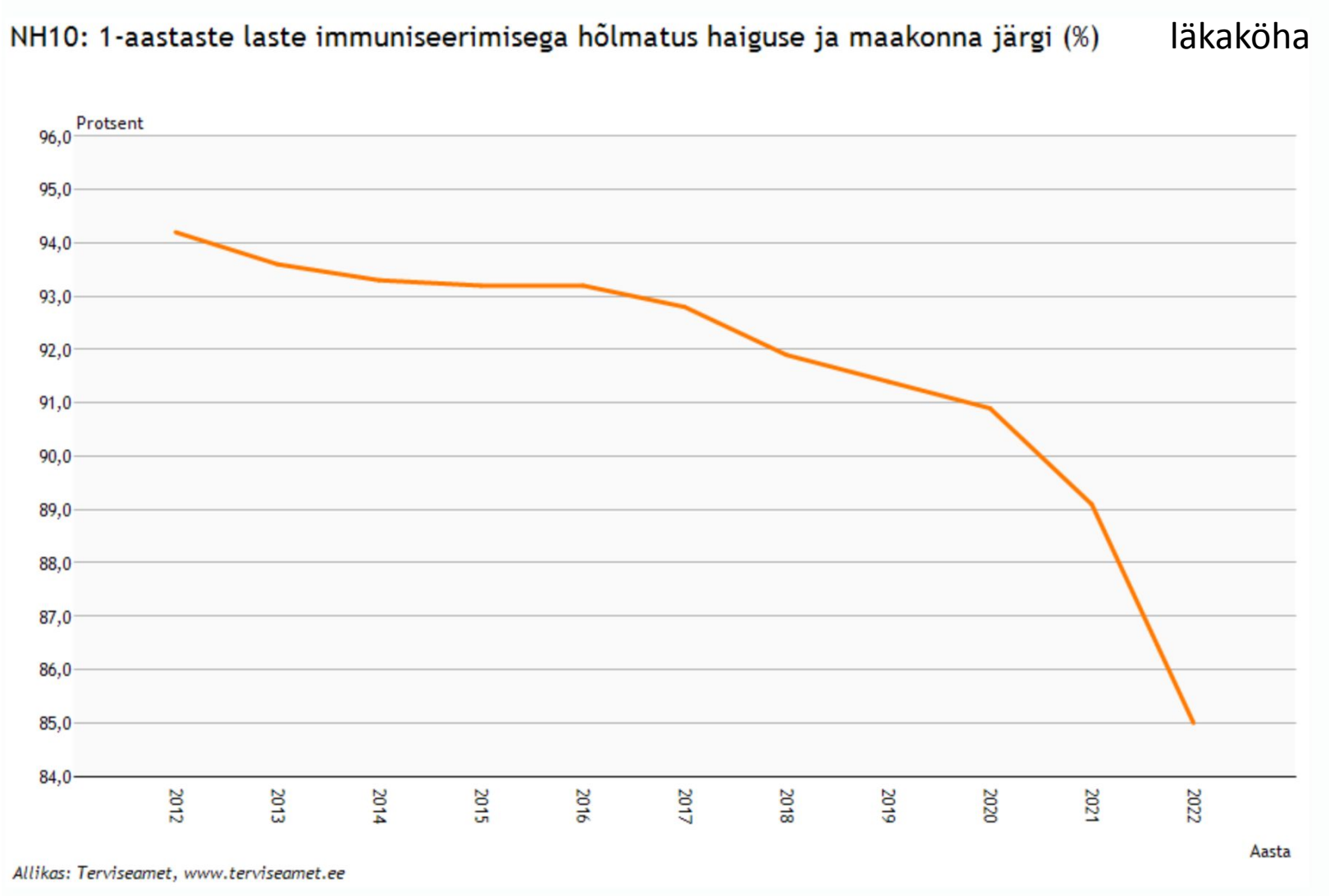
läkaköha

R_0=5,5
82%



Pertussis	Respiratory droplets	5.5[47]	82%

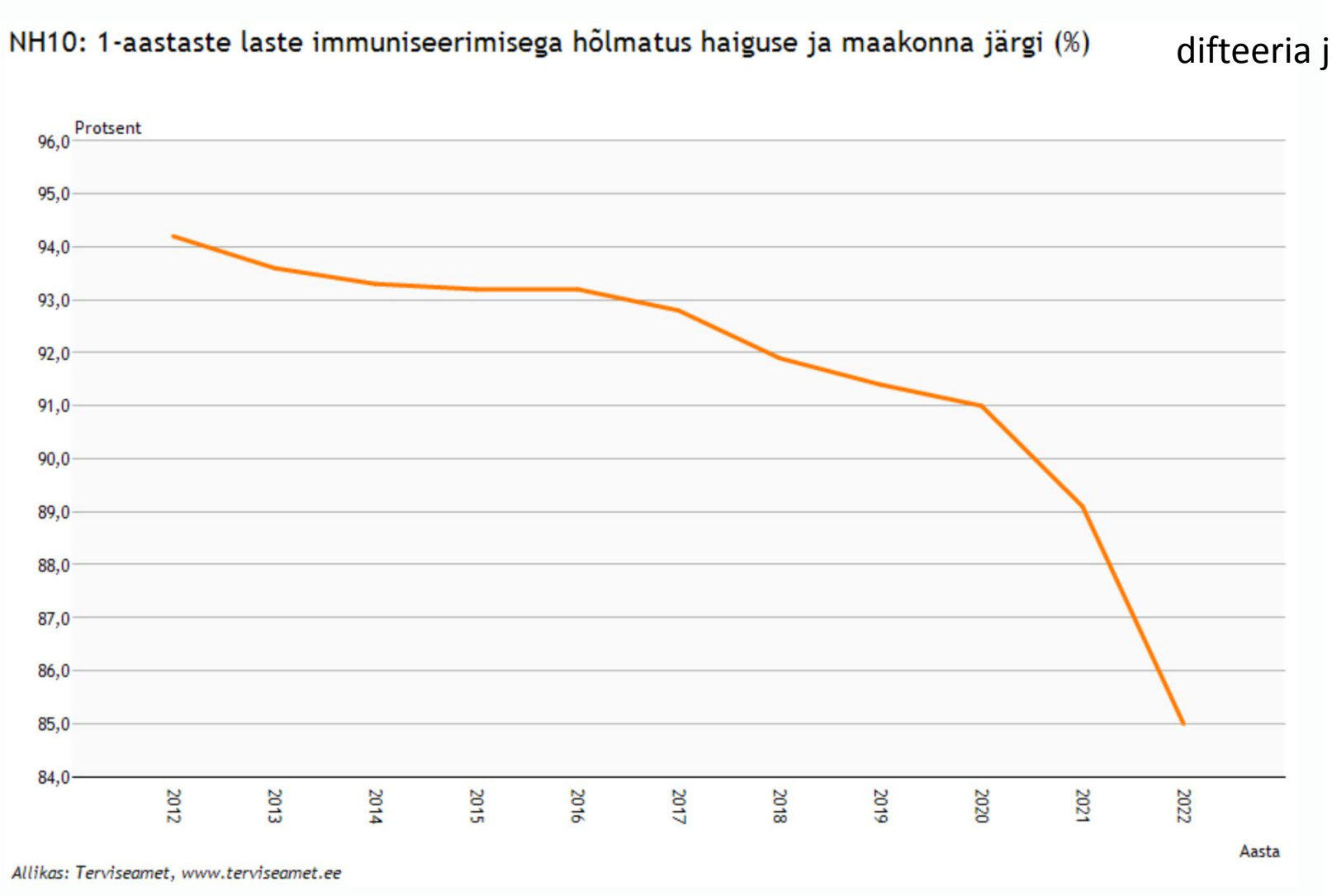
läkaköha



R_0 = 12-17

Pertussis	Respiratory droplets	5.5[47]	82%

difteeria ja teetanus



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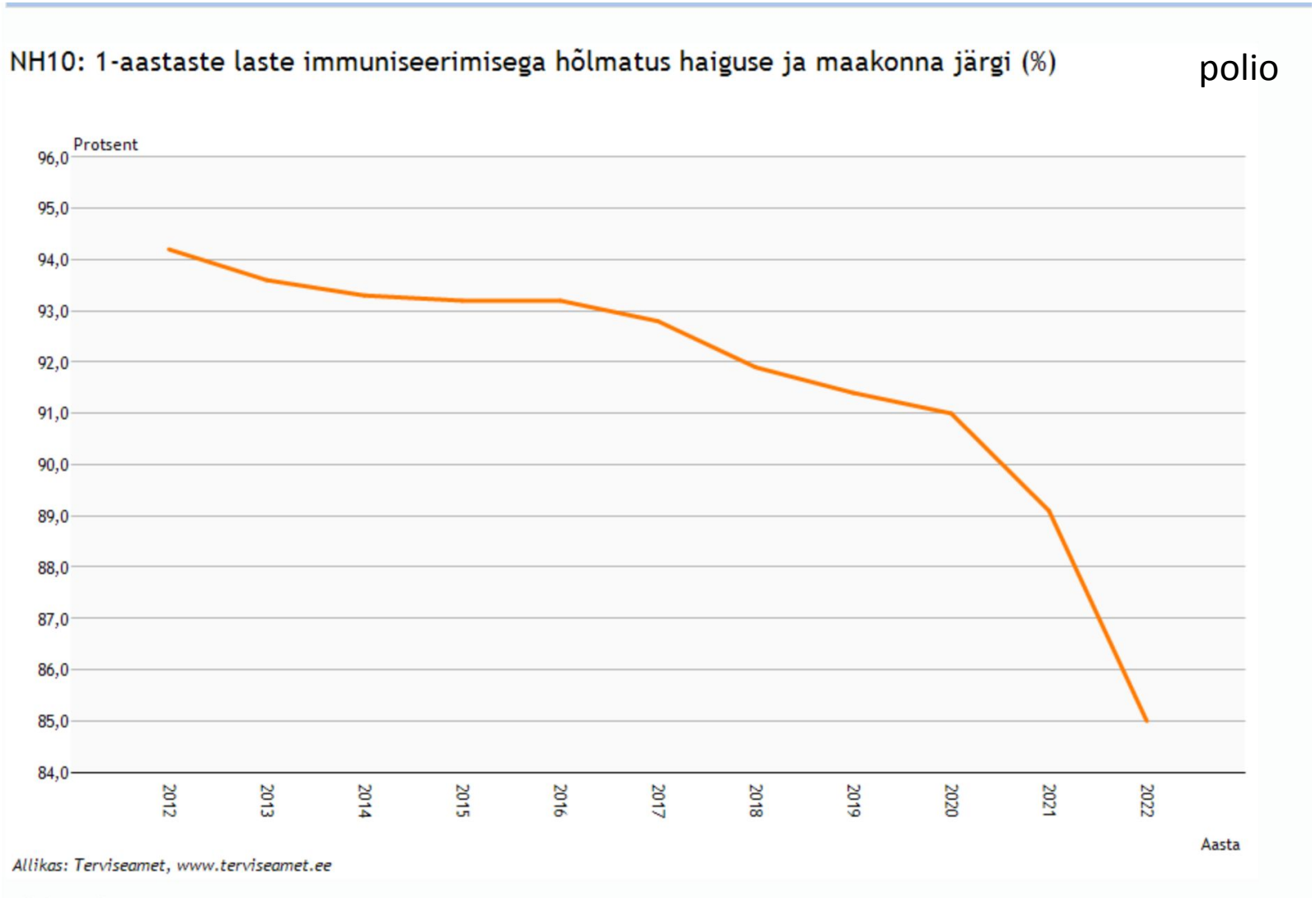

polio

R_o = 5-7
(10-12)

80-86%
(90%)

Polio	Fecal–oral route	5–7[b]	80–86%

MIDA EESTIS PEAKS TÄNA TEGEMA, ET VAKTSINEERIMINE TÕUSEKS VAJALIKULE TASEMELE?