# Measles elimination:
# How much immunity is necessary?

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**Target 5** ⇨
*Elimination of specific diseases*

***By the year 2000, there should be no indigenous measles, poliomyelitis, neonatal tetanus, congenital rubella, diphtheria, congenital syphilis or indigenous malaria in the Region.***

*This target could be achieved through a well organized primary health care system ensuring effective epidemiological surveillance, vaccination coverage, malaria control measures, education on the risks of syphilis, screening and, when necessary, treatment of expectant mothers.*

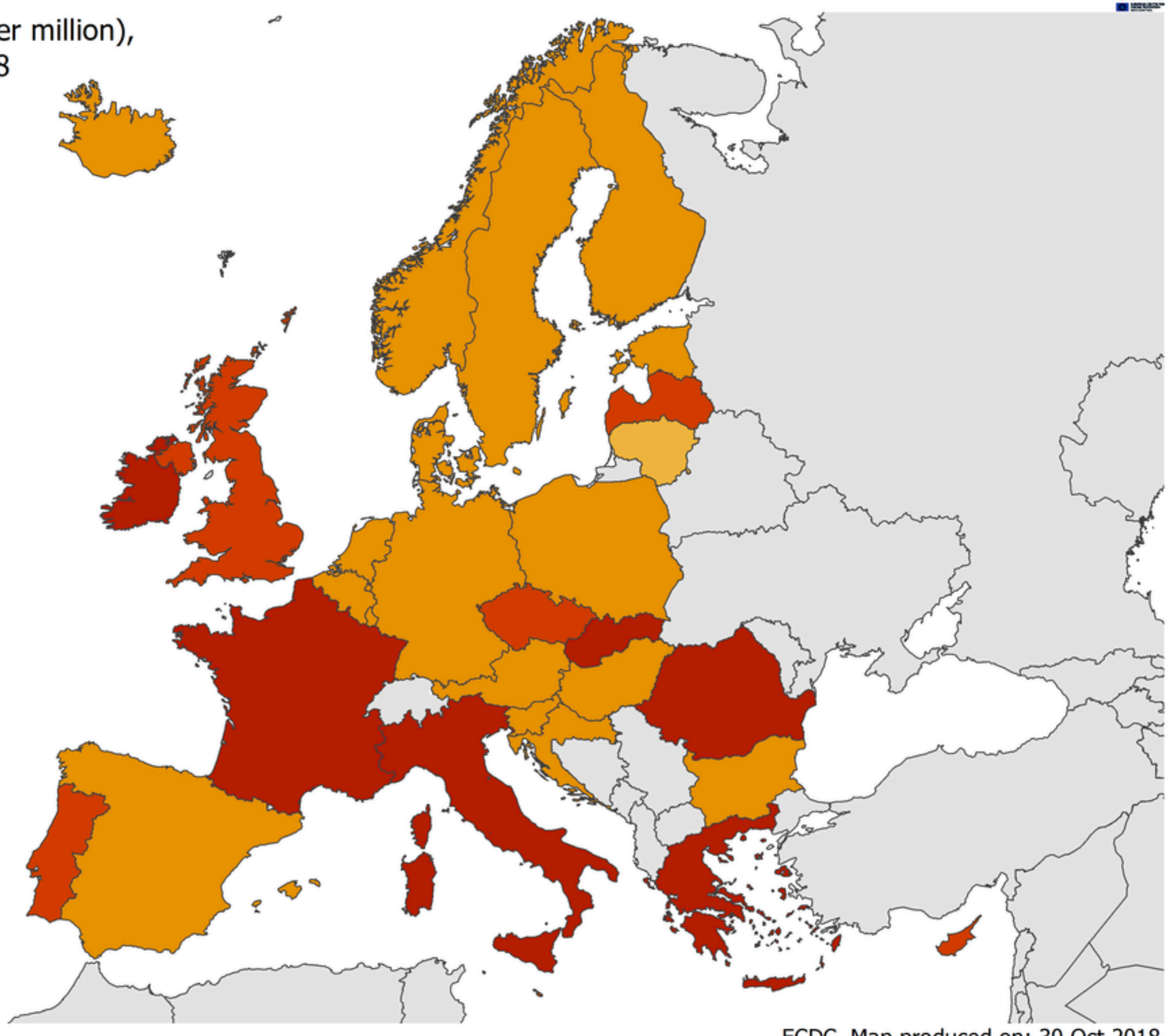
WHO EURO (1985)

Notification rate of measles (per million),
October 2017–September 2018

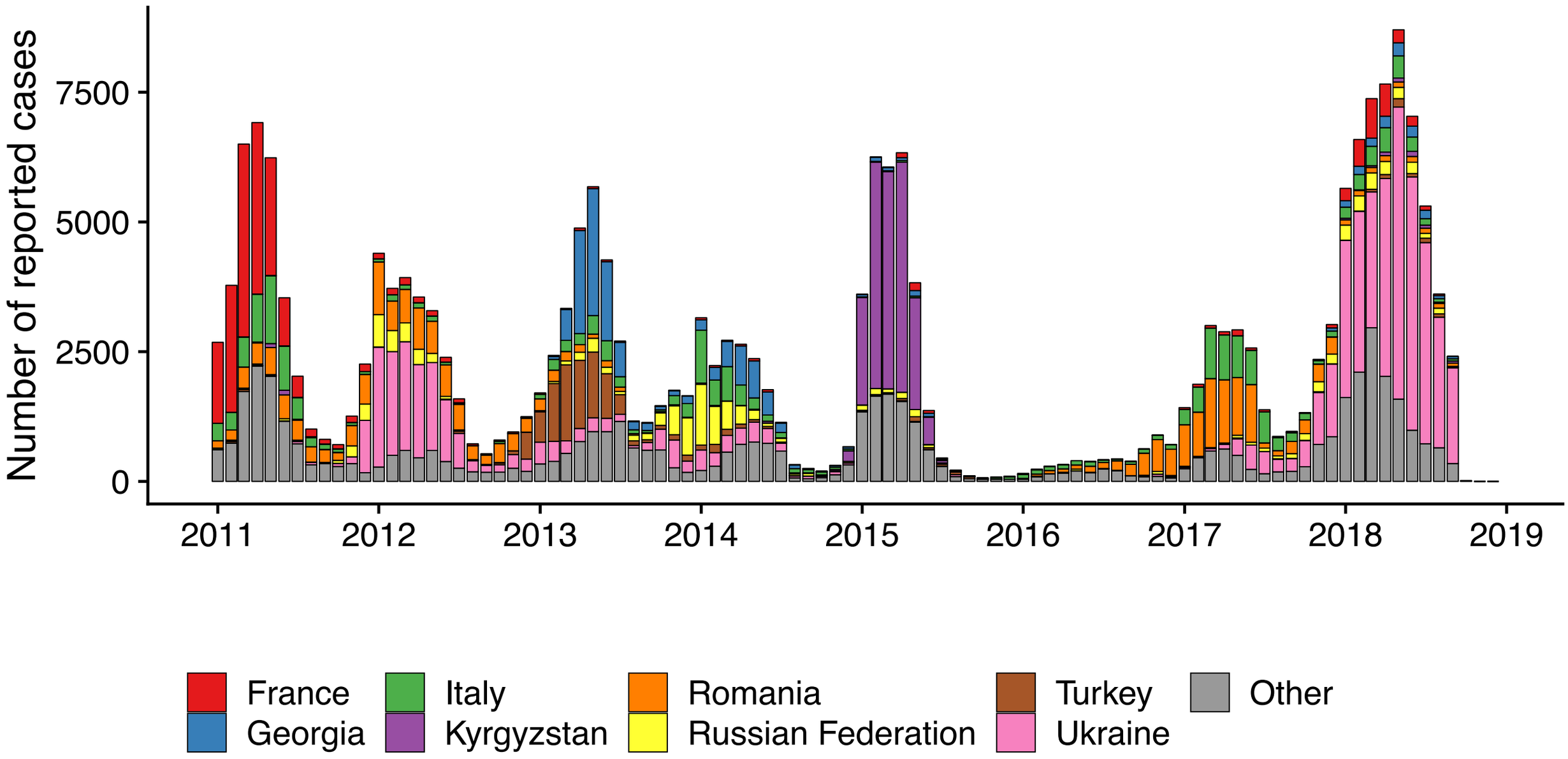
- 0
- 0.01–0.99
- 1.00–9.99
- 10.00–19.99
- ≥20.00

- Not included

- Luxembourg
- Malta



ECDC. Map produced on: 30 Oct 2018
ECDC map maker: https://emma.ecdc.europa.eu

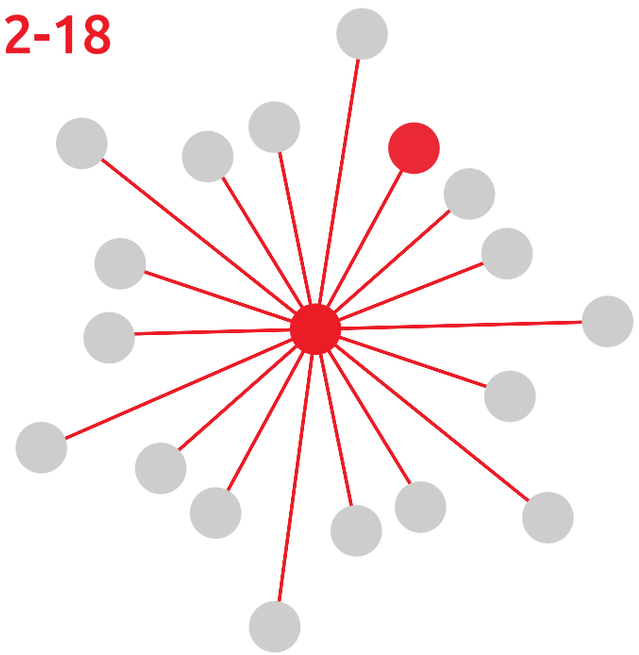

Number of reported cases
7500
5000
2500
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
France
Georgia
Italy
Kyrgyzstan
Romania
Russian Federation
Turkey
Ukraine
Other

Source: WHO

# Measles elimination:
# How much immunity is necessary?

# ~~Basic~~ Reproduction number R

**Measles**
**$R_0$= 12-18**



## Herd-immunity threshold:

Vaccinate at least so many that R = 1.

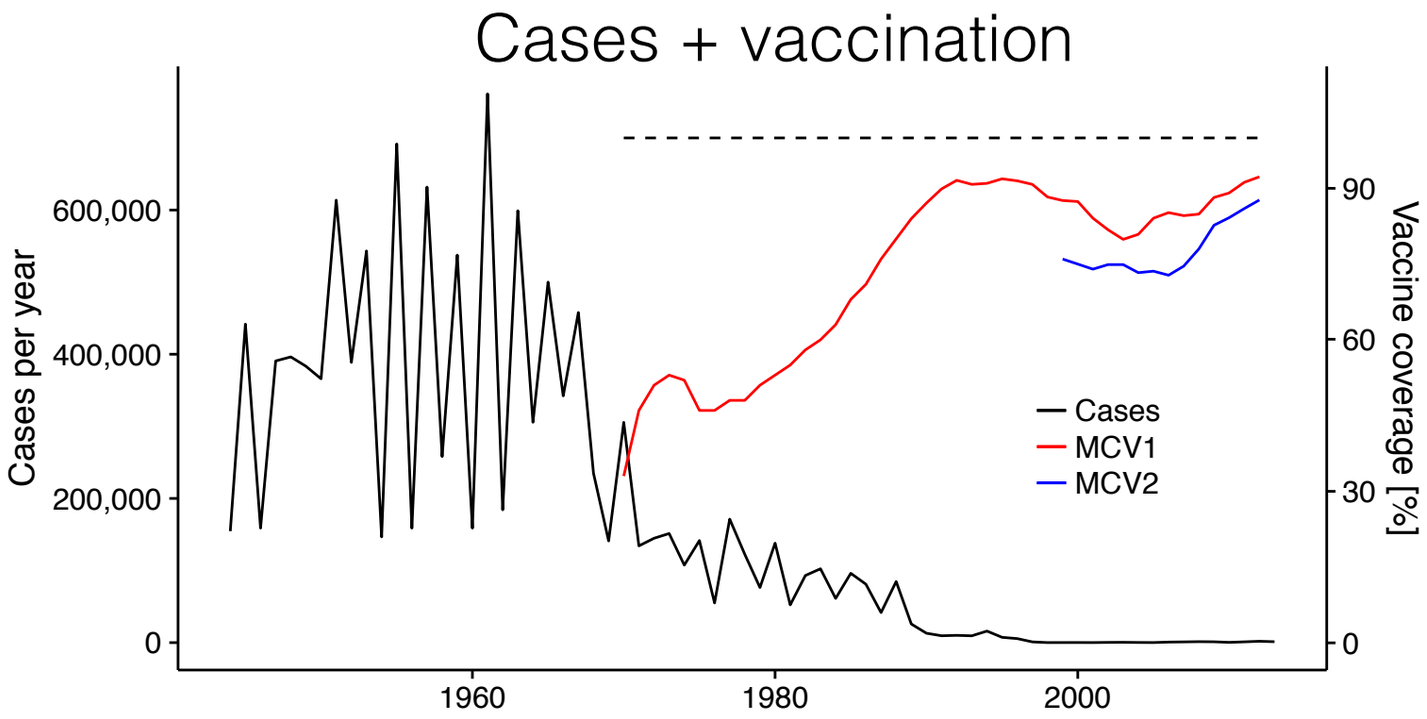
Measles: 93-95%, assuming contacts are random.

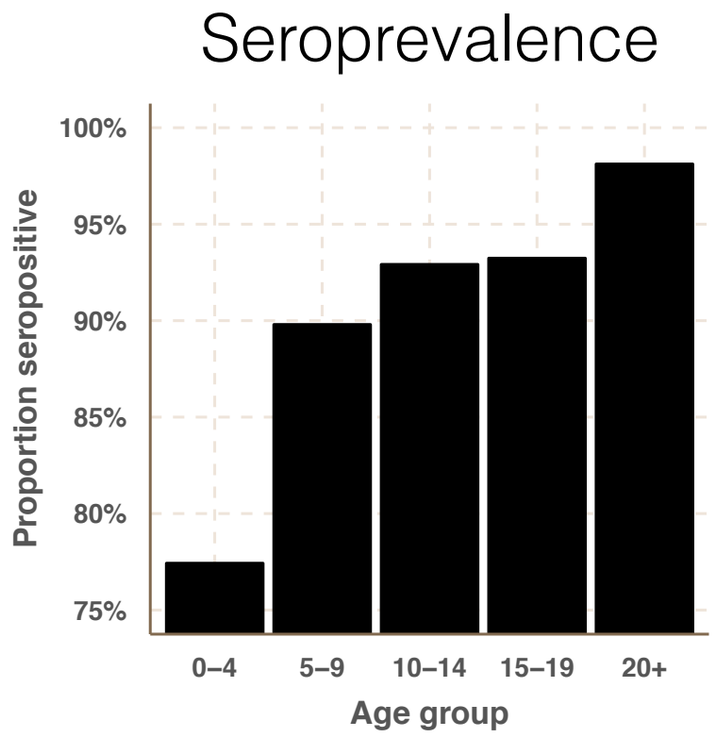
## Limitations:

Population immunity reflects vaccination and case history.

(Person-to-person) contact is age-dependent.

# Measles immunity profile (e.g., UK)

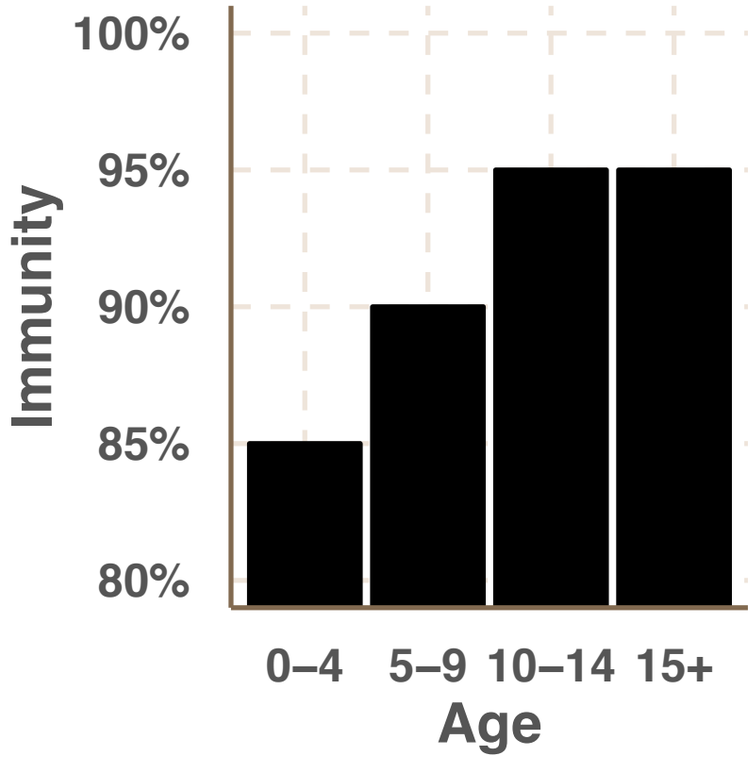



Andrews, 2008

# Target immunity levels for measles

The age specific transmission rates used in the model are derived from age stratified notifications of measles in England and Wales before vaccination was introduced [4]. Similar estimates can be

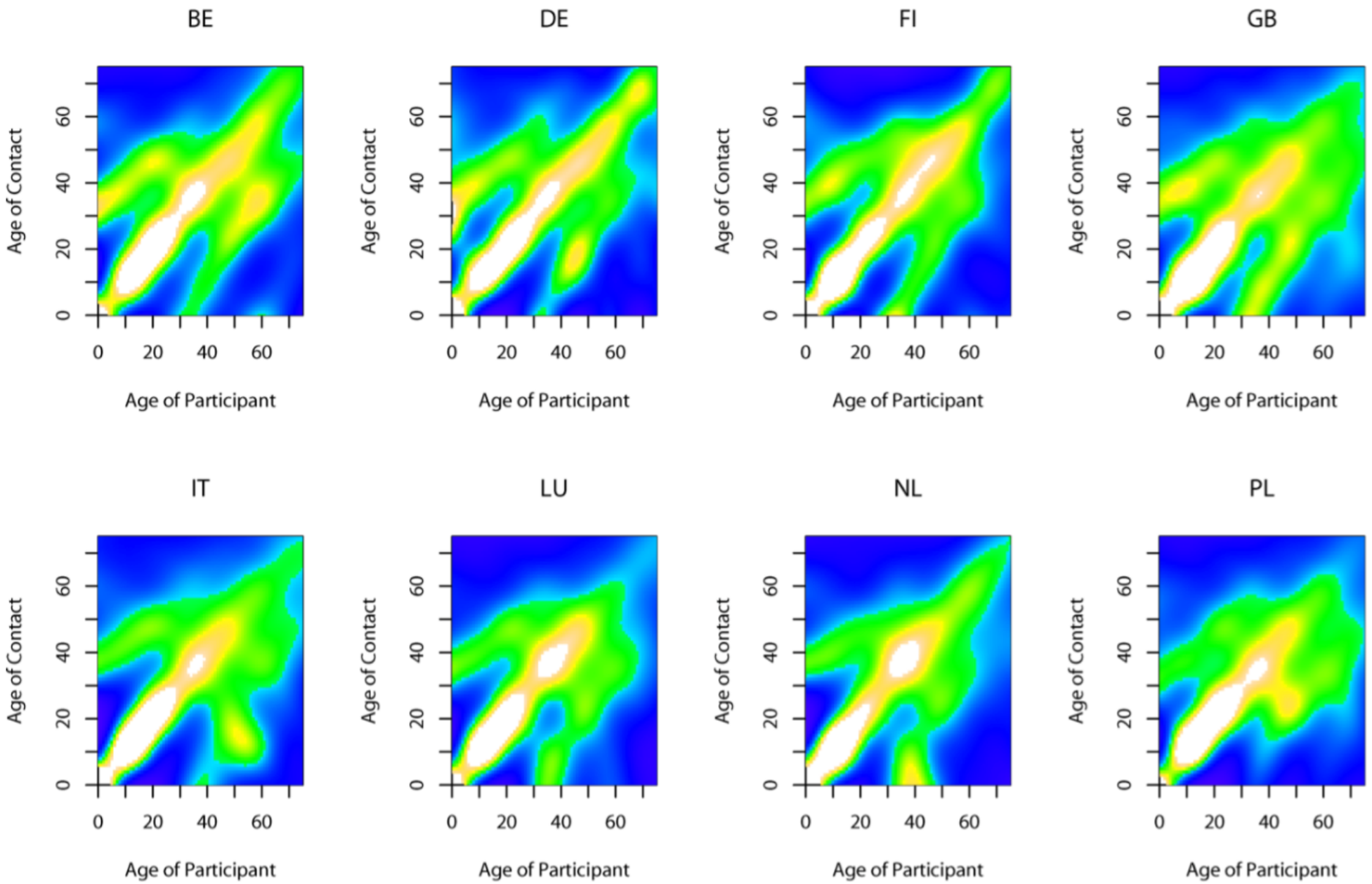



WHO European Region
Ramsay, 1997

Question:

Are these appropriate? If yes, in which settings?

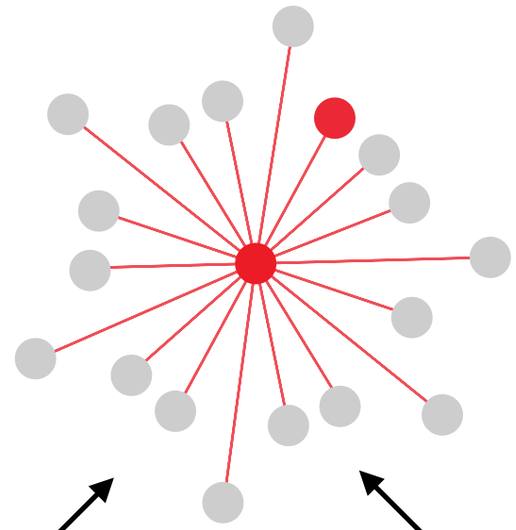
# Age-specific contacts

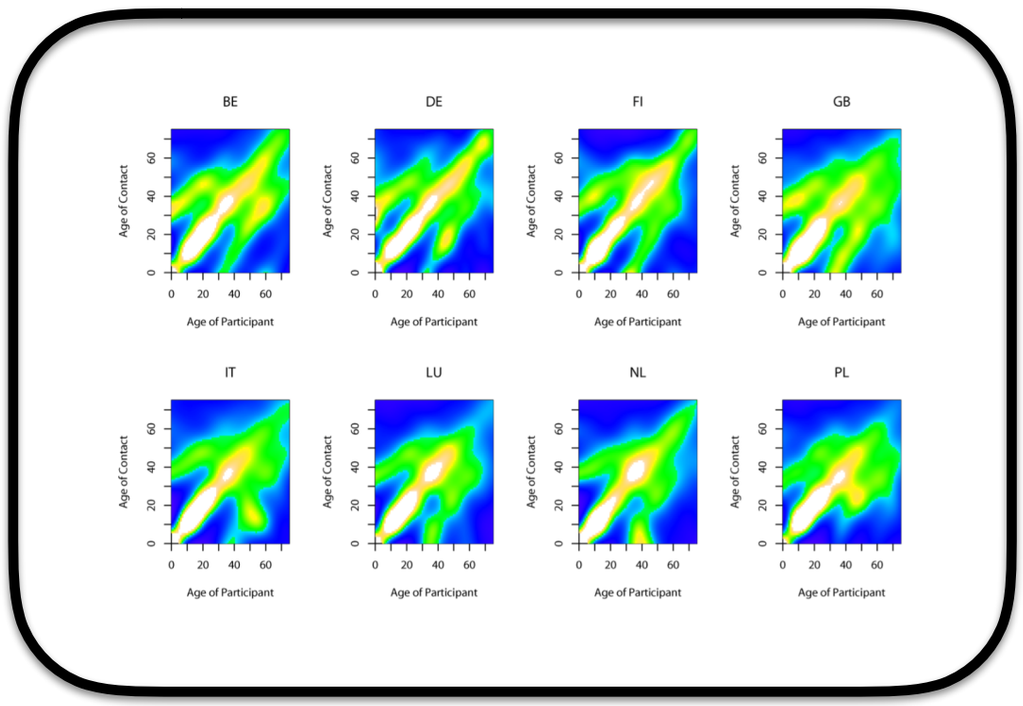


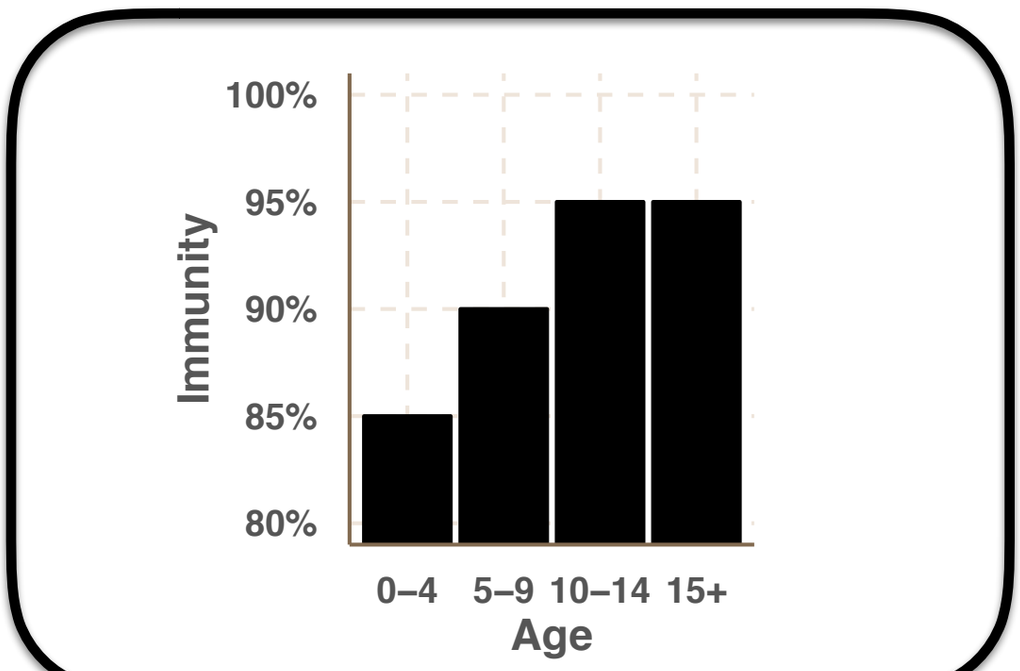

Mossong et al., 2008

# Contact-adjusted immunity:

- Percent of population immune, weighted by contacts.
- Threshold level from serological studies: 93%





Current guidelines

B

C

D

E

Immunity

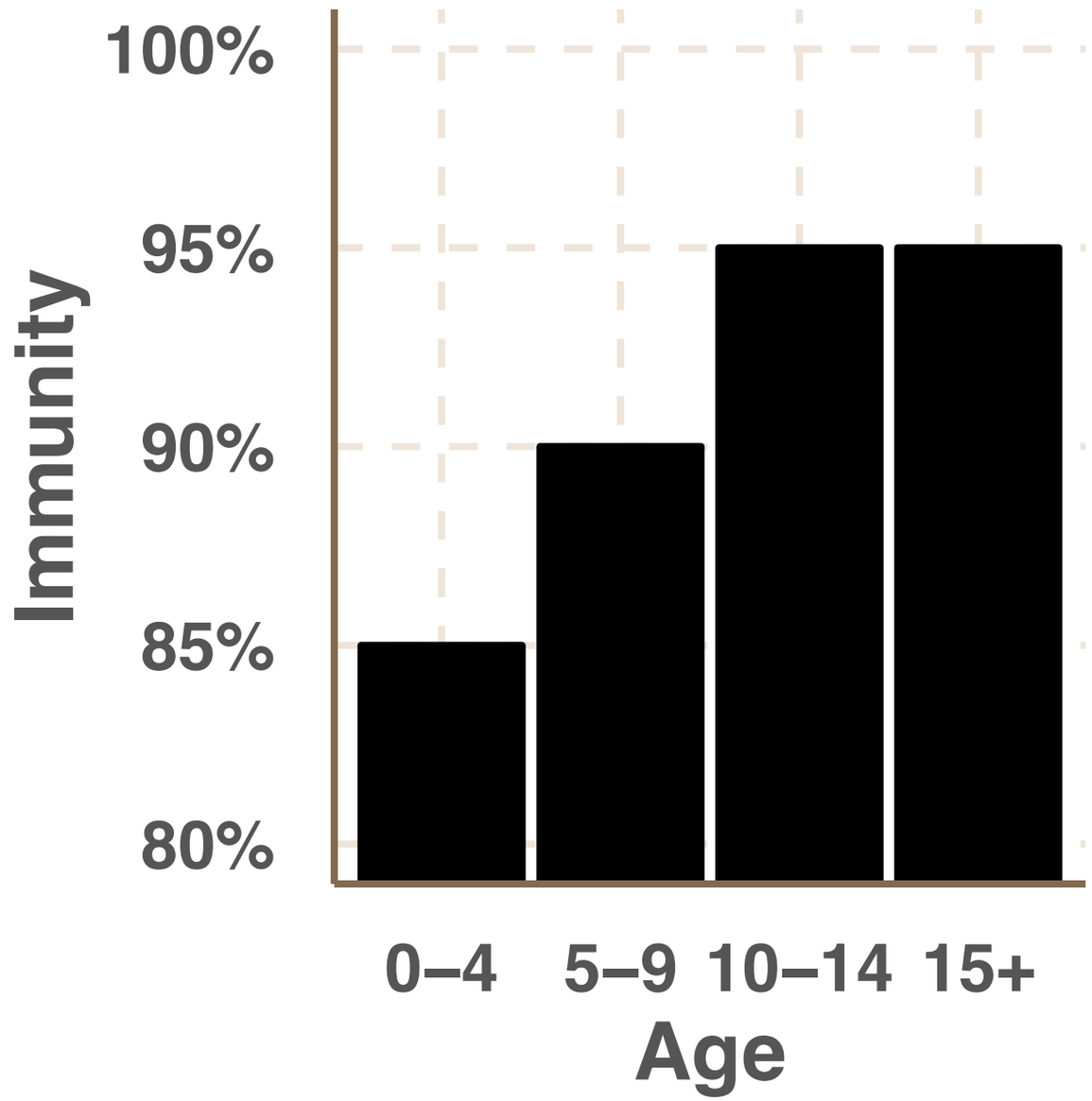
100%
95%
90%
85%
80%

0–4
5–9
10–14
15–19
20+

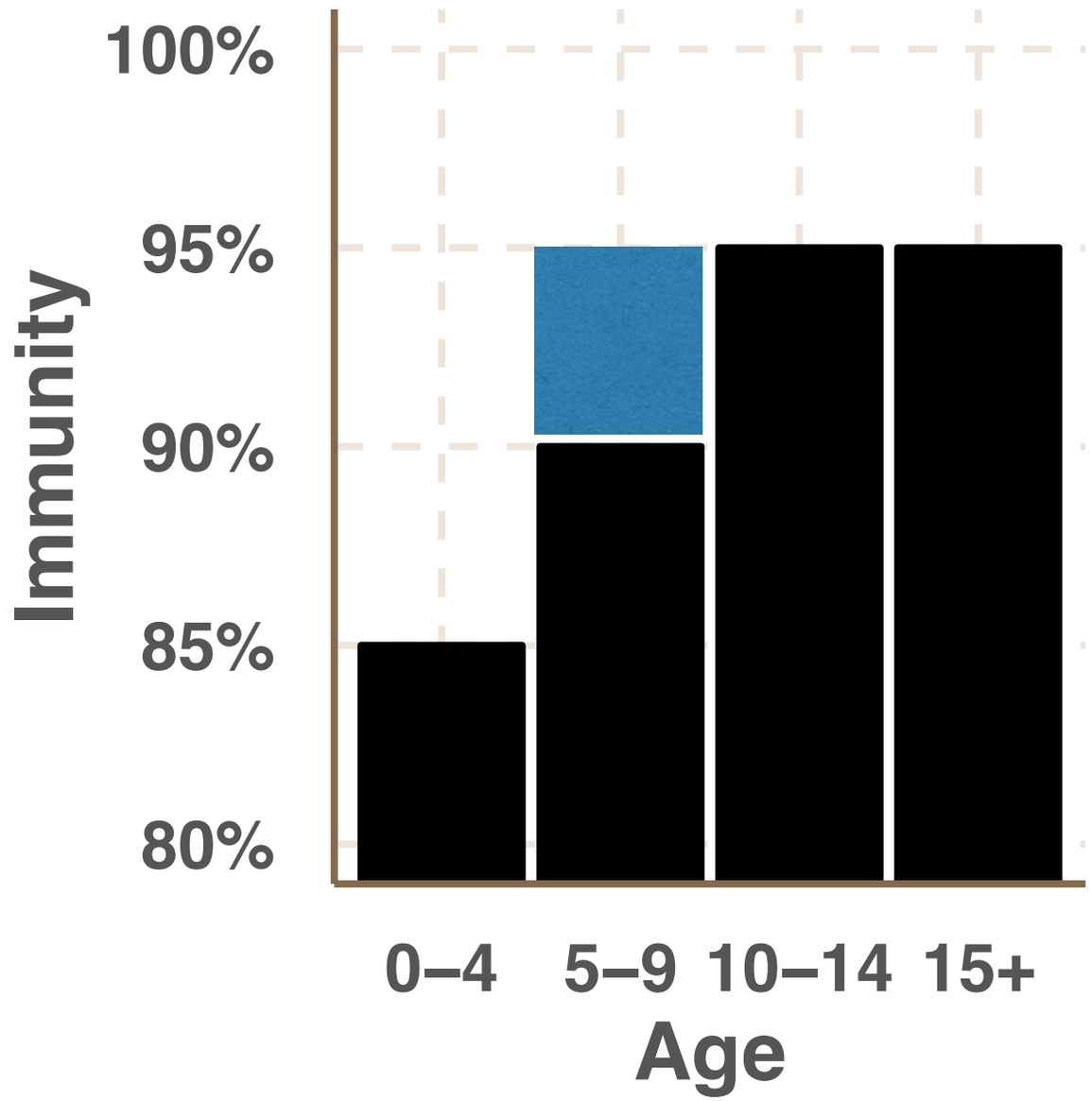
Finland
Germany
Italy
Netherlands
Peru
Poland
Taiwan
Thailand
Uganda
United Kingdom
Vietnam
Zimbabwe

90%
95%

Contact–adjusted immunity



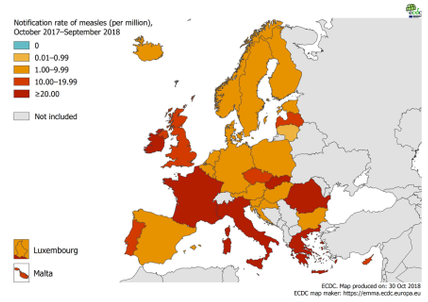

This immunity profile is not sufficient for elimination.



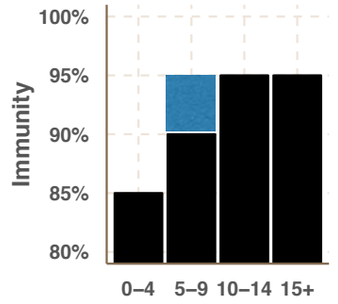

This immunity profile is sufficient for elimination.

# Conclusions

- Large measles outbreaks continue to occur across Europe.




- To guarantee elimination, 95% immunity are needed at the age of school entry.

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