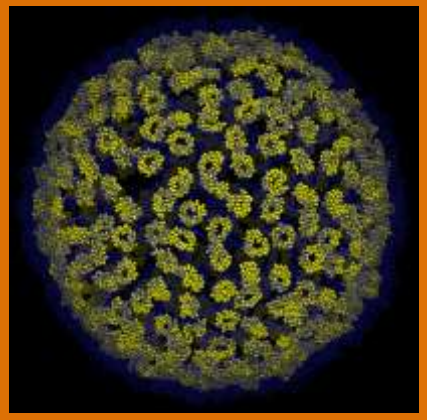
Sanquin
Blood Supply

Transfusion-transmissible infections in donors: *Viruses don't lie.*



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Blood and Beyond

Donor selection

I) Donor Health Questionnaire (DHQ)

Protect the donor

Protect the recipient

II) Routine donor screening

Human Immunodeficiency virus (HIV)

Hepatitis B virus (HBV)

Hepatitis C virus (HCV)

Treponema *pallidum* (Syphilis)

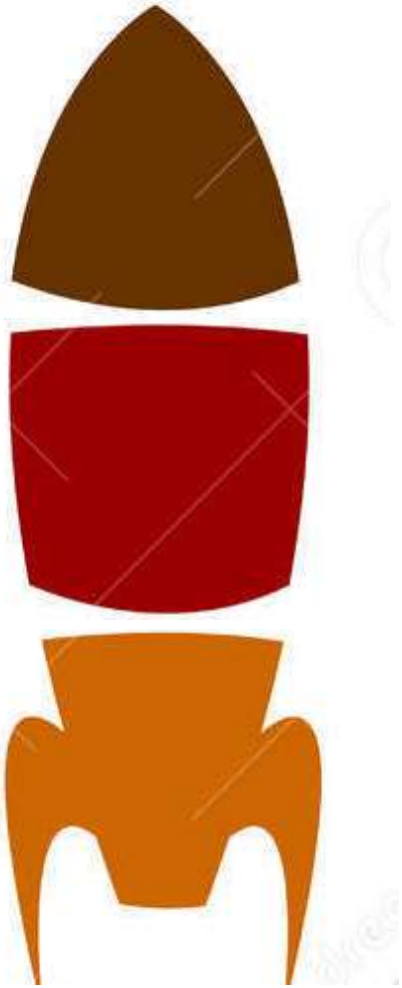
Human T cell lymphotropic virus (HTLV) – *new donors only*

III) Exit gesprek

Medical counseling

Confirmation of test result

Risk factor questionnaire: extended DHQ



Dutch repeat donors (1995-2014): Exit interview

	HIV (n=53)	HBV (n=110)	HCV (n=14)	HTLV (n=11)	LUES (n=196)
High-risk	24 (45%)	32 (29%)	0 (0%)	7 (64%)	40 (20%)
Medium-Low Risk	12 (23%)	19 (17%)	6 (43%)	0 (0%)	18 (9%)
No Risk	12 (23%)	36 (33%)	1 (7%)	3 (27%)	62 (32%)
No Return	5 (9%)	23 (21%)	7 (50%)	1 (9%)	76 (39%)
	31%	**54%**	**57%**	**36%**	**71%**

Slot et al, Transfusion, 2016

What does the donor tell us?

DONOR: exit interview

What if:

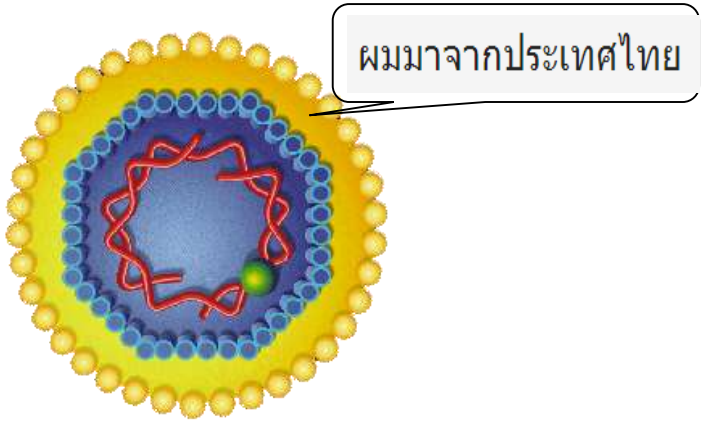
Donor does not return

Donor does not report risk behavior

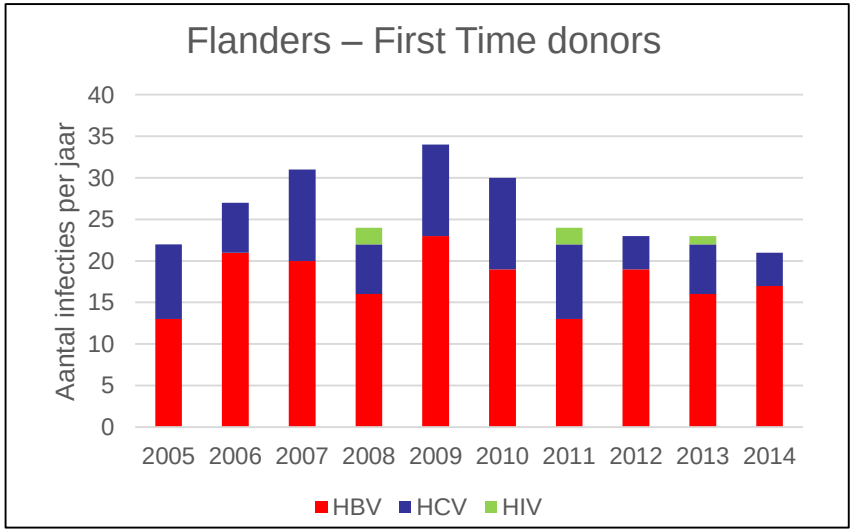
Donor reports multiple risk factors

What does the virus tell us?

VIRUS: can it give us a clue?



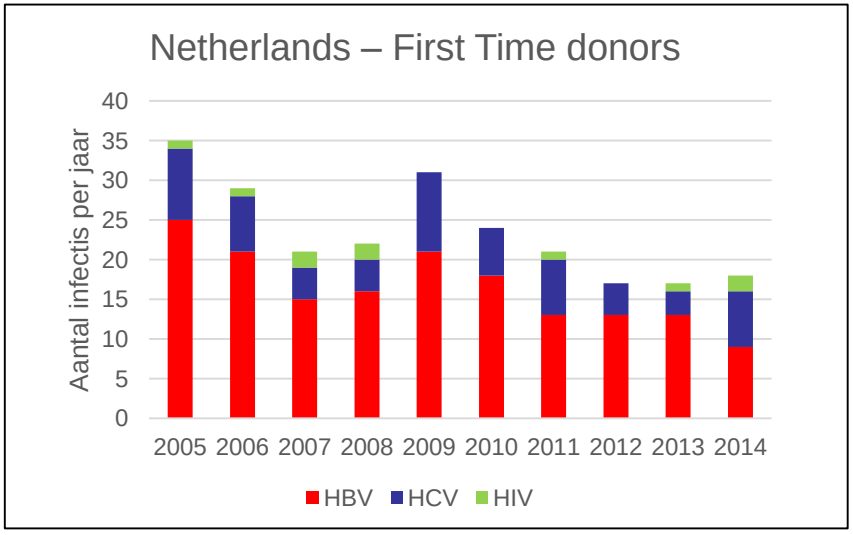
Prevalence of HBV, HCV and HIV in Dutch and Flemish Donors (2005-2014)



PREVALENce - Flanders

HBV = 69.9 ↓
HCV = 30.4 ↓
HIV = 2.0

per 100.000
First-time donors

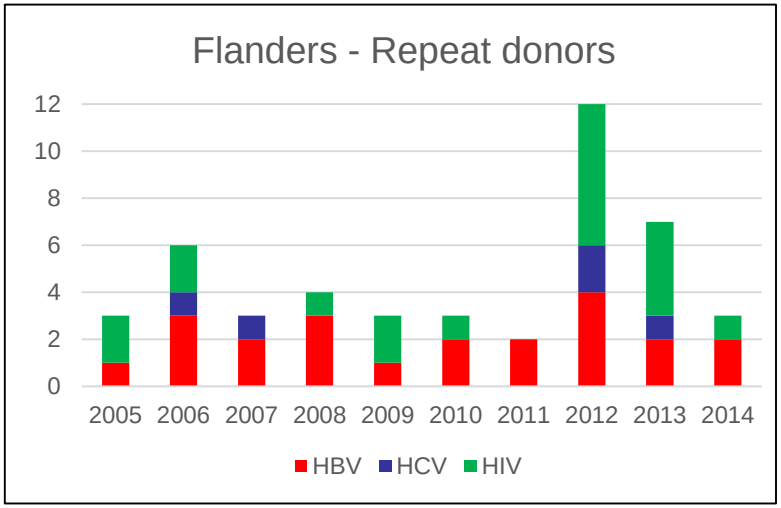


PREVALENCE - Netheralnds

HBV = 50.7 ↓
HCV = 18.9 ↓
HIV = 3.1

per 100.000
First-time donors

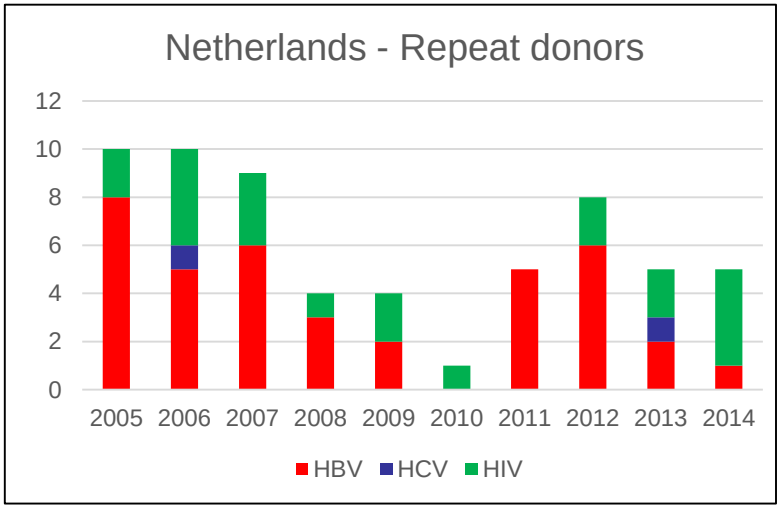
Incidence of HBV, HCV and HIV in Dutch and Flemish Donors (2005-2014)



INCIDENCE - Flanders

HBV = 1.60
HCV = 0.36
HIV = 1.38

per 100.000 repeat donors



INCIDENCE - Netherlands

HBV = 1.13
HCV = 0.06
HIV = 0.63

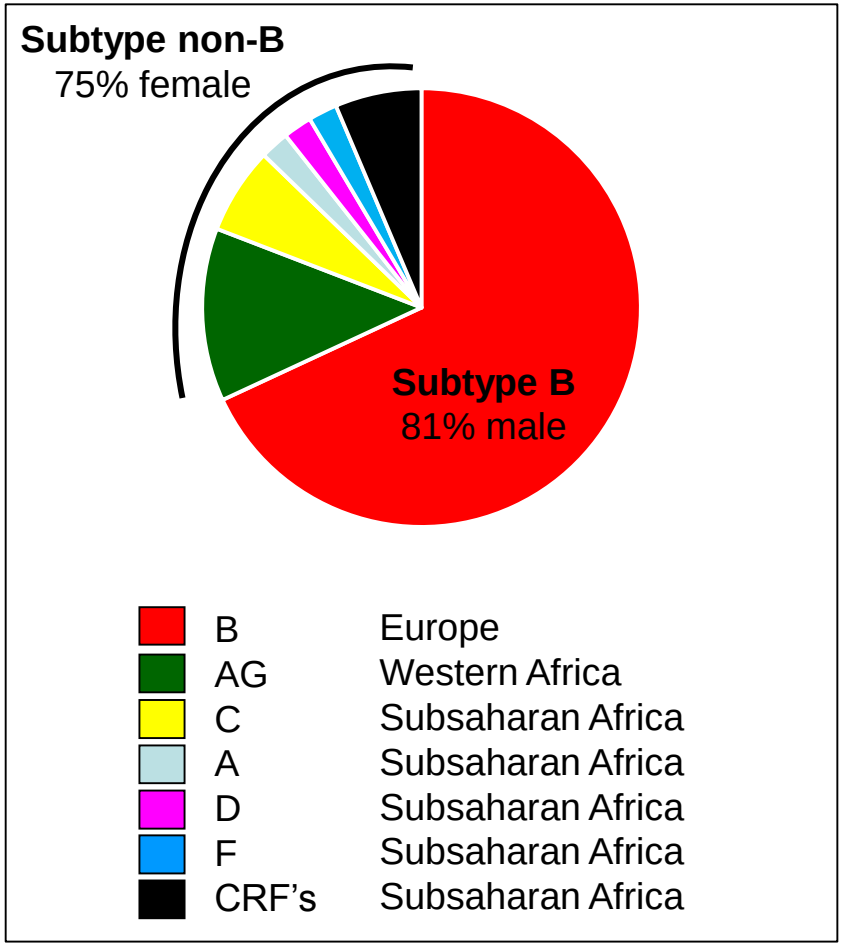
per 100.000 repeat donors

Dutch and Flemish donors with HIV (2005-2014)

DONOR talking

	Donors (n=55)
Donor:	
New donor	27%
Repeat donor	63%
Demografics:	
Male	69%
Country of birth (NL/B)	90%
Age	45 yrs
Risk factor: Blood	**7%**
Injecting drug use	-
Blood transfusion	-
Blood-blood minor	7%
Risk factor: Sex	**60%**
Male-to-male sex	24%
Heterosexual Africa	13%
Heterosexual high-risk	9%
Heterosexual low-risk	15%
No Risk	**22%**
No Exit interview	**11%**

VIRUS talking



HIV phylogenetic tree

HIV donor sequences:

48/55 (87%) HIV-positive donors

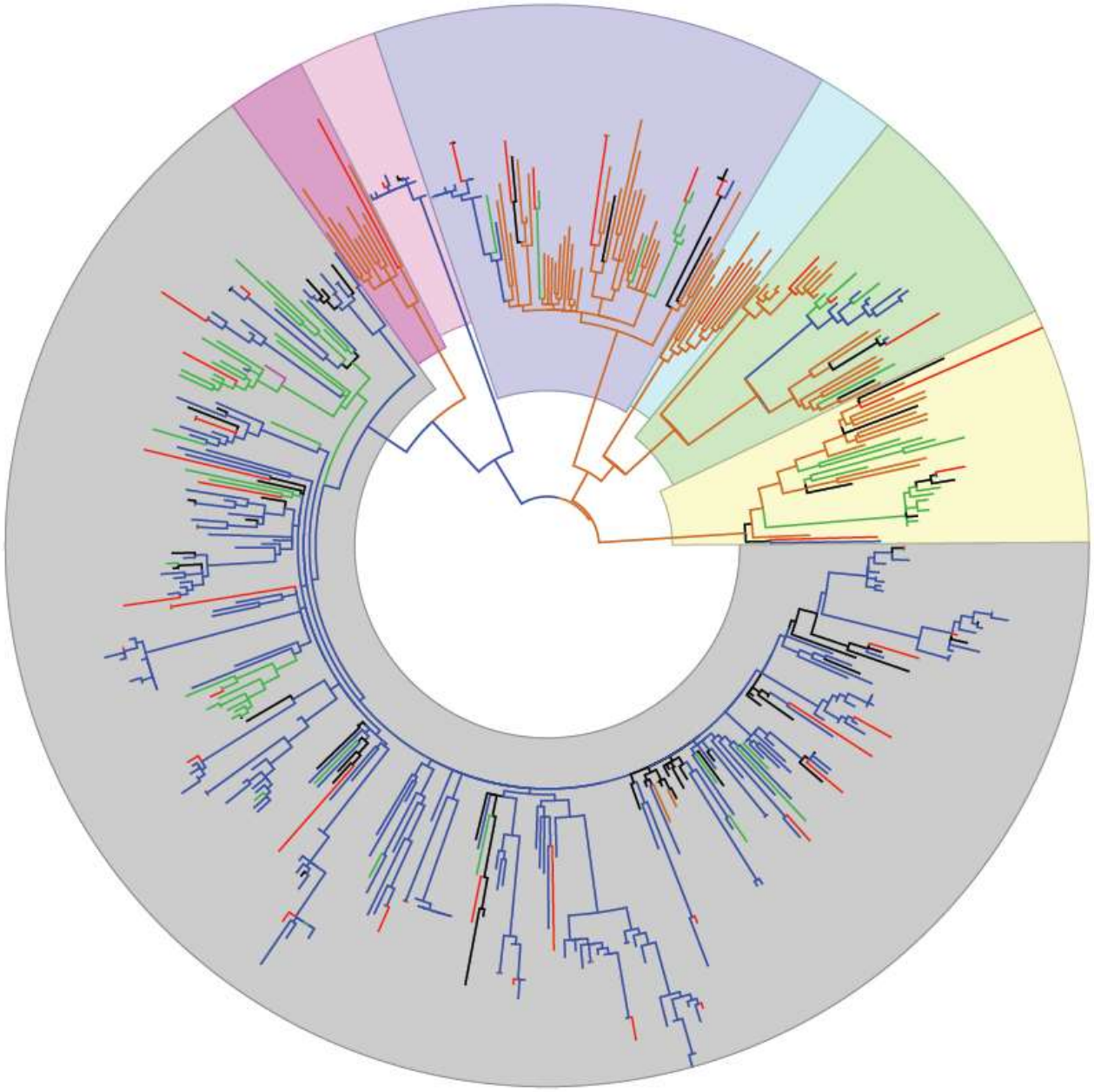
HIV reference Sequences

Dutch ATHENA cohort (n=9,106)
±40% of HIV-infected patients in Netherlands

Flemish UH LEUVEN cohort (n=1,451)
±15% of HIV-infected patients in Flanders

International GENBANK (n=±480)
For each donor, the 10 most similar sequences

	ATHENA	LEUVEN
Demographics		
Male	80%	74%
Age	45 yrs	46 yrs
Country of birth		
NL/B	56%	51%
Subshara Africa	15%	22%
Other/unknown	29%	11%
Risk		
MSM	61%	40%
Heterosexual	30%	32%
Other/Unknown	9%	28%
Genotype		
A	5.6%	16.4%
B	76.2%	52.4%
C	5.3%	10.9%
D	1.0%	1.3%
F	1.0%	3.9%
AG	7.3%	10.3%
Other	3.6%	4.5%

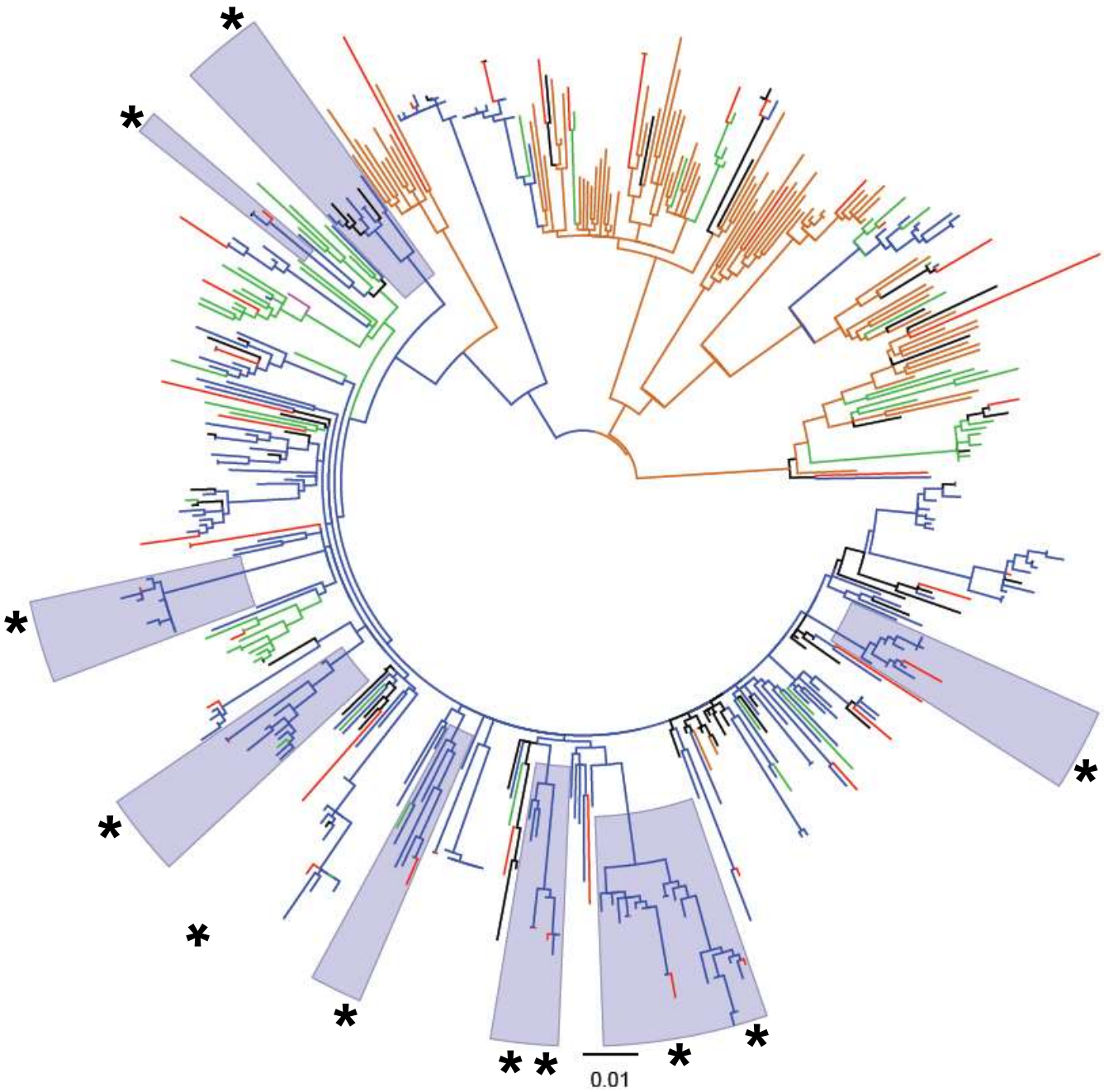


HIV subtype

- B
- A
- C
- D
- F
- CRF02_AG
- CPX_09

Risk behavior

- Donor
- MSM
- Heterosexual
- Africa
- IDU
- Unknown



Risk Behavior

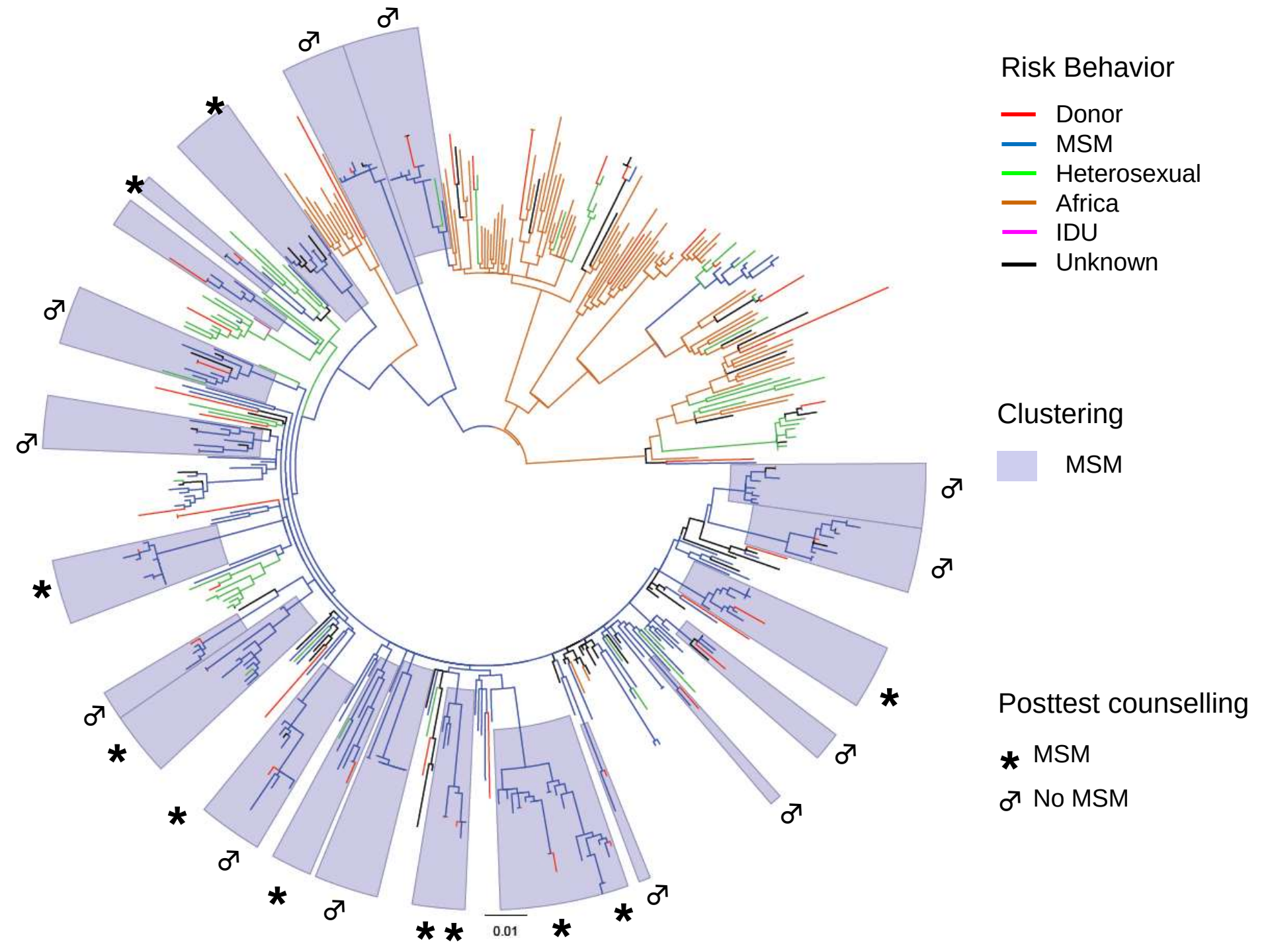
- Donor
- MSM
- Heterosexual
- Africa
- IDU
- Unknown

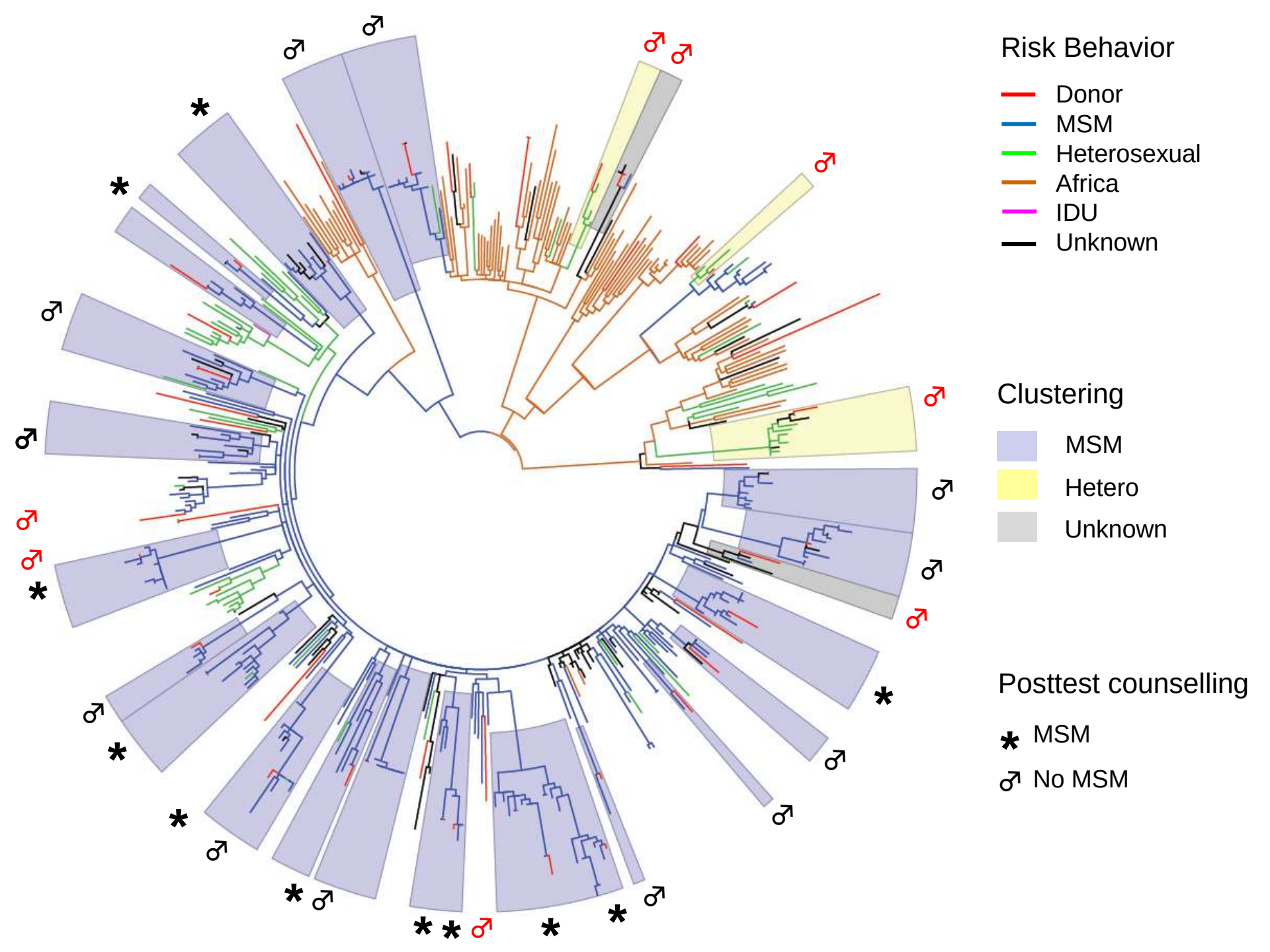
Clustering

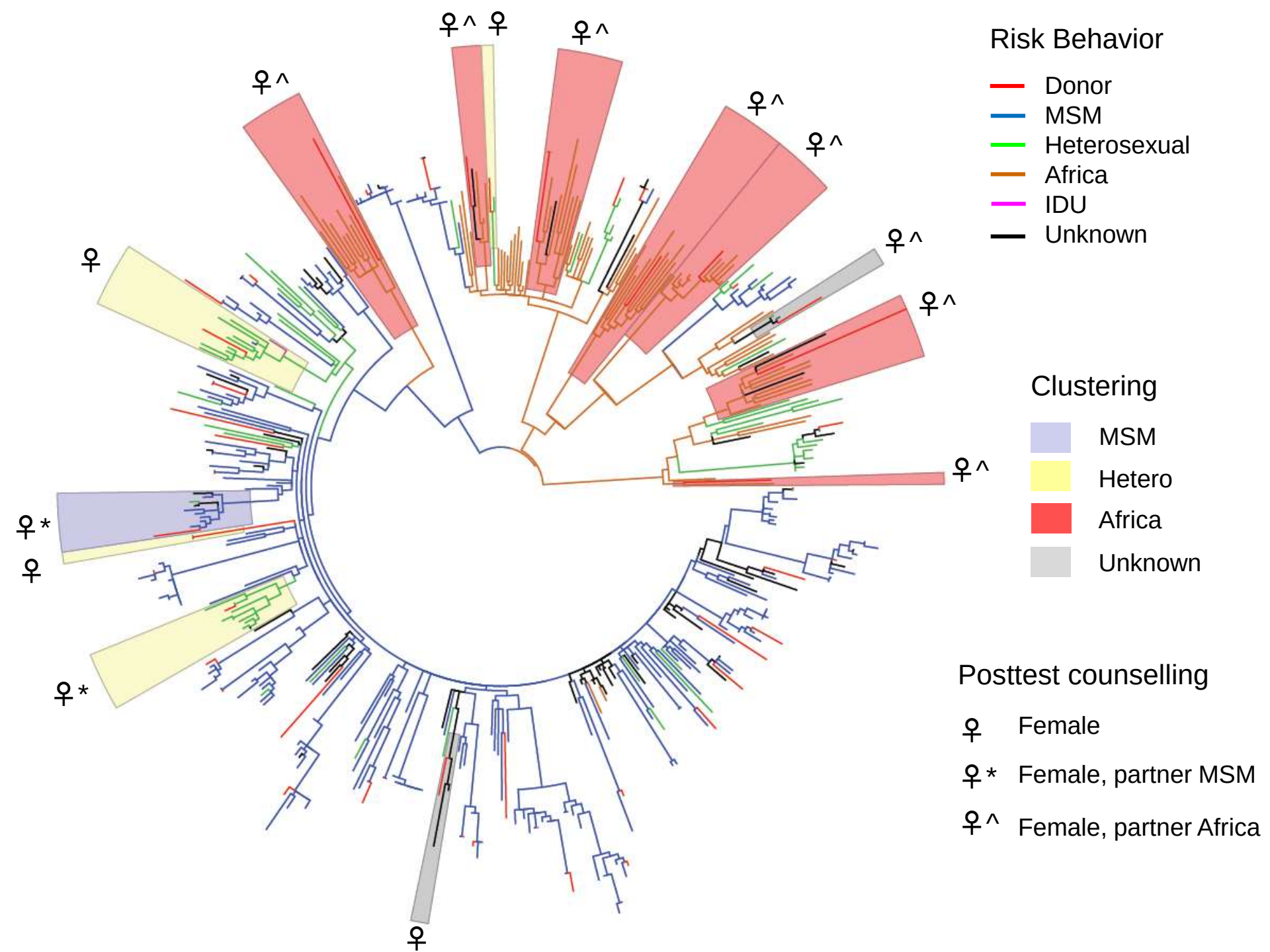
- MSM

Posttest counselling

* MSM


Risk Behavior
Donor
MSM
Heterosexual
Africa
IDU
Unknown
Clustering
MSM
Posttest counselling
* MSM
♂ No MSM
0.01


Risk Behavior
Donor
MSM
Heterosexual
Africa
IDU
Unknown
Clustering
MSM
Hetero
Unknown
Posttest counselling
MSM
No MSM


♀^ ♀
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♀
Risk Behavior
Donor
MSM
Heterosexual
Africa
IDU
Unknown
Clustering
MSM
Hetero
Africa
Unknown
Posttest counselling
♀ Female
♀* Female, partner MSM
♀^ Female, partner Africa

HIV-infected Dutch donors

Sex	Donor talking	HIV	Virus talking	Combination
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	Hetero - NL	B	MSM	MSM
M	Operation India	B	MSM	MSM
M	Operation Iraq	B	MSM	MSM
M	Dentist NL	AG	MSM	MSM
M	No Risk	B	MSM	MSM
M	No Risk	B	MSM	MSM
M	No Risk	B	None related	MSM
M	No Risk	C	Heterosexual	Hetero - NL
F	Partner MSM	B	MSM	Hetero - MSM
F	Partner MSM	B	Hetero NL	Hetero - NL
F	Partner Dutch	B	Hetero NL	Hetero - NL
F	Partner Guatemala	B	None related	Hetero - Latin
F	Partner Cape Verde	A	None related	Hetero - Africa
F	Partner Malawi	C	None related	Hetero - Africa
F	Partner Rwanda	C	None related	Hetero - Africa
F	Partner Guinea	CPX09	None related	Hetero - Africa
F	Partner Gambia	AG	None related	Hetero - Africa
F	Partner Surinam	AG	None related	Hetero - Latin

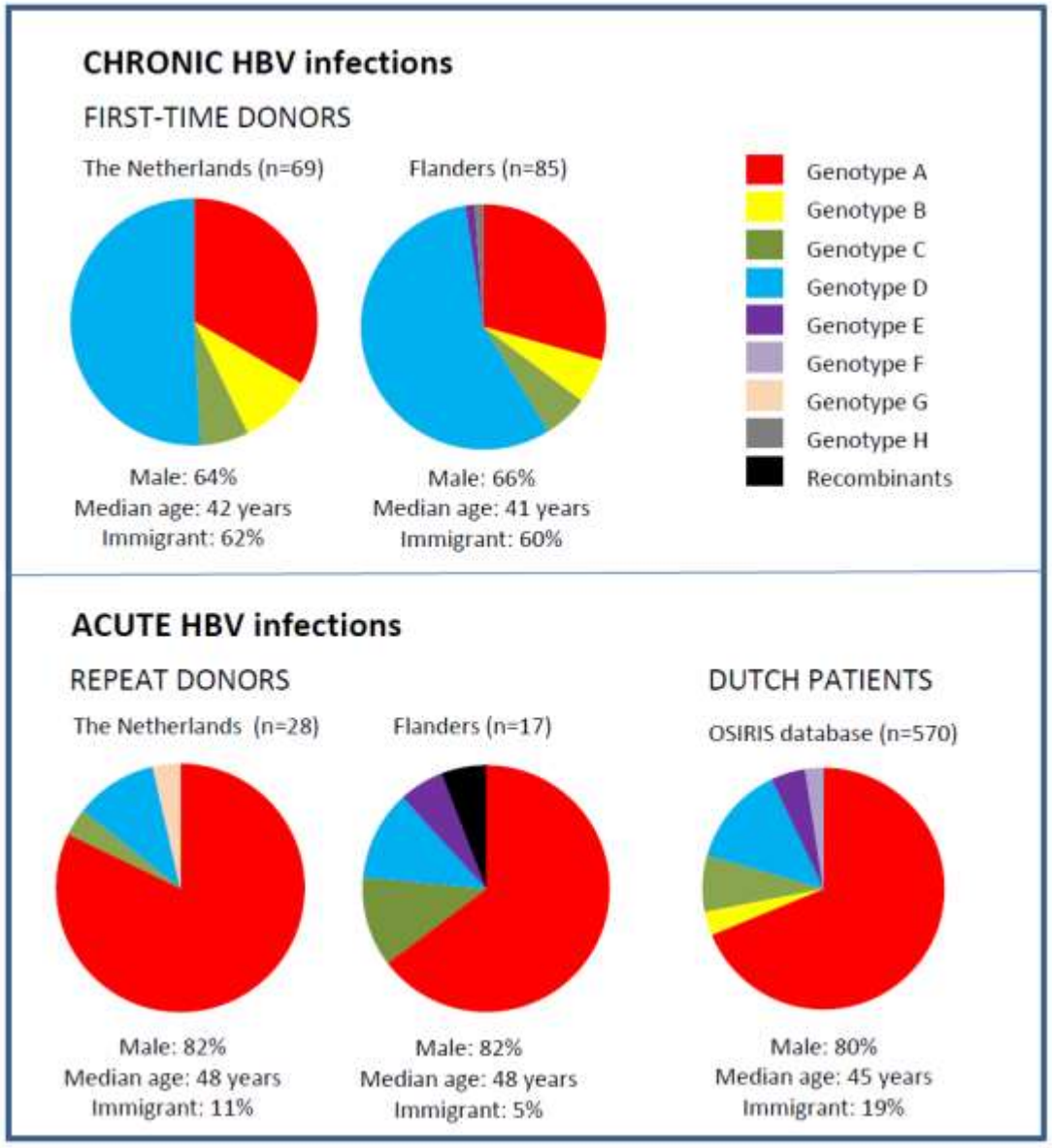
HIV-infected Flemish donors

Sex	Donor talking	HIV	Virus talking	Combination
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	MSM	MSM
M	MSM	B	None related	MSM
M	No Risk	B	MSM	MSM
M	No Risk	B	MSM	MSM
M	No Risk	F	MSM	MSM
M	No Risk	B	MSM (n = 2)	MSM
M	No Risk	B	MSM (n = 2)	MSM
M	Hetero - Belgium	B	MSM	MSM
M	Hetero - Belgium	B	Hetero	Hetero Belgium
M	Hetero - Belgium	AG	Hetero	Hetero Belgium
M	Hetero - Ukrain	A	None related	Hetero Ukrain
M	No Risk	AG	All male	?
M	No Risk	B	None related	?
M	No Risk	B	None related	?
F	Partner Belgium	B	None related	Hetero – Belgium
F	No Risk	B	None related	?
F	Partner Kenya	D	None related	Hetero – Kenya
F	Partner Belgium	AG	Hetero	Hetero - Belgium
F	COB Russia	A	Russia/IDU	Russia

HBV infected donors – the DONOR talking

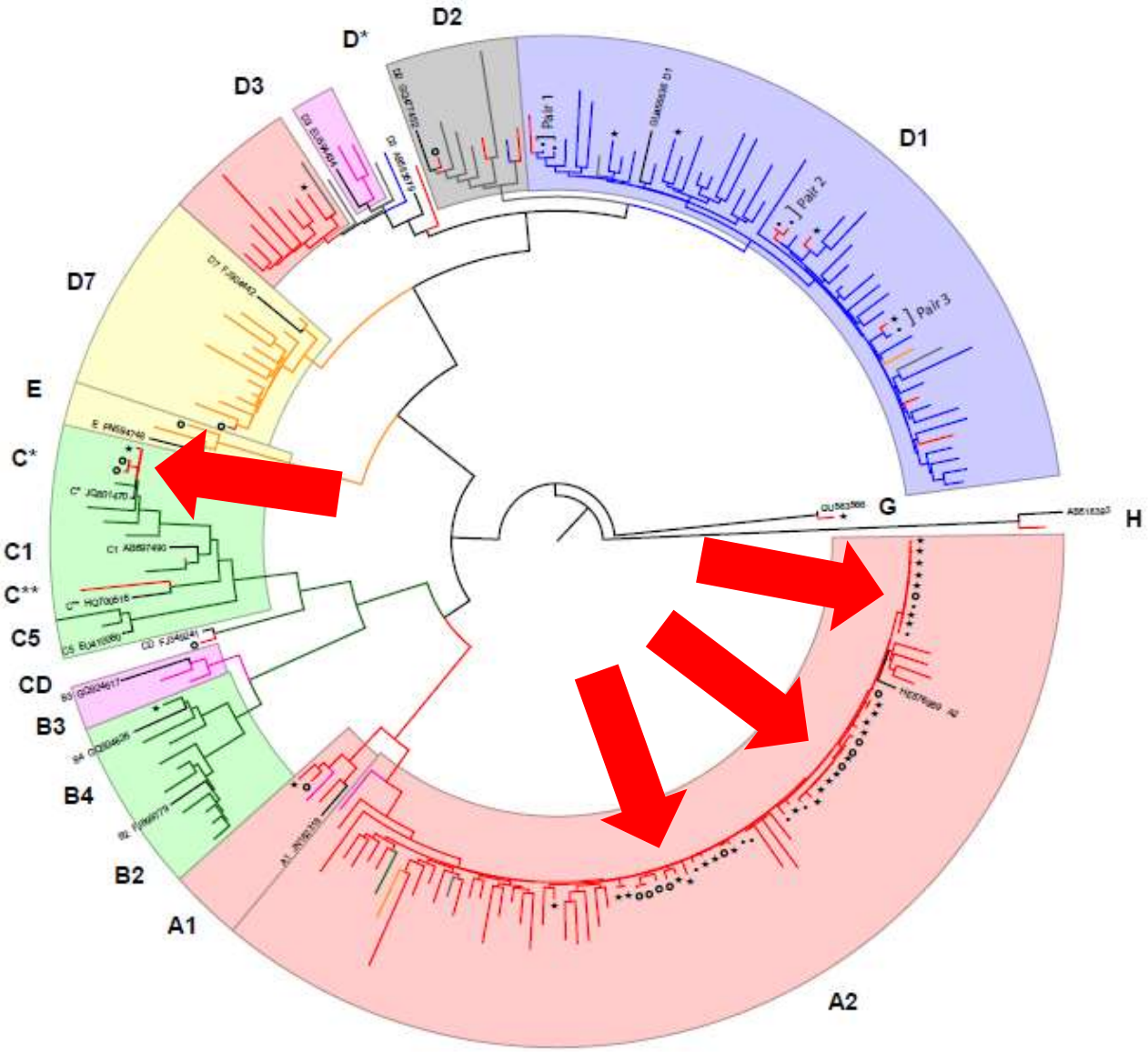
HBV	First-time donors	Repeat donors
Demographics		
Male	65%	86%
Age	42 yrs	43 yrs
Migrant	69%	14%
Risk Factor: Blood	**59%**	**15%**
Injecting drug use	0%	0%
Transfusion	3%	1%
(Minor) blood-related	58%	14%
Risk Factor: Sex	**34%**	**69%**
Male-to-Male sex	1%	20%
Sex for money	17%	0%
Heterosexual: high-risk	9%	2%
Heterosexual: low-risk	24%	25%
Risk factor: Endemicity	**72%**	**15%**
No Risk	**9%**	**40%**

HBV infected donors – the VIRUS talking



Western Europe
South East Asia
South East Asia
Central Asia
Africa
Latin America
Western Europe
Latin America

HBV infected donors – the VIRUS talking



Origin subtype

- Western Europe
- Eastern-Europa
- Central Asia + Turkey
- South East Asia
- Latin America + Surinam
- Africa + Morocco

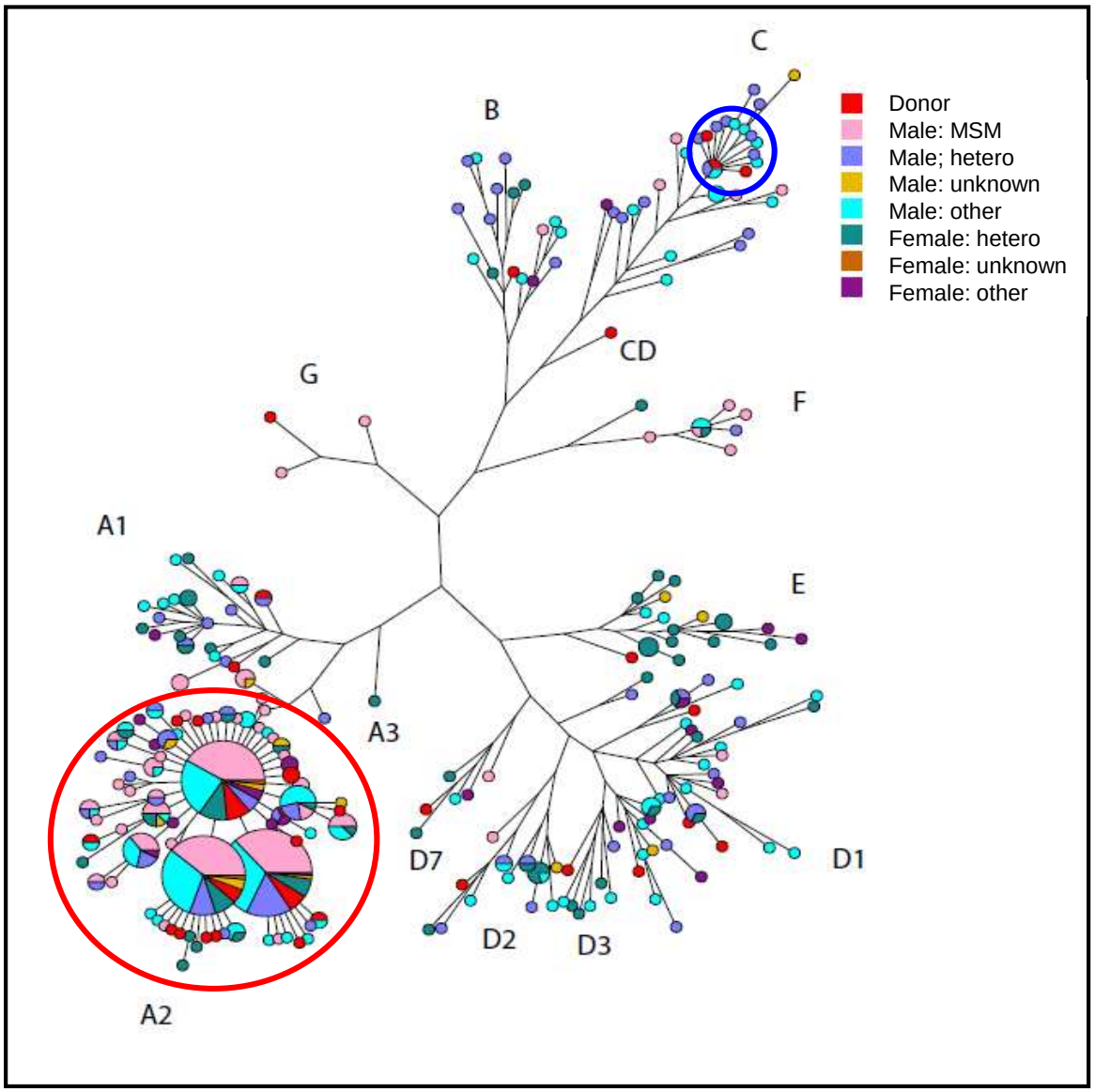
Origin donor

- Western Europe
- Eastern-Europe
- Central Asia + Turkey
- South East Asia
- Surinam
- Africa + Morocco

HBV infectie

- ★ Acute – Netherlands
- ○ Acute – Flanders
- ● Chronic – genetically similar

Dutch national database patients with acute HBV



Dutch Database (n=570)

Acute HBV
Notification requirement
Risk behaviour data
Sequence data

Epidemic A2 lineage(s)

Infects:
363/570 (63%) patients
35/52 (69%) donors

Affects:
MSM, Heterosexuals, other

Thai C lineage

Infects:
11/570 (2%) patients
3/52 (6%) donors

Affects:
Only (heterosexual) males

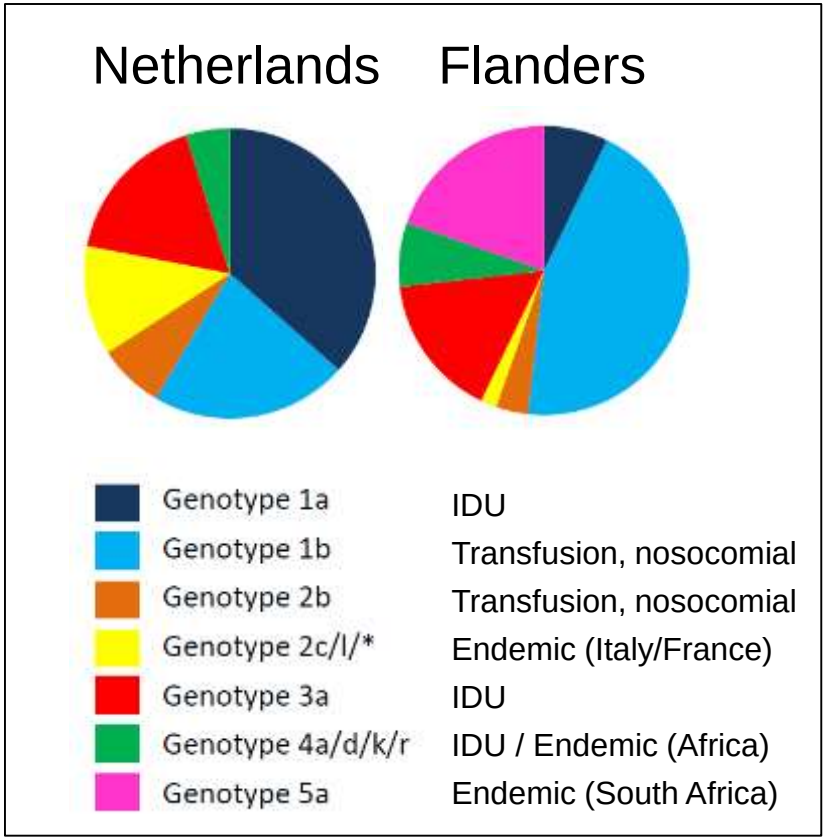
HCV-infected Dutch donors (2005-2014)

The DONOR talking

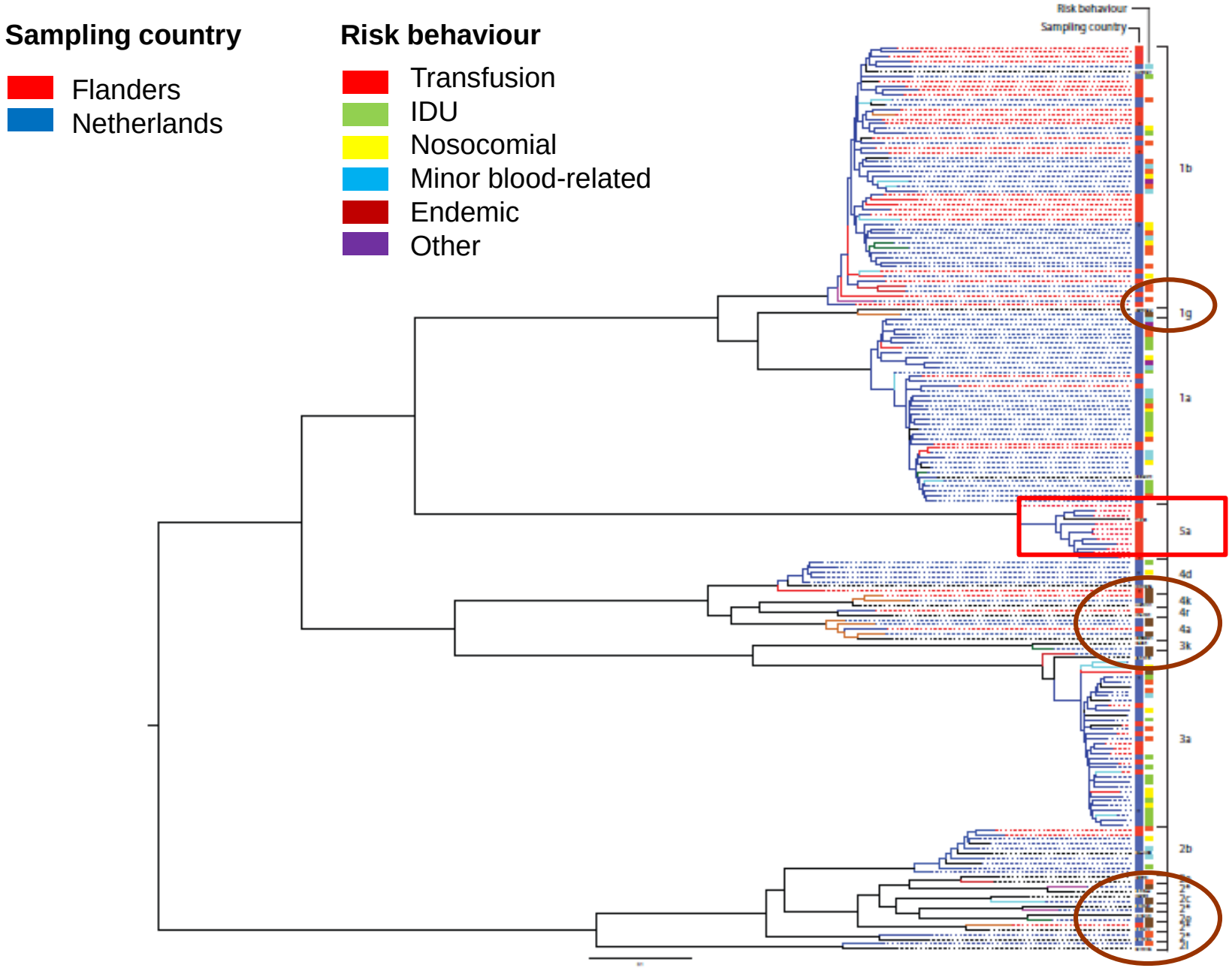
HCV	First-time donors	Repeat donors
Demographics		
Man	49%	*
Leeftijd	48 jaar	*
Migrant	49%	*
Risk Factor: blood	**81%**	**100%**
Injecting drug use	13%	*
Transfusion	19%	*
(Minor) blood-related	72%	100%
Risk Factor: sex	**58%**	*****
Male-to-male sex	2%	*
Sex for money	14%	*
Heterosexual: high-risk	19%	*
Heterosexual: low-risk	47%	*
Risk Factor: Endemic	**14%**	*****
Geen risico	**7%**	*****

Only 2 incident HCV infections: both needle-stick injuries

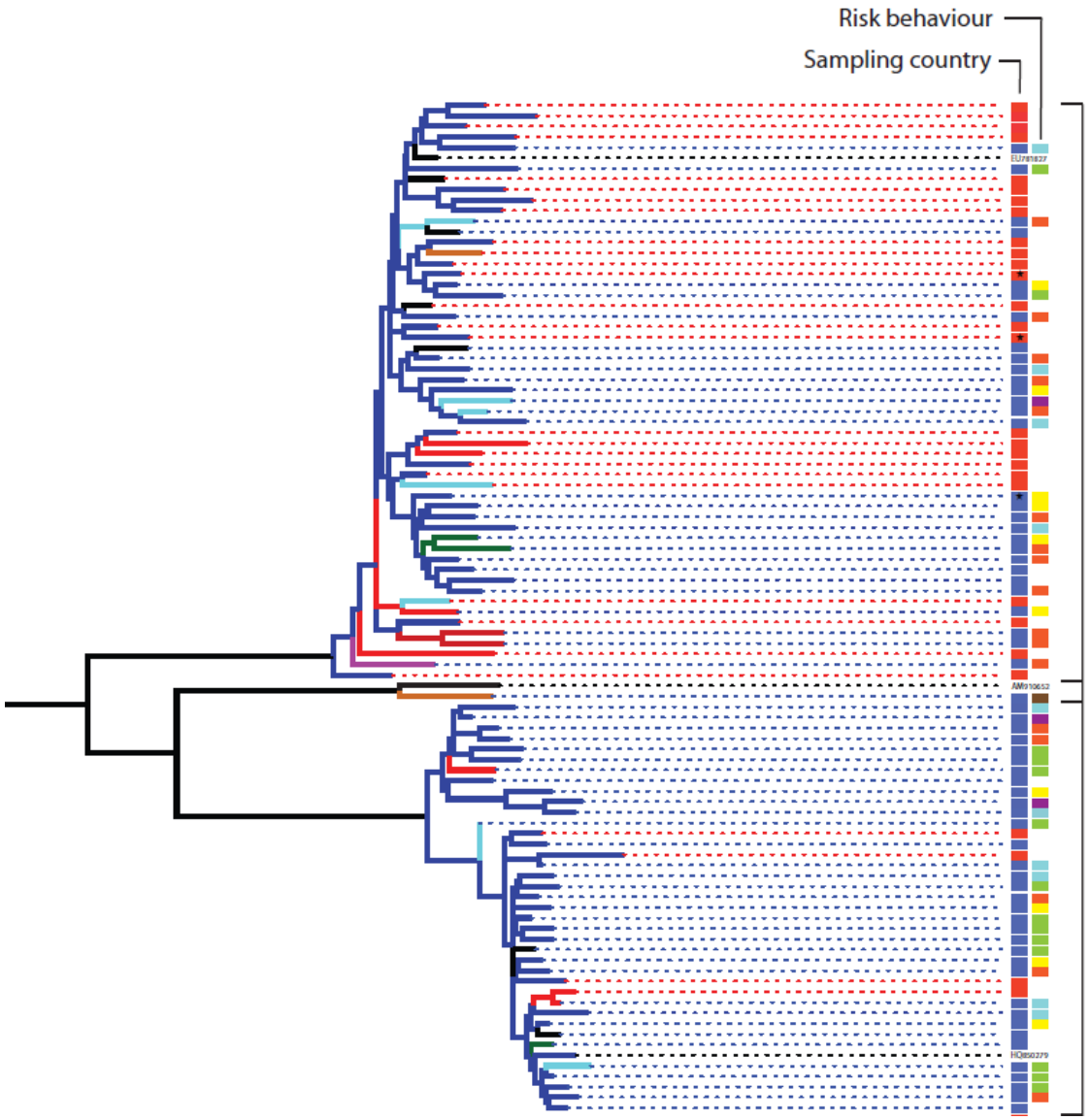
The VIRUS talking



75% of HCV infections: 1a, 1b, 3a


Sampling country
Flanders
Netherlands
Risk behaviour
Transfusion
IDU
Nosocomial
Minor blood-related
Endemic
Other
Risk behaviour
Sampling country
1b
1g
1a
5a
4d
4k
4r
4a
3k
3a
2b

HCV-infected Dutch donors: genotype 1



HCV-1b
RISK: relatively much RED
(Transfusion)

HCV-1g
RISK:Endemic (Sudan)

HCV-1a
Risk: relatively much GREEN
(IDU)

Conclusions

- Virus typing is fun and provides additional information on TTI in donors
  ESSENTIAL: Classic epidemiological data and elaborate databases

- HIV: Males – MSM discrepancy (donor 35% versus virus 77%)
  Females – Heterosexual partners from HIV endemic areas (60%)

- HBV: First-time donors – Migration
  Genotype linked to donor ethnicity

- HBV: Repeat donor – Sexual transmission within indigenous population
  Epidemic HCV-A2 lineage(s) – MSM and heterosexuals

- HCV: Epidemic has been halted
  No clear link HCV genotype and risk factor
  Genotype distribution varies per country (majority 1a, 1b, 3a)

Sanquin Blood-borne Infections
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Boris Hogema
Marijke Molenaar
Hans Zaaijer
Ed Slot

Sanquin Blood bank
Tanneke Marijt
Donor Physicians

DONORS

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Annie de Smet
Giovanni Vandewalle

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