

# The cascade of care: how to make predictions for the early steps?

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Ülkemizde HIV Epidemiyolojisinin Güncel Durumu ve Önleme Stratejileri  
KLİMİK Derneği HIV/AIDS Çalışma Grubu

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# Disclosures

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- The ATHENA database is maintained by Stichting HIV Monitoring and supported by a grant from the Dutch Ministry of Health, Welfare and Sport through the Centre for Infectious Disease Control of the National Institute for Public Health and the Environment.

# Outline

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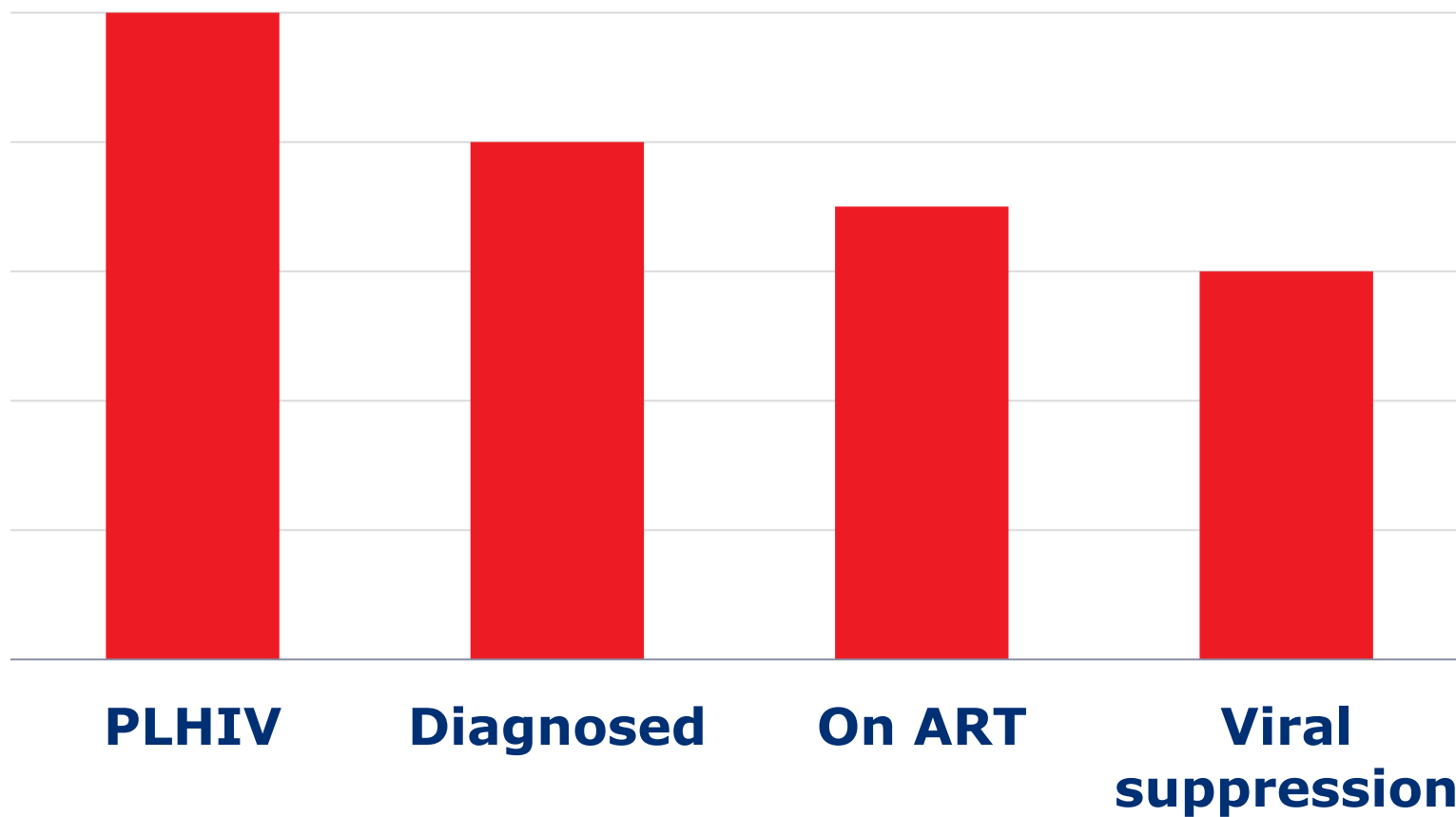
- Continuum of HIV care
- Estimating the number of people living with HIV

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## **Continuum of HIV care**

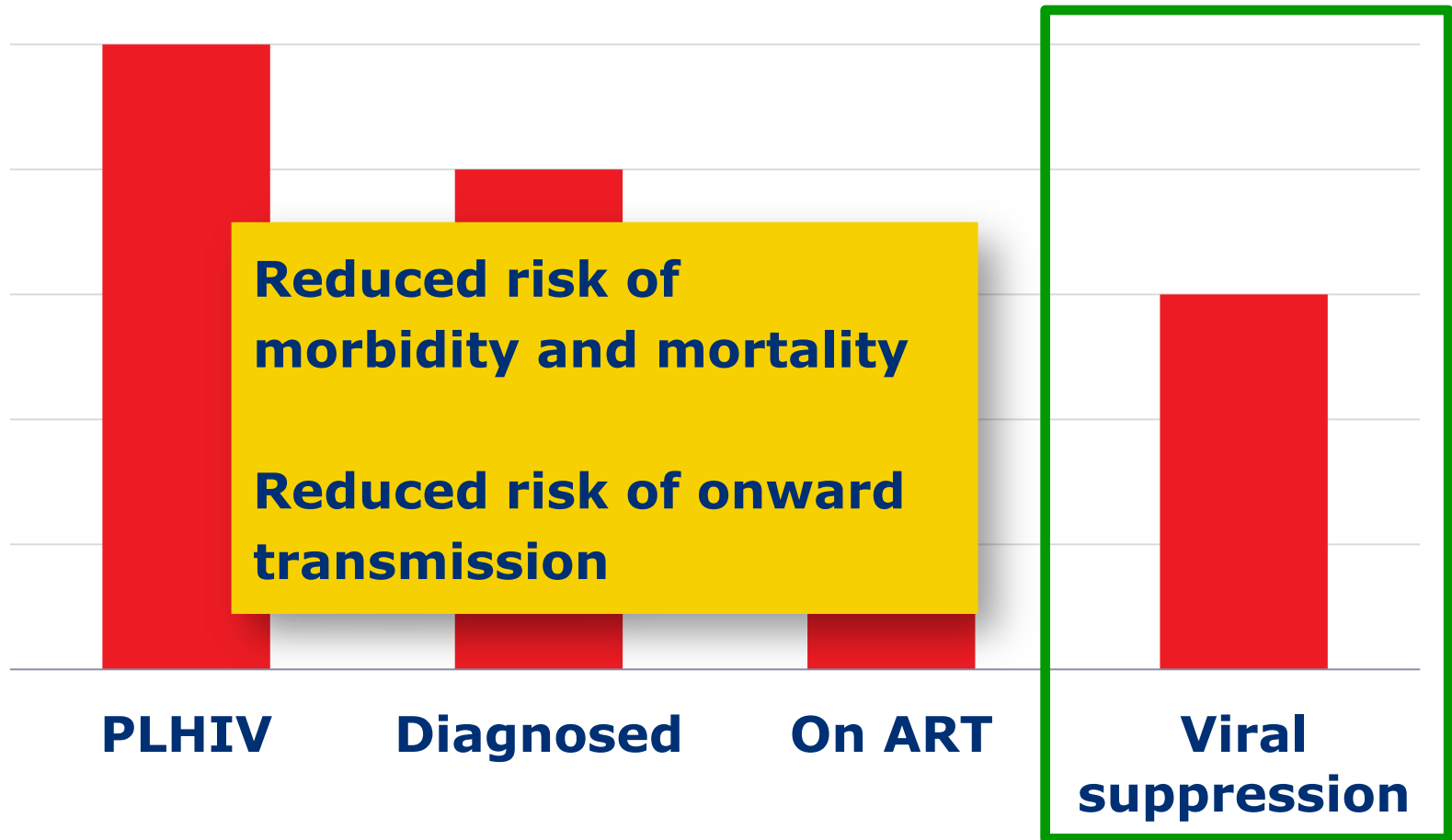
# Continuum of HIV care

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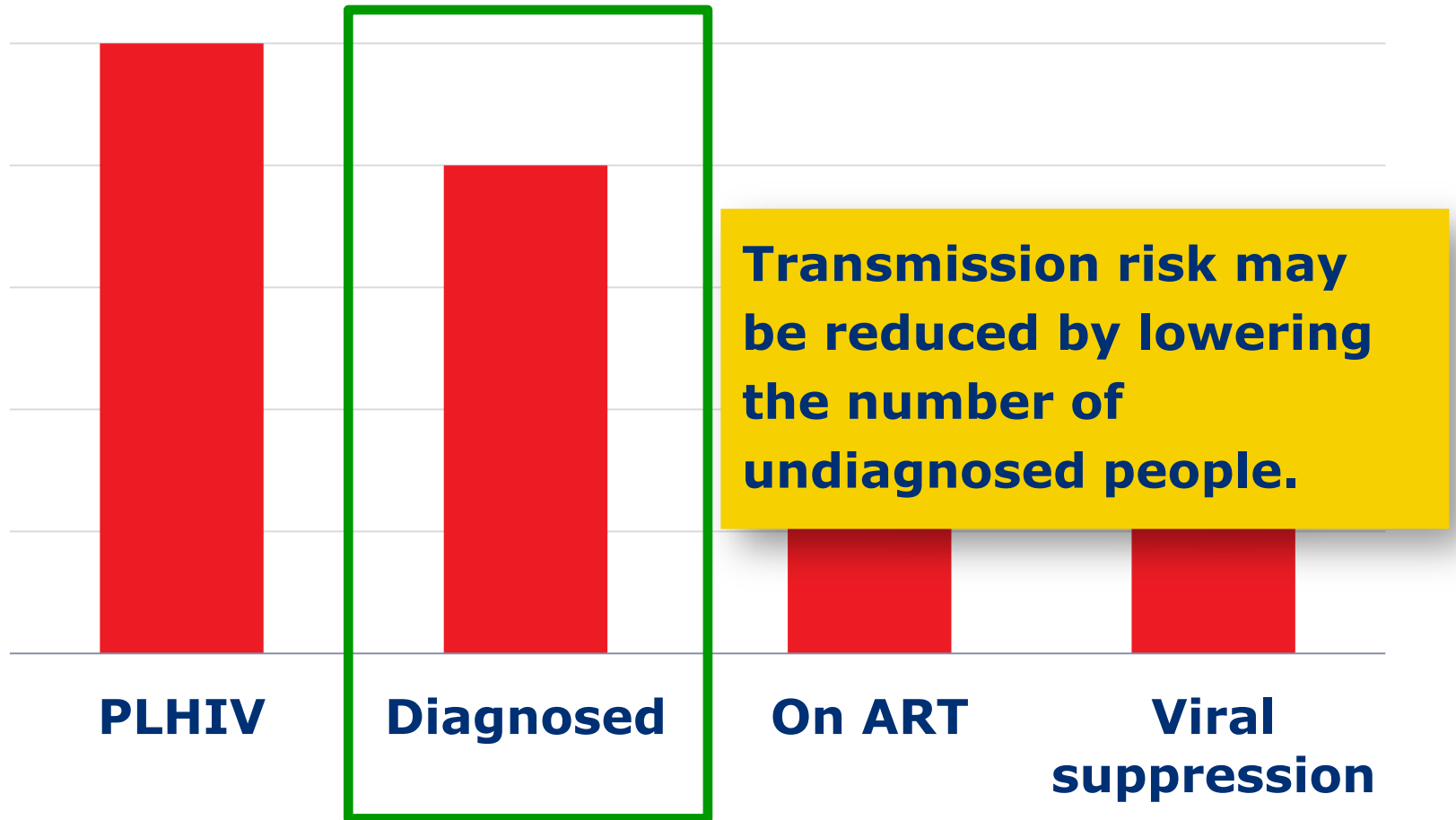
# Continuum of HIV care

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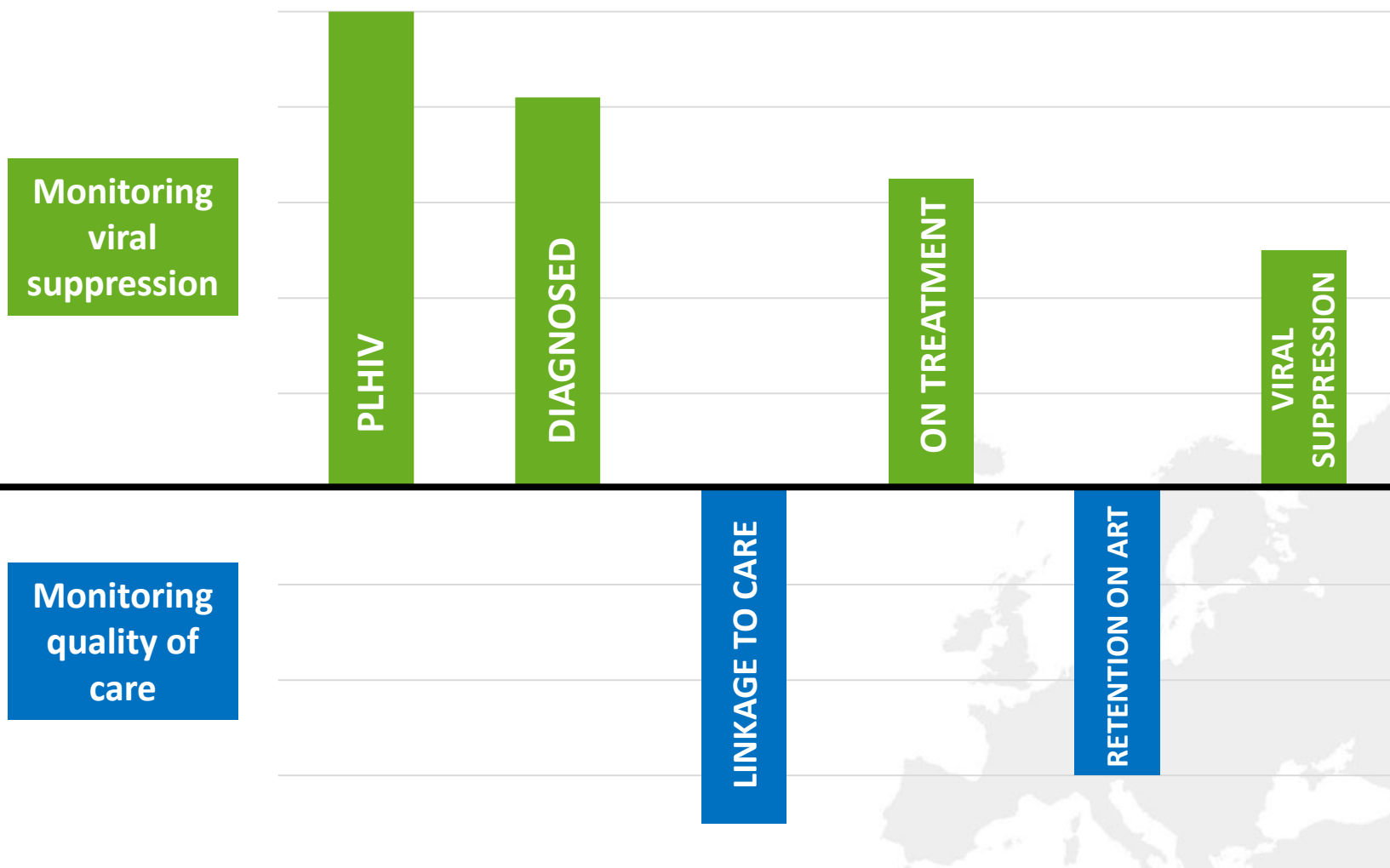


# Continuum of HIV care

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# Monitoring a 4-point continuum





# UNAIDS 90-90-90 targets

## Target 1

90%

of all



living with HIV

**DIAGNOSED**

## Target 2

90%

of all



diagnosed with HIV

**ON ART**

## Target 3

90%

of all



on ART

**VIRALLY  
SUPPRESSED**

=

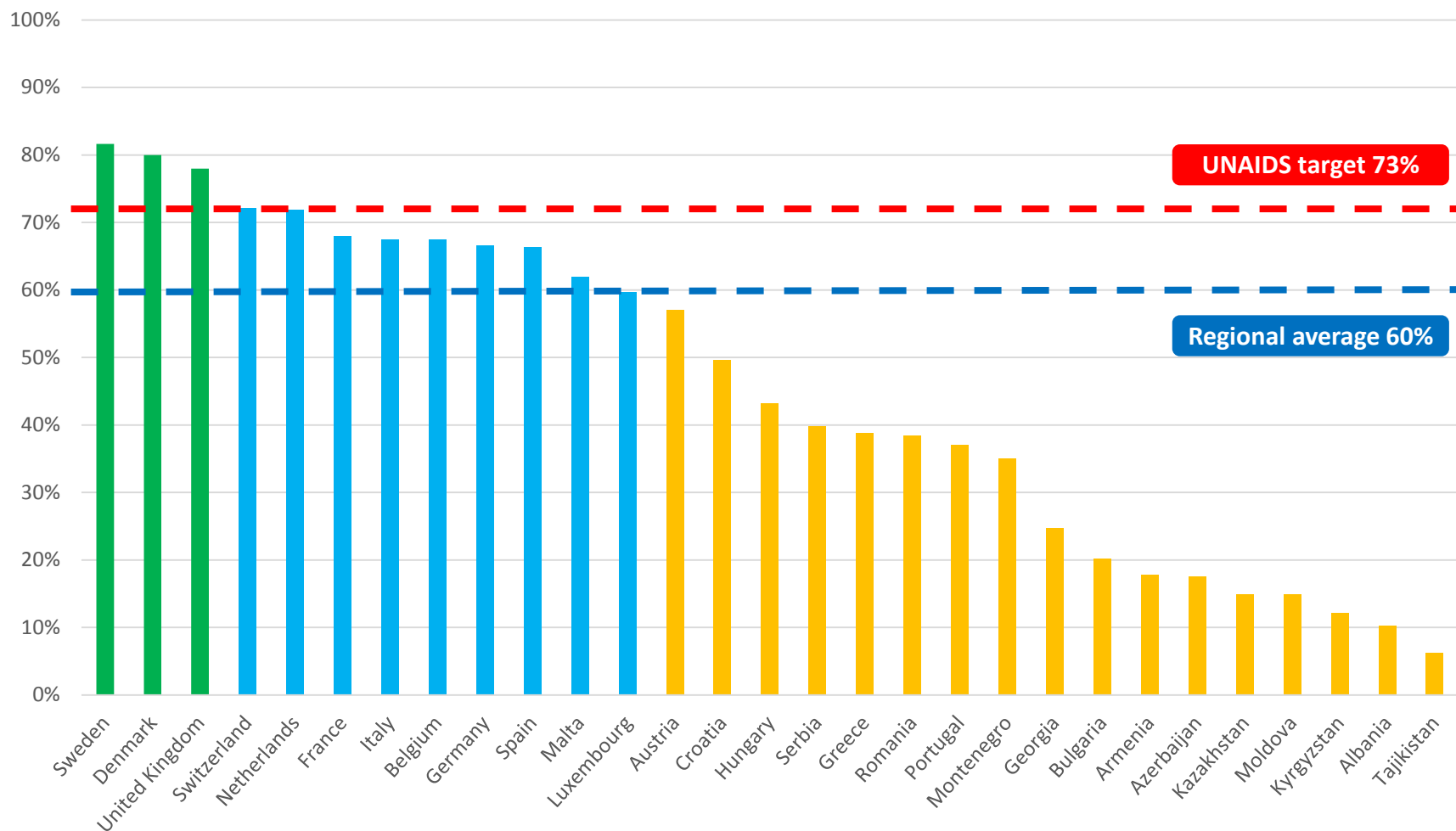
73%

of all people living  
with HIV

**VIRALLY  
SUPPRESSED**

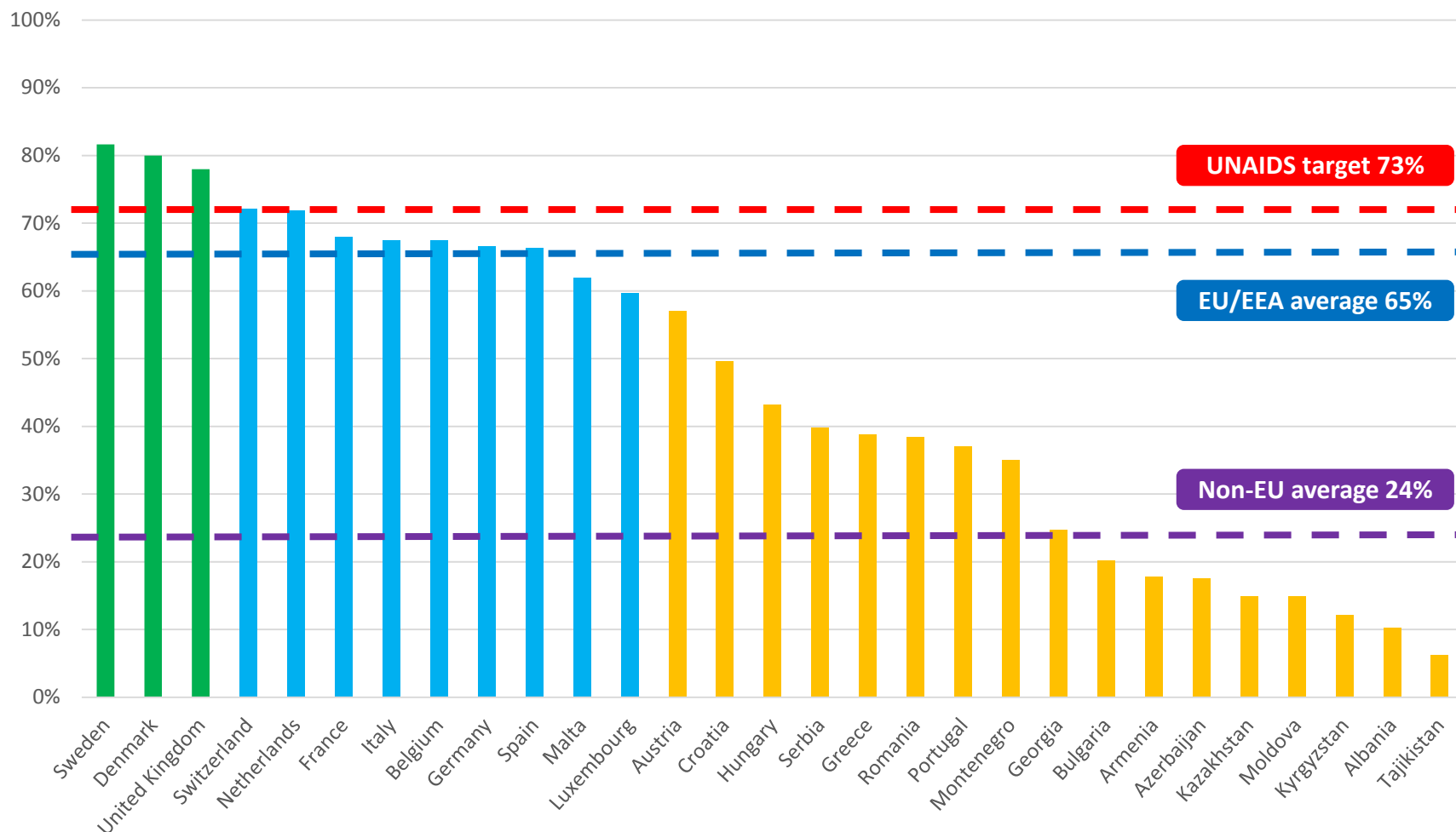
# Progress toward achieving the 90-90-90:

## Target 4: 73% of all PLHIV virally suppressed (n=29/55)



# Progress toward achieving the 90-90-90:

## Target 4: 73% of all PLHIV virally suppressed (n=29/55)



# How close is Europe to reaching the 90-90-90 targets?

## Target 1

90%

of all



living with HIV

**DIAGNOSED**

## Target 2

90%

of all



diagnosed with HIV

**ON ART**

## Target 3

90%

of all



on ART

**VIRALLY  
SUPPRESSED**

=

## Target 4

73%

of all people living  
with HIV

**VIRALLY  
SUPPRESSED**

75%

**DIAGNOSED**

77%

**ON ART**

88%

**VIRALLY  
SUPPRESSED**

60%

**OF ALL PLHIV  
ARE VIRALLY  
SUPPRESSED**

# Towards standardised definitions...

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- Limited consistency in methods and definitions used to construct the stages in the HIV care continuum.
- Difficult to compare and combine results across countries.

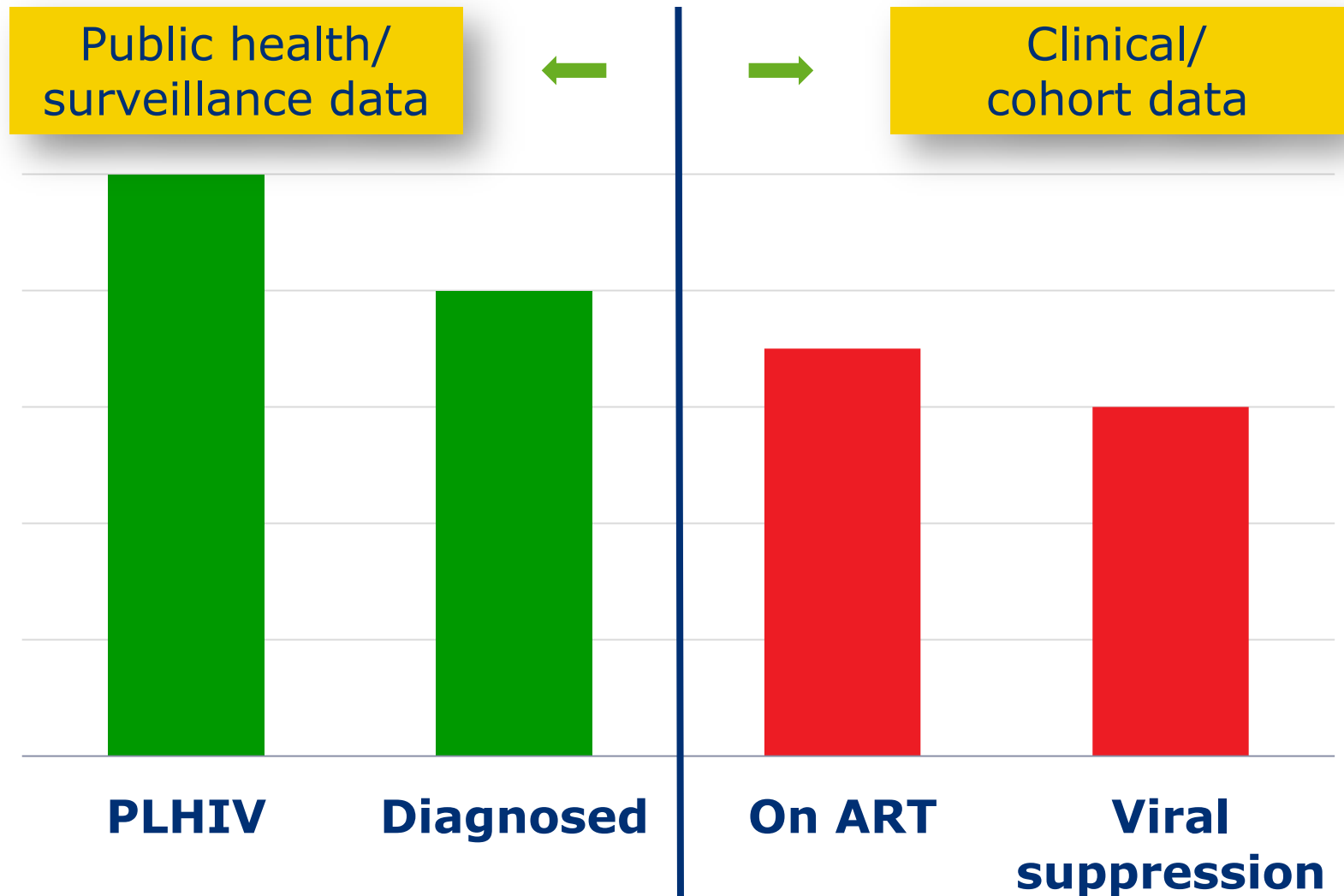
## **Towards standardized definitions for monitoring the continuum of HIV care in Europe**

**Annabelle J. Gourlay<sup>a</sup>, Anastasia M. Pharris<sup>b</sup>, Teymur Noori<sup>b</sup>,  
Virginie Supervie<sup>c</sup>, Magdalena Rosinska<sup>d</sup>, Ard van Sighem<sup>e</sup>,  
Giota Touloumi<sup>f</sup> and Kholoud Porter<sup>a</sup>**

*AIDS* 2017, **31**:2053–2058

**Keywords:** continuity of patient care, epidemiologic measurements, epidemiological monitoring, Europe, HIV infections, public health surveillance, sustained virologic response

# Bringing together HIV surveillance and clinical data



# EuroCoord/ECDC collaboration on estimating the continuum of care



- ECDC project with UCL & EuroCoord on estimating the continuum of care using surveillance and cohort data
- Using standard definitions and high quality data sources

## The HIV continuum of care in European Union countries in 2013: data and challenges

Annabelle Gourlay<sup>1</sup>, Teymur Noori<sup>2</sup>, Anastasia Pharris<sup>2</sup>, Maria Axelsson<sup>3</sup>, Dominique Costagliola<sup>4</sup>, Susan Cowan<sup>5</sup>, Sara Croxford<sup>6</sup>, Antonella d'Arminio Monforte<sup>7</sup>, Julia del Amo<sup>8</sup>, Valerie Delphech<sup>6</sup>, Asunción Díaz<sup>6</sup>, Enrico Girardi<sup>9</sup>, Barbara Günsheimer-Bartmeyer<sup>10</sup>, Victoria Hernandez<sup>8</sup>, Sophie Jose<sup>1</sup>, Gisela Leierer<sup>11</sup>, Georgios Nikolopoulos<sup>12,13</sup>, Niels Obel<sup>14</sup>, Eline Op de Coul<sup>15</sup>, Dimitra Paraskeva<sup>13</sup>, Peter Reiss<sup>16,17</sup>, Caroline Sabin<sup>1</sup>, André Sasse<sup>18</sup>, Daniela Schmid<sup>19</sup>, Anders Sonnerborg<sup>20</sup>, Alexander Spina<sup>19</sup>, Barbara Suligoi<sup>21</sup>, Virginie Supervie<sup>4</sup>, Giota Touloumi<sup>22</sup>, Dominique Van Beckhoven<sup>18</sup>, Ard van Sighem<sup>16</sup>, Georgia Vourli<sup>22</sup>, Robert Zangerle<sup>11</sup>, Kholoud Porter<sup>1</sup> and the European HIV continuum of care working group

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Number of words: abstract (250), manuscript (3071)

Tables (3), Figures (1), Supplementary file (1)

Key words: HIV infection; continuum of care; surveillance; cohort analysis; antiretroviral therapy

40 word summary: Definitions for a four-stage continuum of HIV care were standardised and applied to HIV surveillance and national cohort data in 11 European Union countries. These countries are nearing the UNAIDS 90-90-90 target, although reducing the proportion undiagnosed remains challenging.

# Surveillance and cohort leads in participating countries

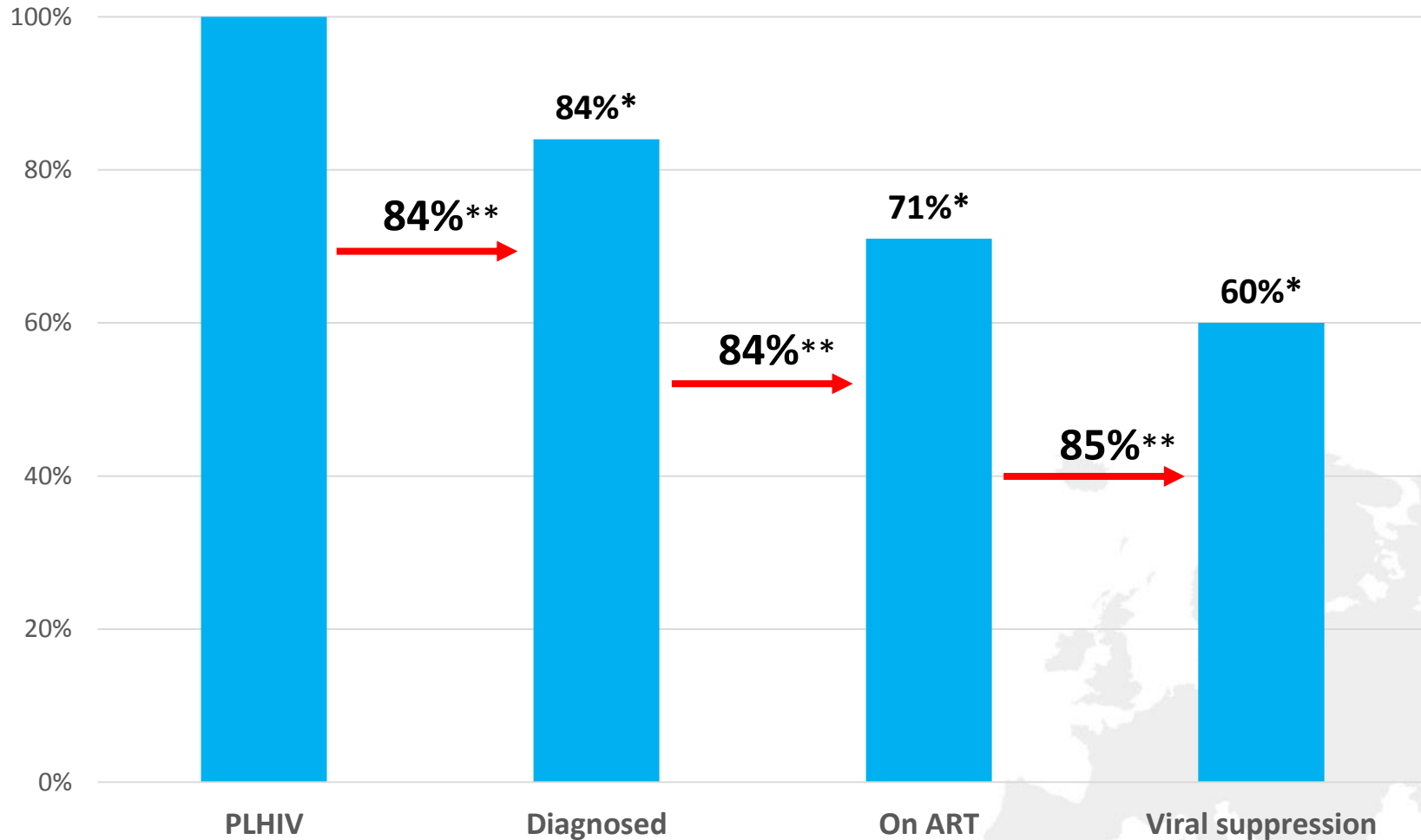
Country	Surveillance leads	Cohort leads
<b>Austria</b>	Daniela Schmid	Robert Zangerle
<b>Belgium</b>	Andre Sasse/Dominique Van Beckhoven	Andre Sasse/Dominique Van Beckhoven
<b>Denmark</b>	Susan Cowan	Niels Obel
<b>France</b>	Florence Lot/Francoise Cazein	Dominique Costagliola/Virginie Supervie
<b>Germany</b>	Barbara Bartmeyer	Barbara Bartmeyer
<b>Greece</b>	Georgios Nikolopoulos	Giota Touloumi
<b>Italy</b>	Barbara Suligoj	Antonella d' Arminio Monforte/Enrico Girardi
<b>Netherlands</b>	Eline Op de Coul	Peter Reiss/Ard van Sighem
<b>Spain</b>	Mercedes Diez/Asuncion Diaz	Julia Del Amo/Vicky Hernando
<b>Sweden</b>	Maria Axelsson	Anders Sönnernborg
<b>United Kingdom</b>	Valerie Delpech	Caroline Sabin



# Surveillance and cohort leads in participating countries

Country	Surveillance leads	Cohort leads
Austria	Daniela Schmid	Robert Zangerle
Belgium	Andre Sasse/Dominique Van Beckhoven	Andre Sasse/Dominique Van Beckhoven
<ul style="list-style-type: none"><li>▪ <b>These 11 countries have a combined population of 378.6 million (74% of the EU population)</b></li><li>▪ <b>The estimated number PLHIV in these 11 countries is 670 000 (<math>\approx</math>80% of all PLHIV in the EU/EEA)</b></li></ul>		
United Kingdom	Valerie Delpech	Caroline Sabin

# HIV continuum using standardised definitions and surveillance/cohort data



\*Percentages out of all PLHIV by end 2013

\*\*Percentages out of the previous step

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## **Estimating the number of people living with HIV**

# Key information for public health monitoring and planning

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## **Burden of HIV:**

- How many people are living with HIV?
- What is the corresponding need for treatment?
- How many are unaware of their infection?

## **Current trends:**

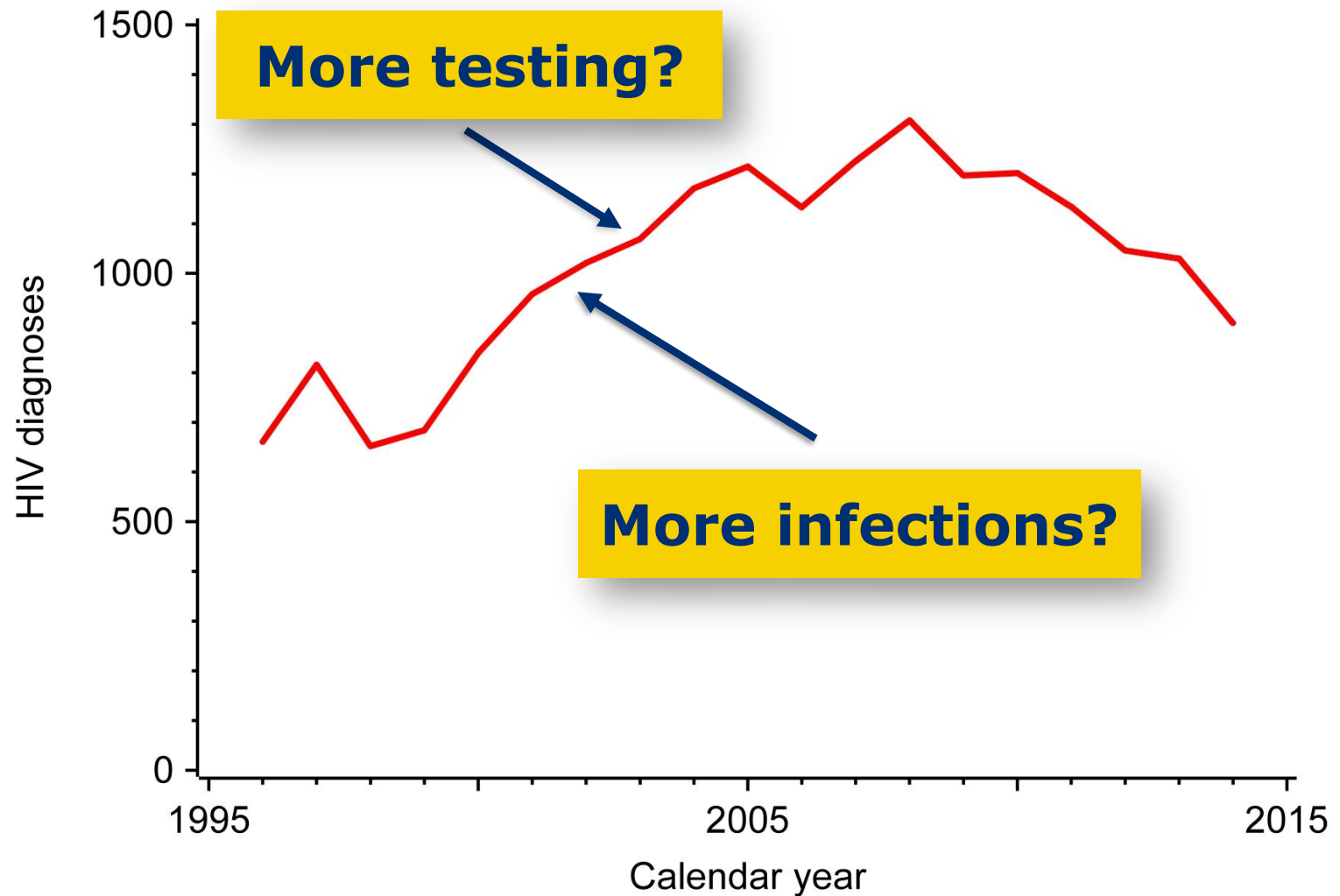
- How many people newly acquire HIV each year?
- What is the time between infection and diagnosis?

# Challenges in concentrated epidemics

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- Estimation methods based on HIV prevalence surveys are less useful in Europe where data are often lacking.
- However, many countries have strong surveillance systems for HIV and AIDS diagnoses:
  - HIV diagnosis is only a proxy for HIV infection.
    - Infection with HIV does not always lead to sufficiently specific symptoms at the time of infection.
    - As a result, diagnosis of HIV is not always close to the time of infection.
  - No direct information on the undiagnosed population.
  - Changes over time in annual number of diagnoses do not necessarily reflect changes in number of infections.

# Challenges in concentrated epidemics



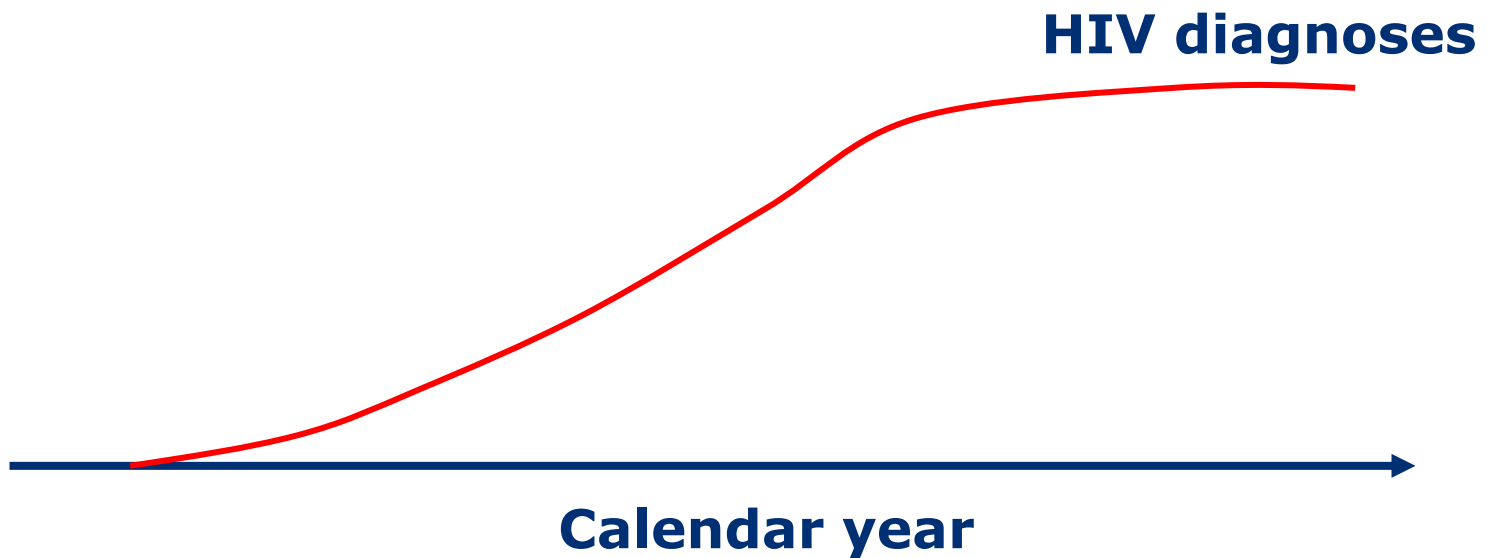
# ECDC HIV Modelling Tool

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- New tools for HIV estimates are available that use data on HIV and AIDS diagnoses:
  - CSAVR in Spectrum
  - **ECDC HIV Modelling Tool**
- ECDC HIV Modelling Tool estimates\*:
  - annual number of newly acquired HIV infections
  - time between infection and diagnosis
  - size of undiagnosed population, stratified by CD4 cell count
- Only need **routinely collected** data on HIV and AIDS, annually reported by many countries to The European Surveillance System (TESSy).

# Back-calculation

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# Back-calculation

**HIV infections**

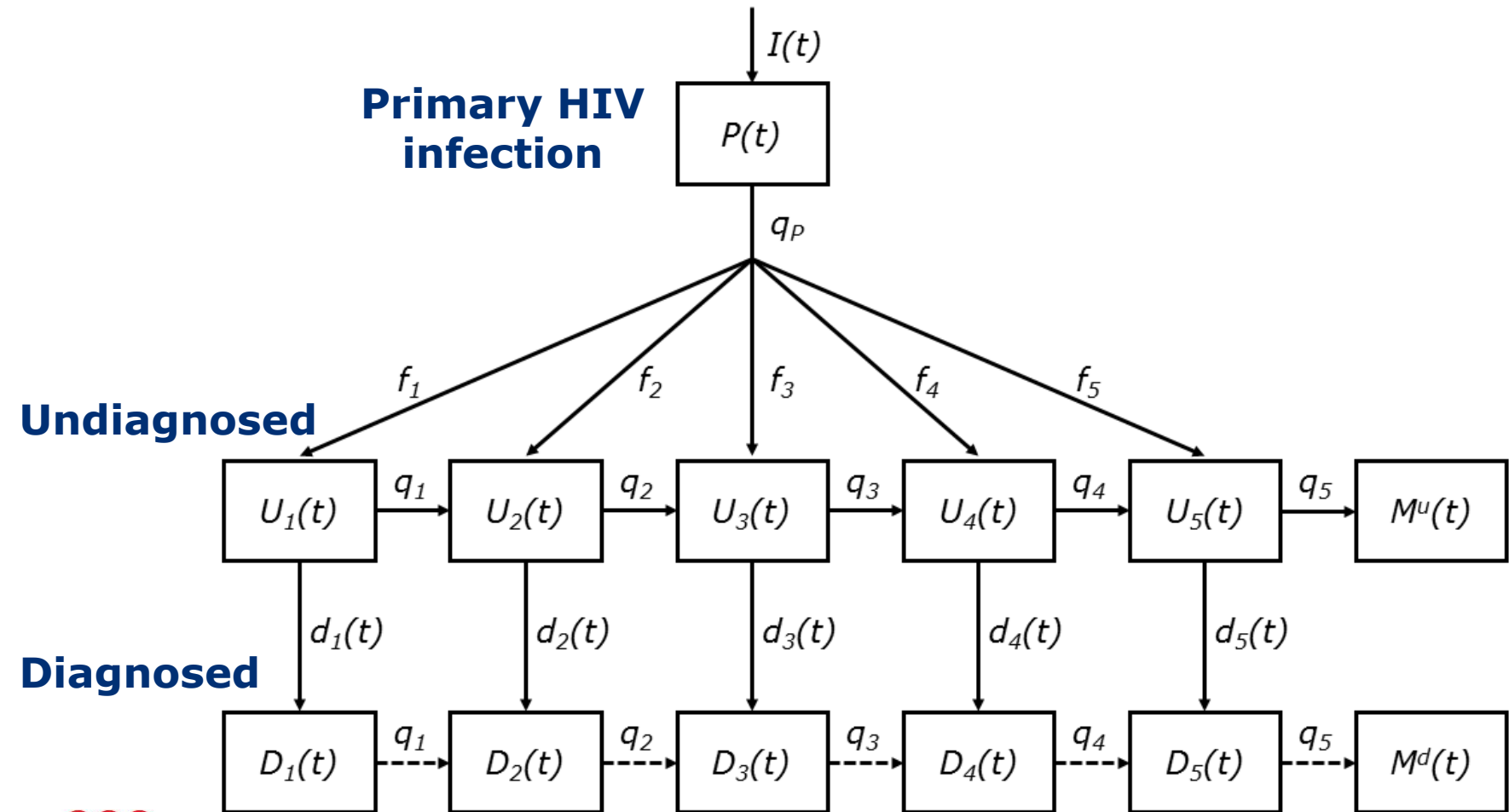
Time between infection and diagnosis

- is *a priori* unknown
- may change over calendar time
- can be estimated with additional data on CD4 counts or AIDS at the time of HIV diagnosis

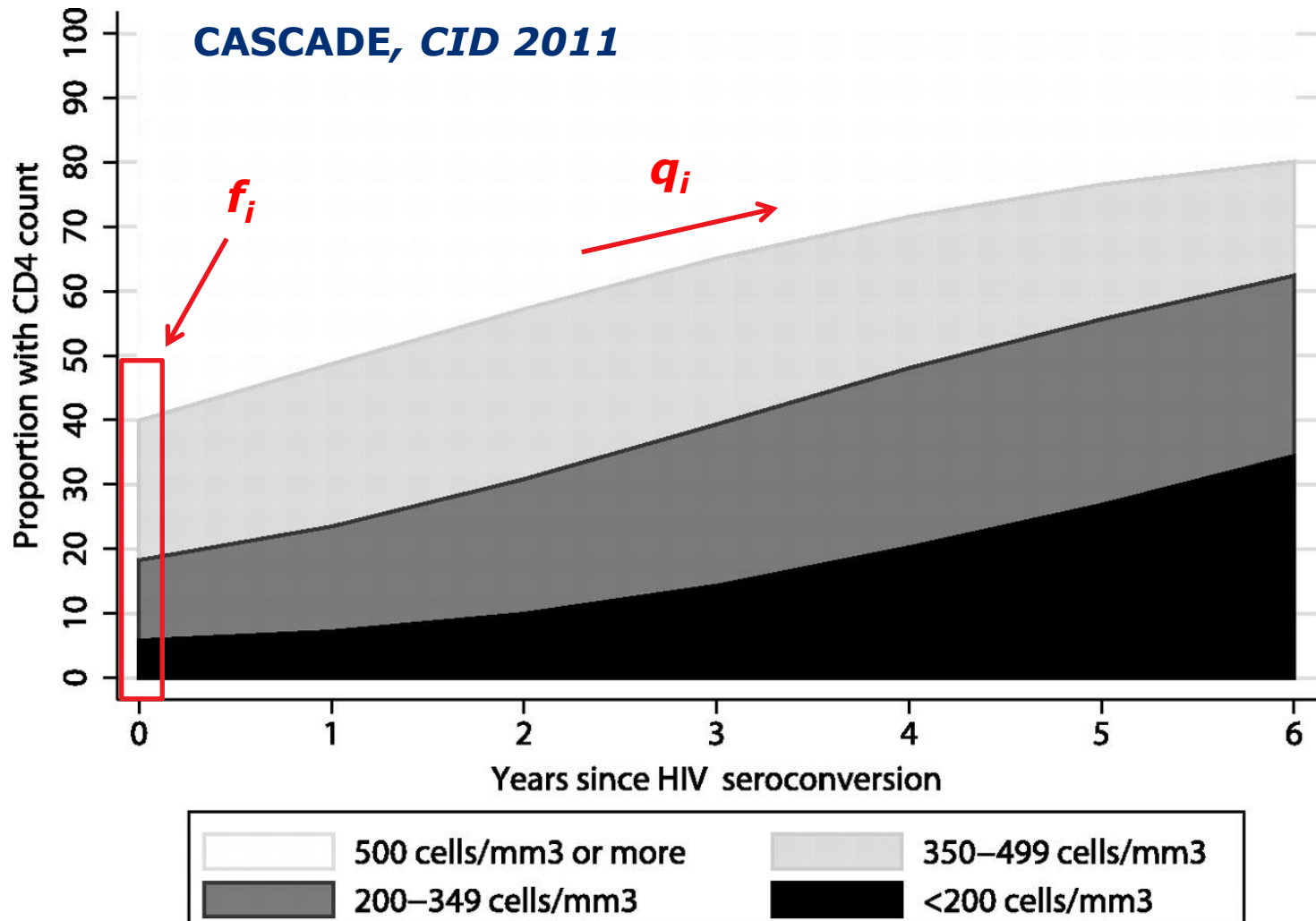
**HIV diagnoses**

**Calendar year**

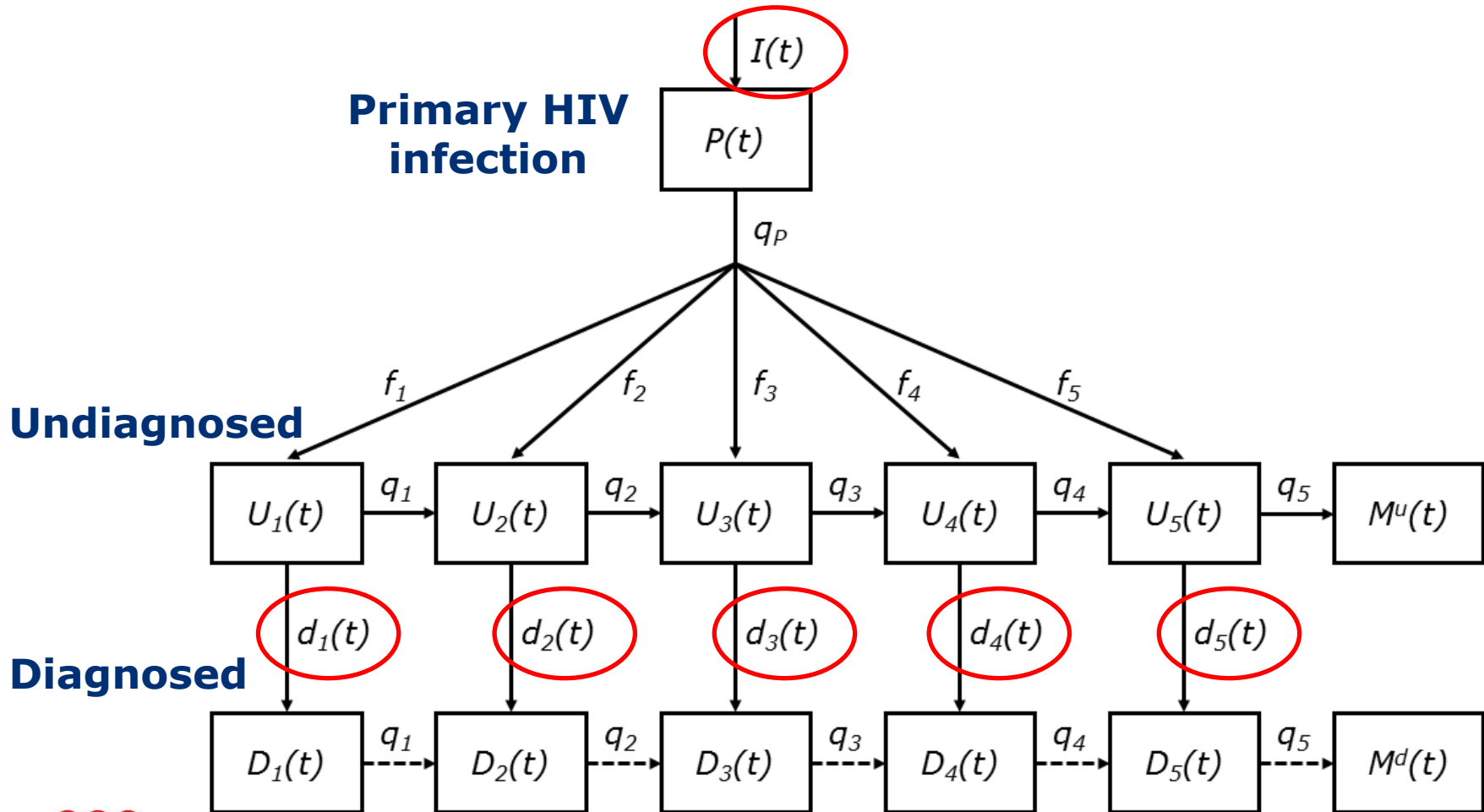
# Incidence Method – underlying model



# Disease progression ( $q_i$ and $f_i$ )



# Incidence Method – underlying model



# Data requirements

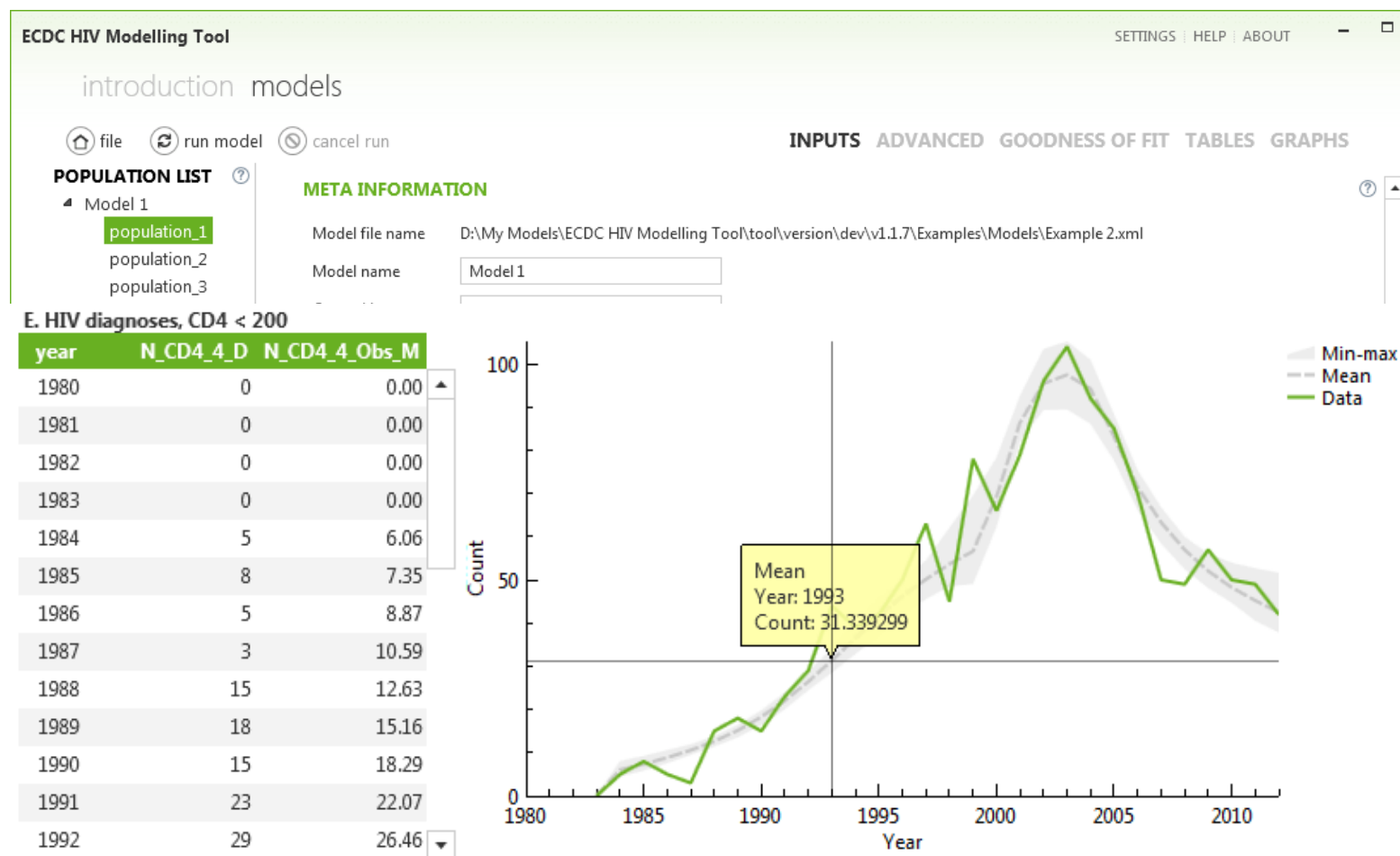
Data item	Remark
HIV diagnoses	assume complete
- HIV/AIDS	assume complete
- CD4 count in people without AIDS	optional; assume unbiased sample
AIDS diagnoses, total	before 1996
Key populations	optional
All-cause mortality	optional; used to determine number living with HIV

## Data structure

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year	pop_1	pop_2	pop_3	pop_4
1984	34	11	2	7
1985	24	8	2	9
1986	22	6	7	18
1987	18	3	17	12
..	..	..	..	..
2011	57	1	128	140
2012	55	1	137	151

# ECDC HIV Modelling Tool



# ECDC HIV Modelling Tool

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## Advisory Team

Fumiyo Nakagawa  
Daniela De Angelis  
Matthias Egger  
Frank de Wolf  
Christophe Fraser  
Andrew Phillips

[ecdc.europa.eu/en/publications-data/hiv-modelling-tool](https://ecdc.europa.eu/en/publications-data/hiv-modelling-tool)

## Tool developer

Daniel Lewandowski

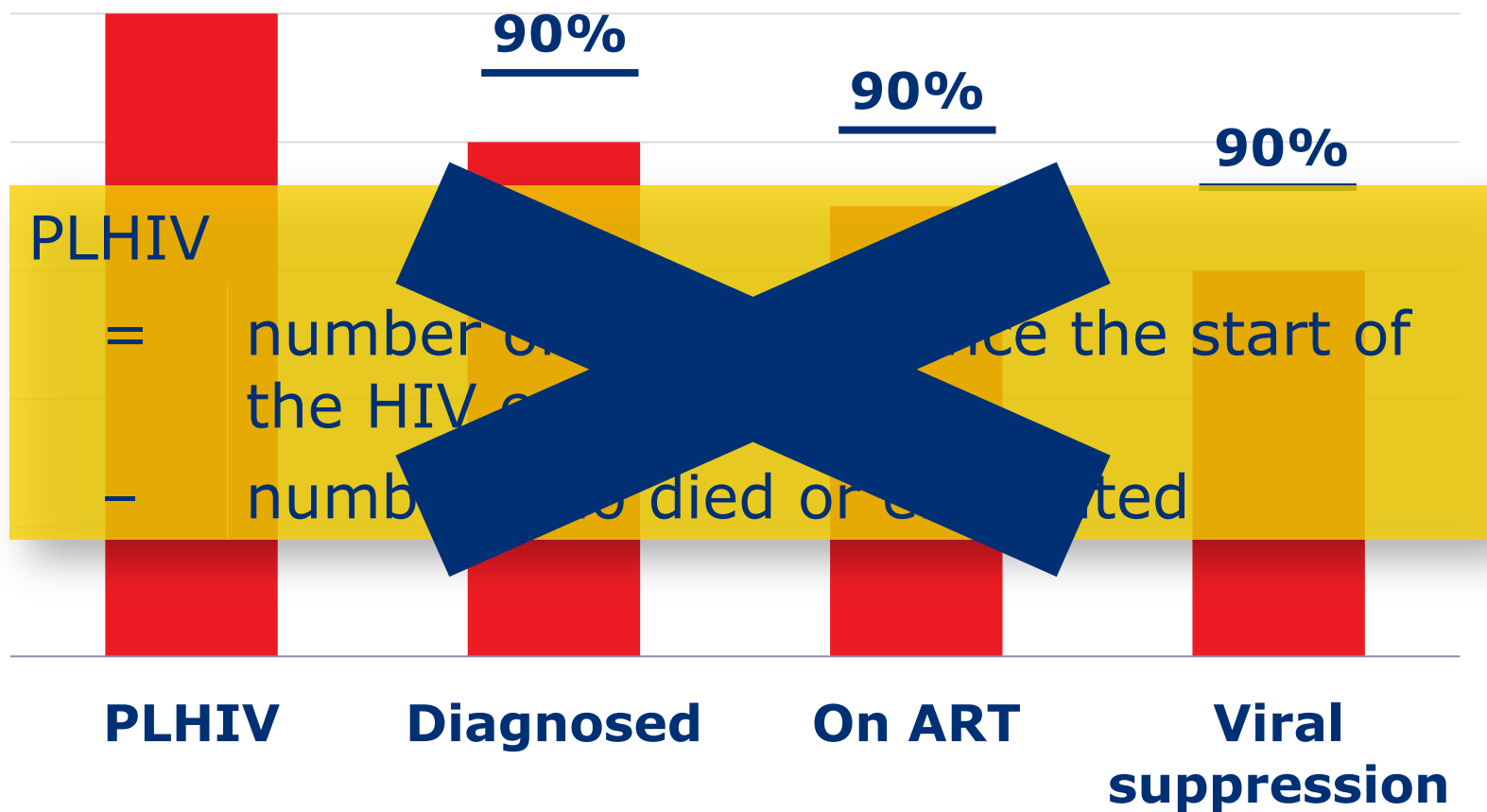
## ECDC Team

Chantal Quinten  
Anastasia Pharris  
Andrew Amato-Gauci

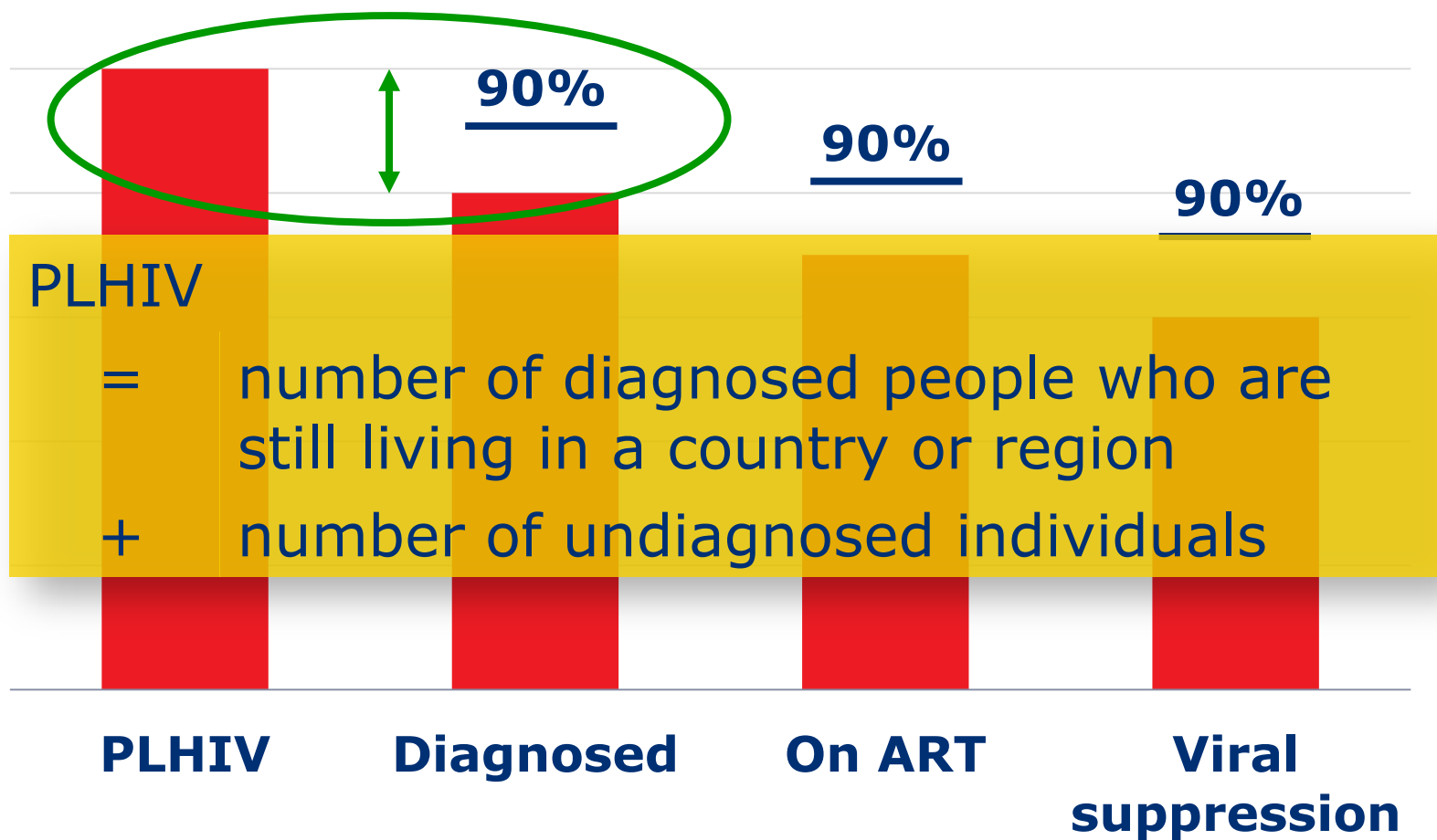




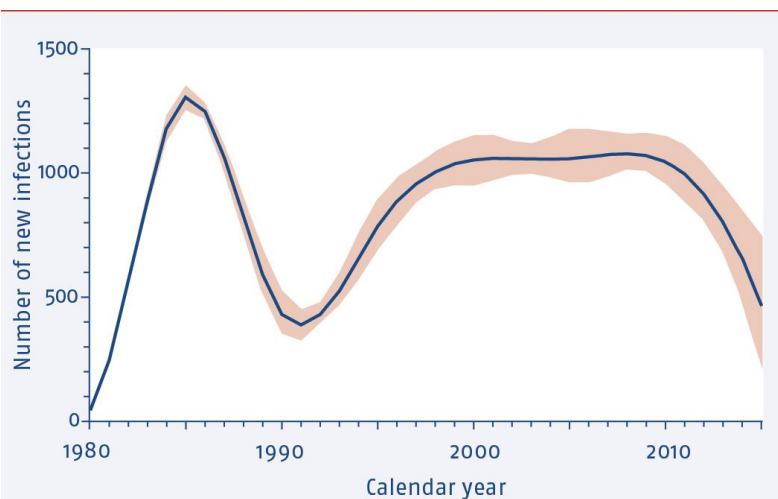
# Continuum of HIV care



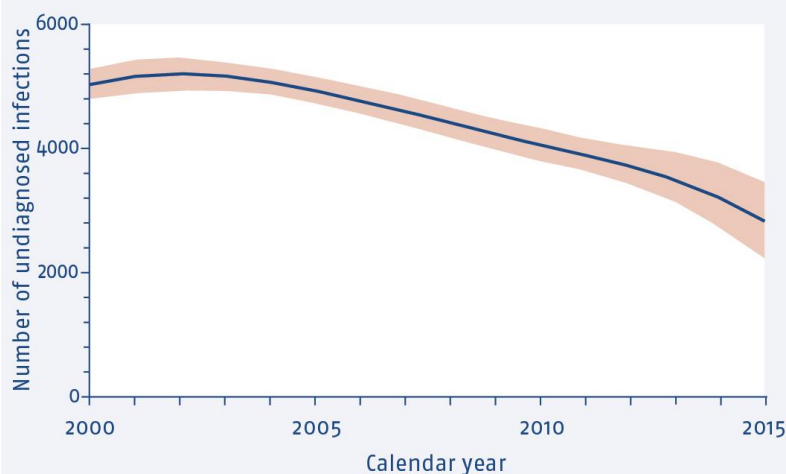
# Continuum of HIV care



# People living with HIV – the Netherlands



**HIV infections**

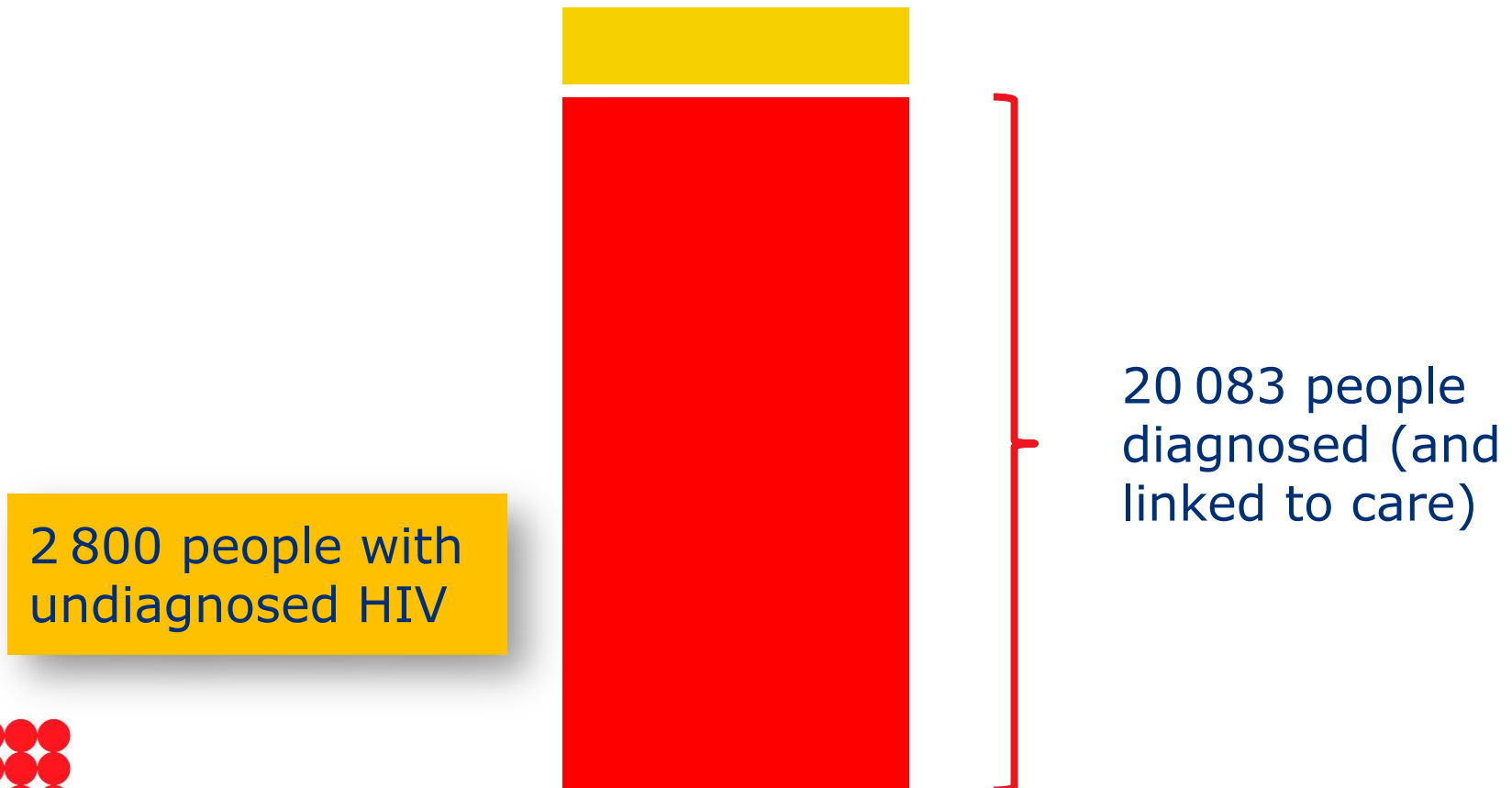


**Undiagnosed**

# People living with HIV – the Netherlands

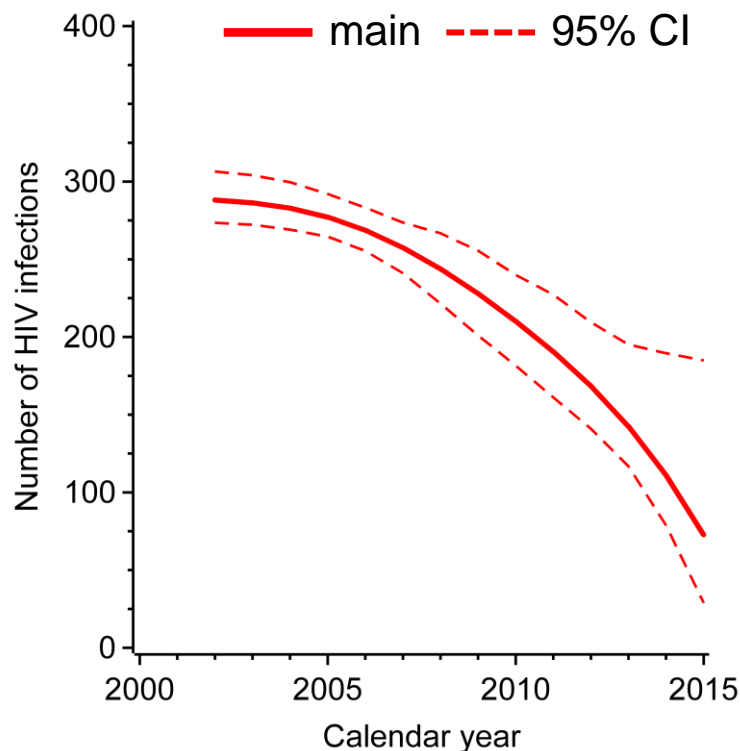
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22 900 PLHIV in 2015



# PLHIV – Amsterdam

## Newly acquired HIV infections

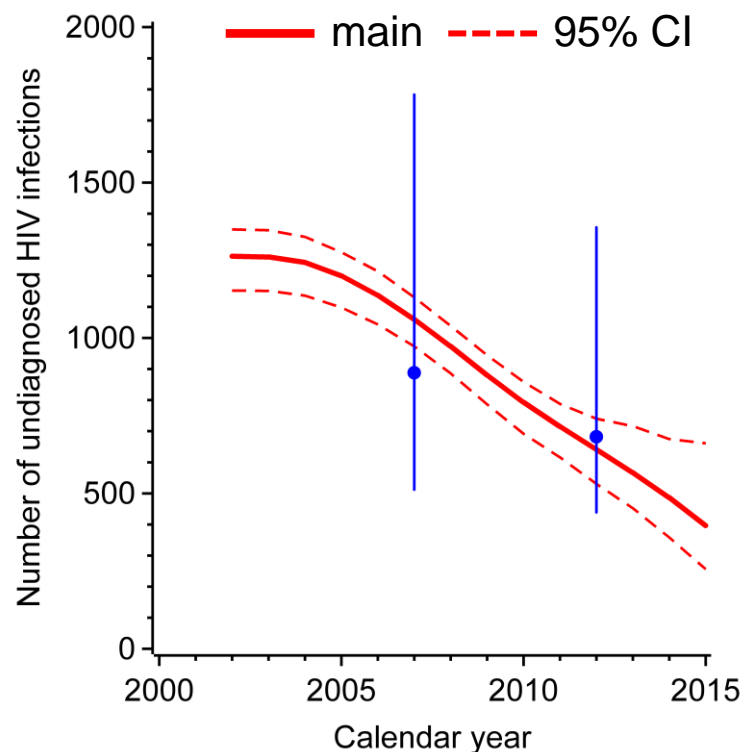


- 70 (95% CI, 30 – 180) new HIV infections in 2015.
- Average time from infection to diagnosis: 2.9 (2.3 – 3.7) years.

including corrections for reporting delay in 2014 (+3%) and 2015 (+11%)

# PLHIV – Amsterdam

## Undiagnosed HIV infections

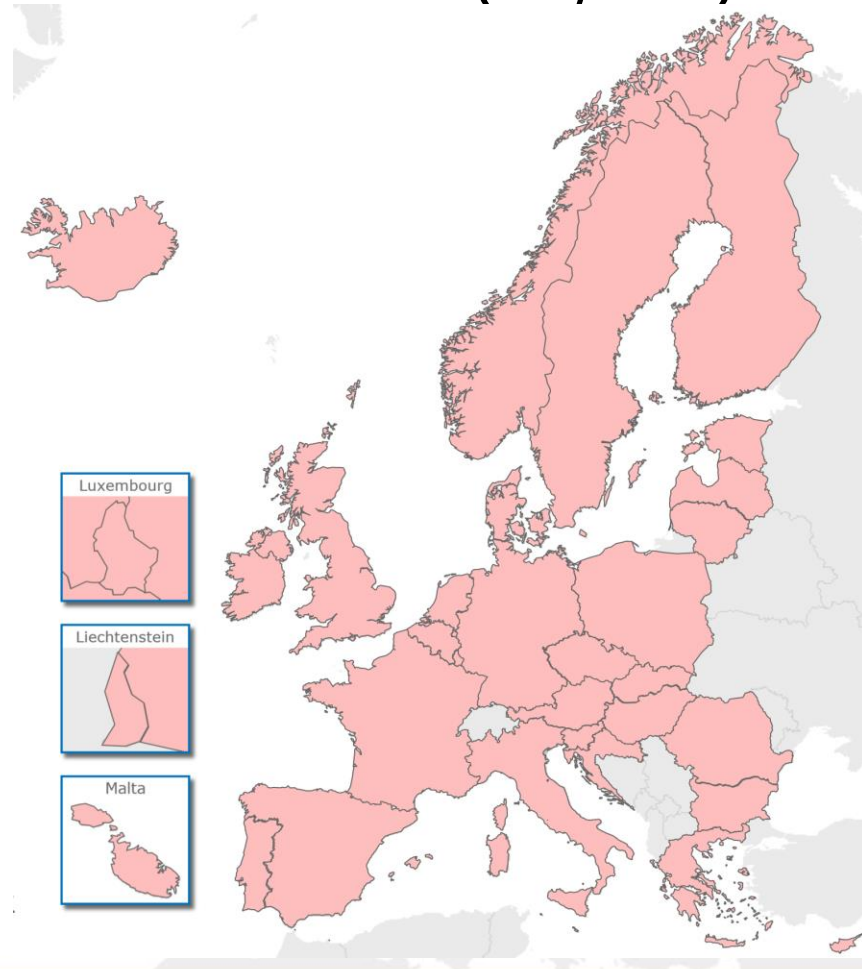


- 400 (95% CI, 260 – 660) people living with HIV were still undiagnosed by the end of 2015.
- Consistent with earlier estimates\*.
- 6 150 PLHIV in 2015.

\*Op de Coul *et al*, PLoS One 2015

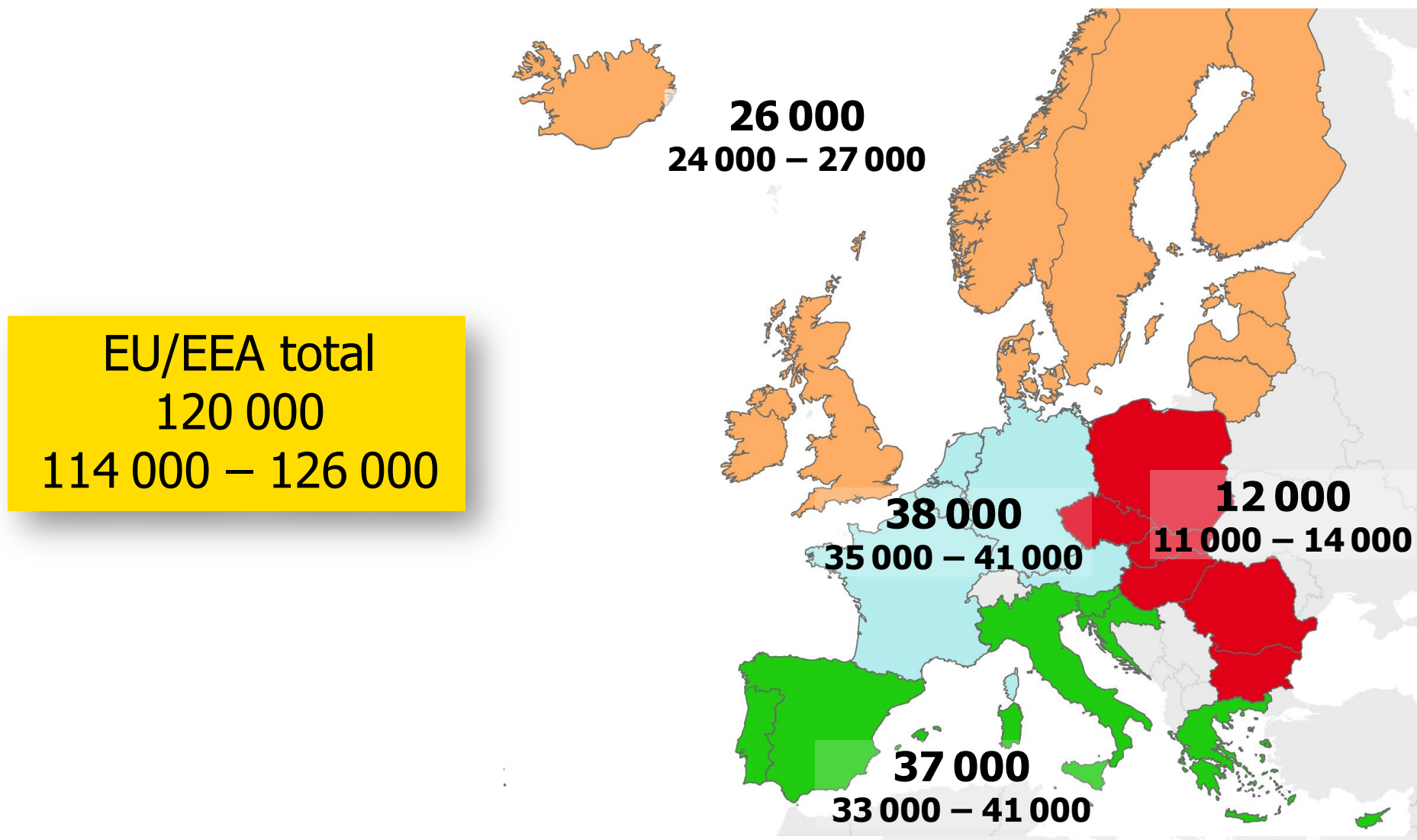
# People living with HIV – EU/EEA

- Each year, ca. 30 000 people are newly diagnosed with HIV in the European Union/European Economic Area (EU/EEA).
- 122 000 people living with HIV (PLHIV) estimated to be undiagnosed in 2015, or 15% of all PLHIV<sup>1</sup>.
- Aim: estimate number undiagnosed by sub-region and stratified by CD4 cell count.



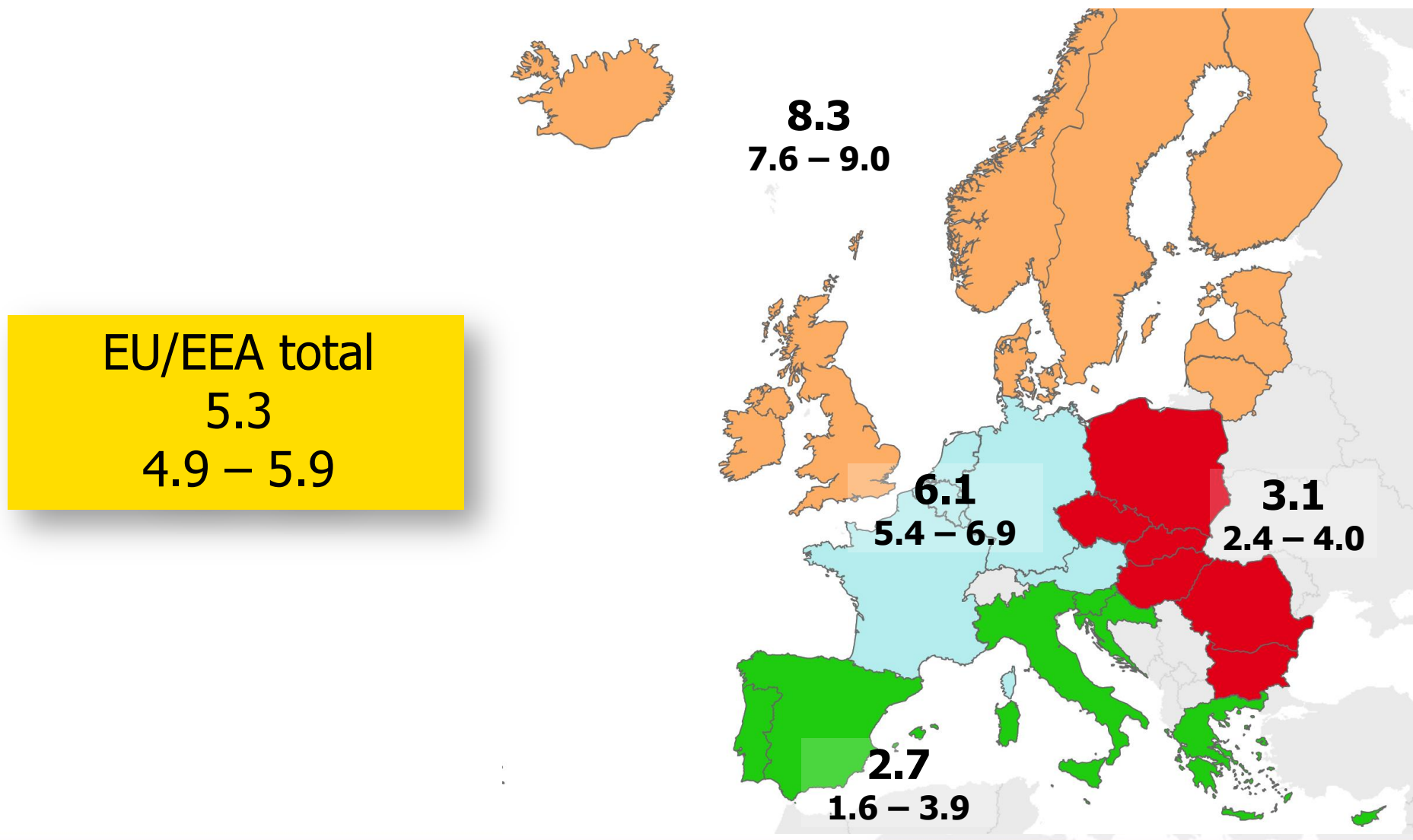
<sup>1</sup>Pharris A, Quinten C, Noori T, Amato-Gauci AJ, van Sighem A *et al.* Estimating HIV incidence and number of undiagnosed individuals living with HIV in the European Union/European Economic Area, 2015. *Euro Surveill.* 2016; 21(48):pii=30417.

# People living with undiagnosed HIV 2015





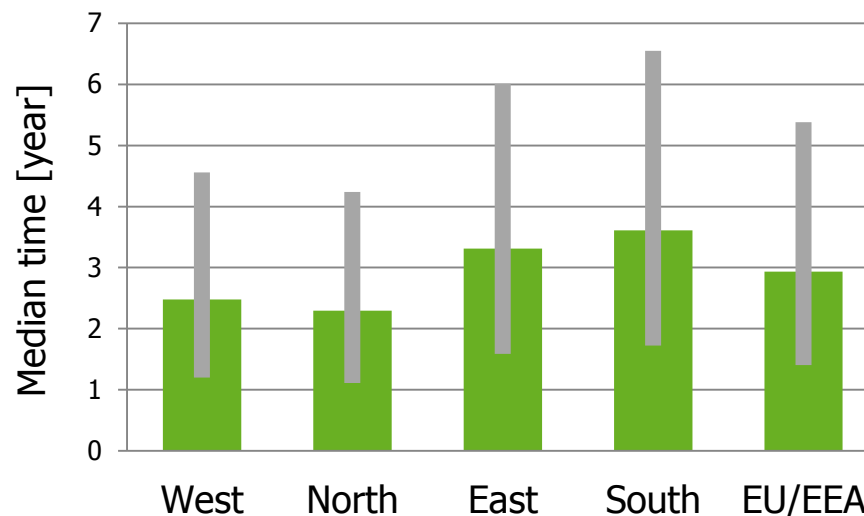
# Infection rate per 100 000 population



# Time to diagnosis and CD4 cell distribution in undiagnosed PLHIV

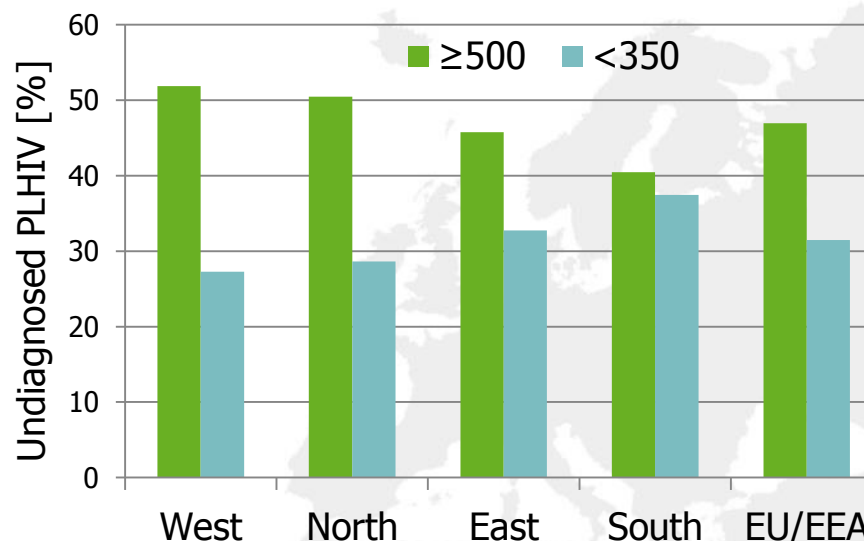
## Time to diagnosis

EU/EEA	
2.9 year	IQR, 1.4 - 5.4



## CD4 distribution

EU/EEA	
$\geq 500$	47%
$< 350$	31%



# Conclusion

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- ECDC HIV Modelling Tool can be used in the estimation of the first step of the continuum of HIV care:
  - Annual number of newly acquired HIV infections.
  - Undiagnosed population.
  - Total number of people living with HIV.
  - Time to diagnosis.
- Only need routine surveillance data.
- ECDC tool works on local, national, and regional level.
- Annual number of HIV infections can be imported into Spectrum to obtain additional information on the HIV epidemic.

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Teymur Noori  
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Andrew Amato  
Annabelle Gourlay  
Kholoud Porter



# Acknowledgements



## Dublin Declaration advisory group

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## Dublin Declaration focal points in Europe and Central Asia

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## EuroCoord/ECDC project collaborators

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