



Monitoring of iron in whole blood donors at Sanquin Blood Bank

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Whole blood donation and iron loss



Whole blood donation



Primum non nocere – First, do no harm
-> iron deficiency

Donors donate iron



One whole blood donation =
250 mg iron

Yearly: 1000 mg

After 100 donations: 25 gram



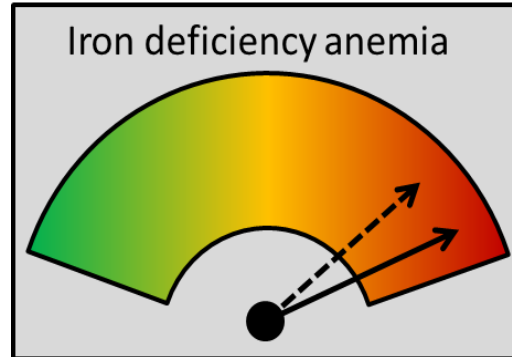
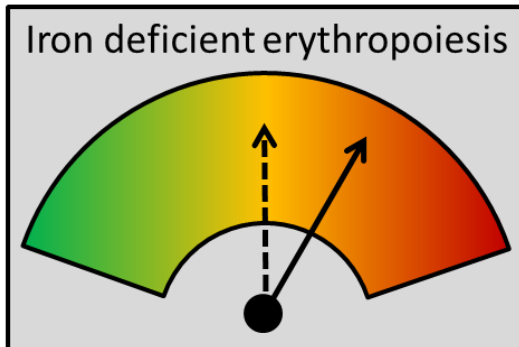
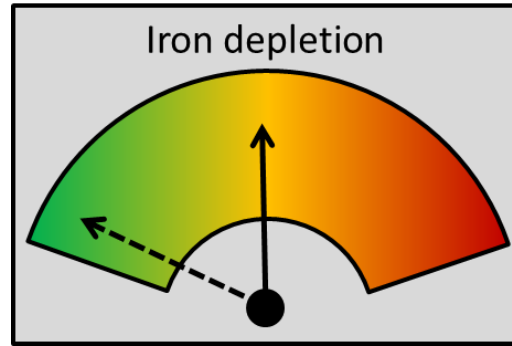
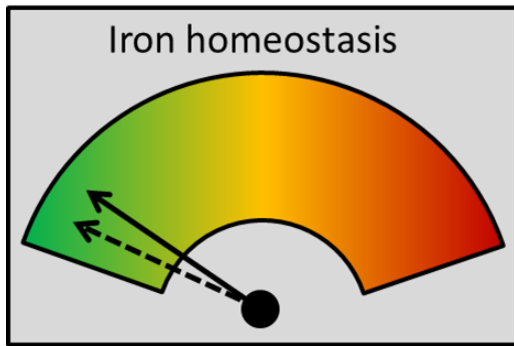
Iron replenishment

- Mean iron intake: 15-20 mg/day
- Mean iron absorption: 1-2 mg/day



Average iron stores: 250 mg in women and 1000 mg in men

Iron depletion



↑ Iron stores
↑ Hemoglobin

Potential effects of iron depletion/ deficiency

- Anaemia
- Fatigue
- Pica (craving for eating non-nutritive substances)
- Restless legs syndrome
- Impaired (neuro)cognitive development, especially teenagers/ fetuses

Current practice at Sanquin



Guidelines whole blood donation Sanquin Blood Bank

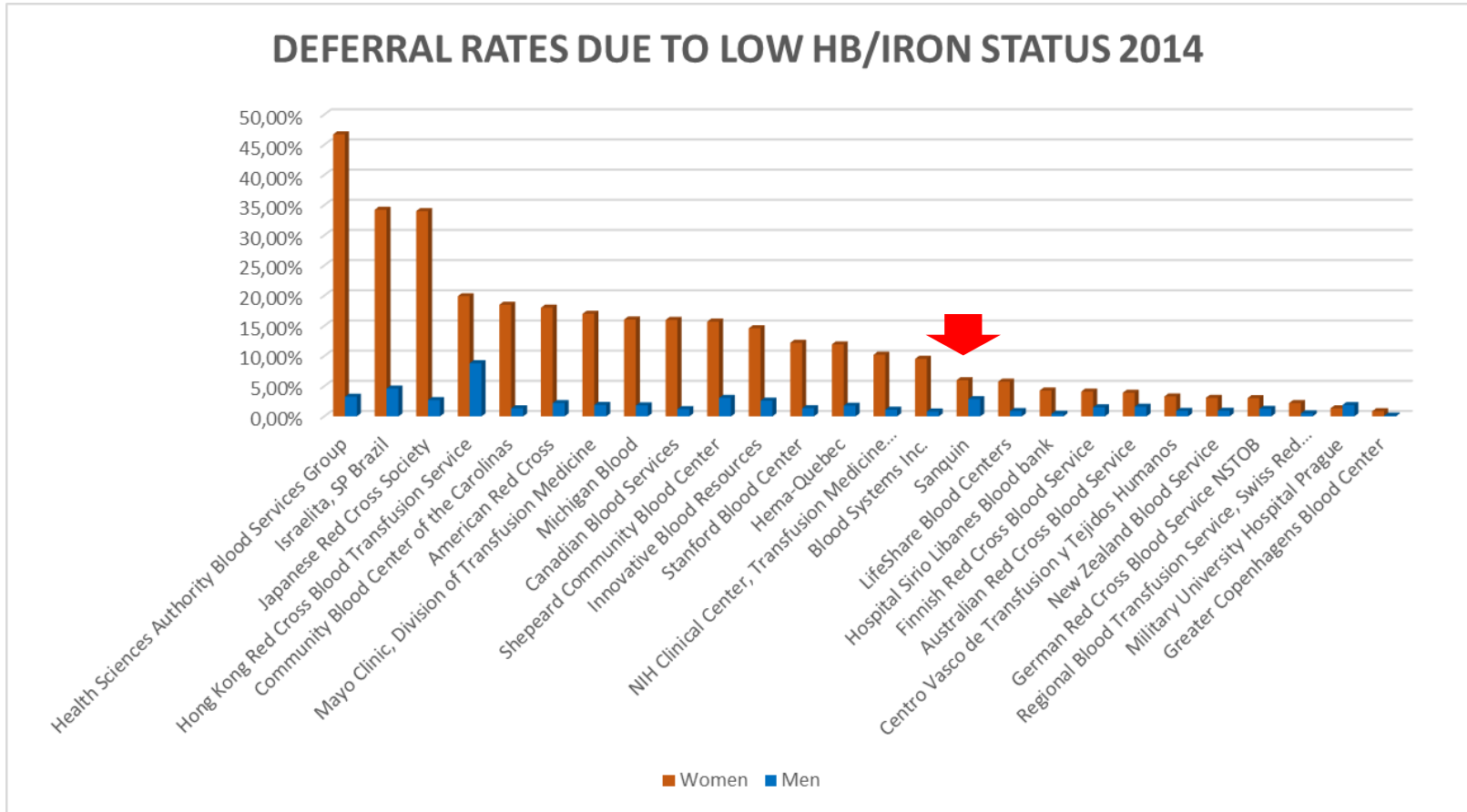
- Donation volume: 500 ml
- Male: 56 days between whole blood donations
- Female: 122 days between whole blood donations
- Frequency
 - Male: 5 times a year
 - Female: 3 times a year
- Hemoglobin (Hb) thresholds:
 - Male: 8.4 mmol/L (13.5 g/dl)
 - Female: 7.8 mmol/L (12.6 g/dl)



Donors deferred for low Hemoglobin (mmol/L)

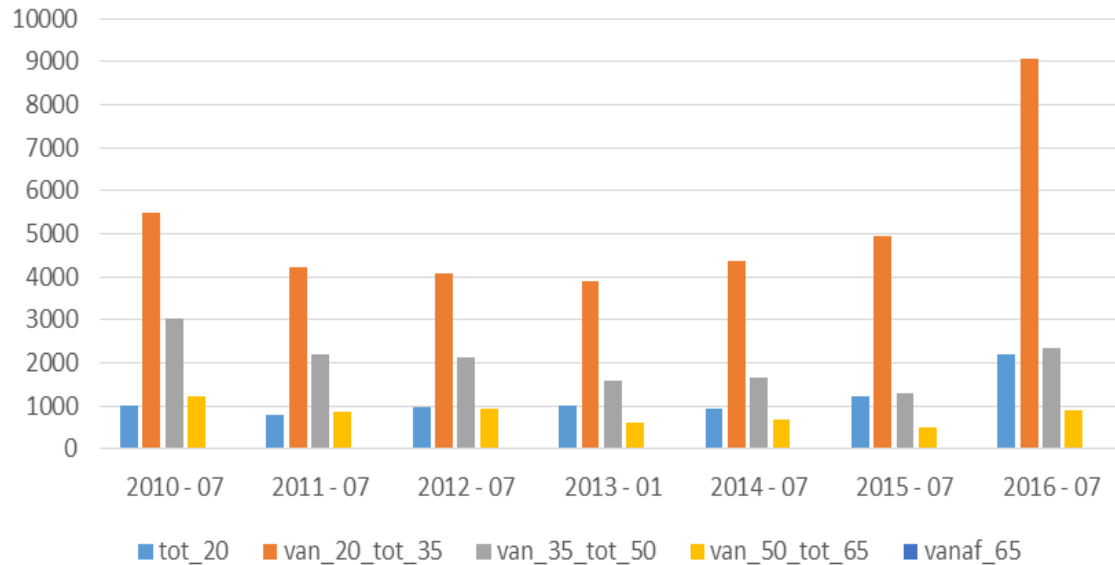
	Hb cut-off (mmol/L)	Number of donation attempts	Number of Hb deferrals	%
Male	< 13.5 g/dl	262,557	7,486	2.9%
Female	< 12.6 g/dl	228,589	13,654	6.0%
			1/1/14 – 31/12/14	

International deferral percentages low Hb

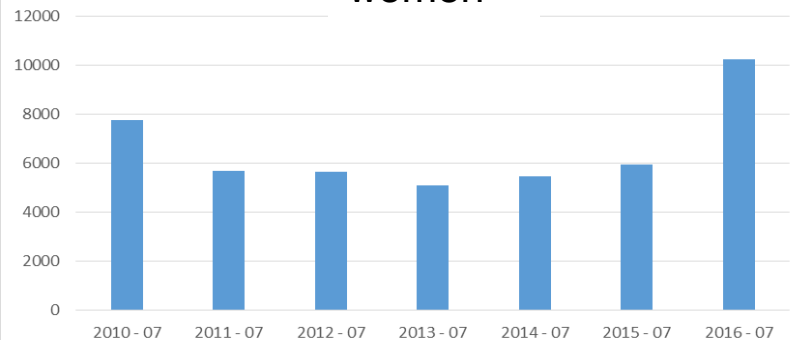


New donors mainly females in the Netherlands

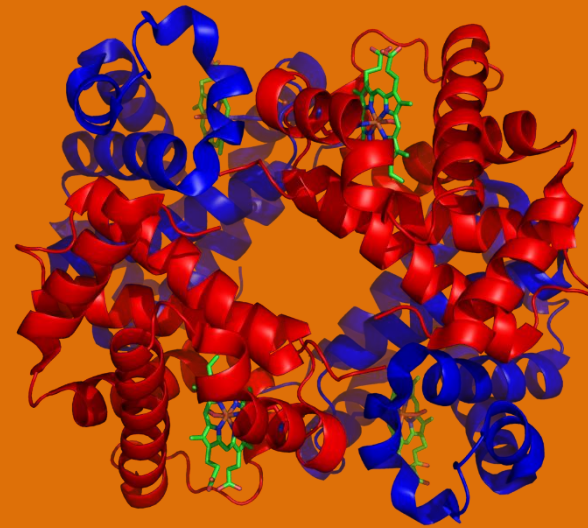
New donors per age category



women



Research on Hb deferral and iron in whole blood donors



Extension of donation intervals

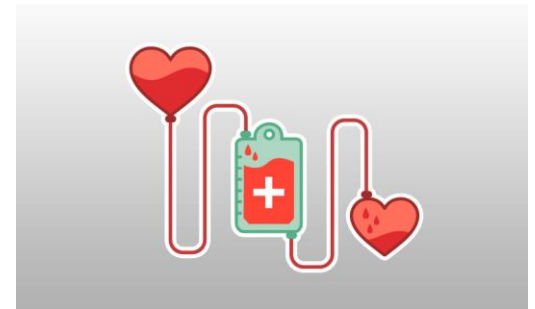
- Longer donation intervals – lower Hb deferral rates*
- Extension of donation intervals in donors at risk effective (submitted)
- Ferritin-guided donation intervals more effective?
 - Odds ratios Hb deferral for ferritin ≤ 30 vs >60 ng/ml: 11,8 and 2,7 (M and F, respectively)**

*Baart et al. Transfusion 2015

**Prinsze et al., ISBT conference 2017

KIND: Kinetics of Iron in Donors

- Minimum donation interval 56 days
- Based on:
 - Studies from 1940s and 1950s
 - Hb levels
- Adequate for all donors?



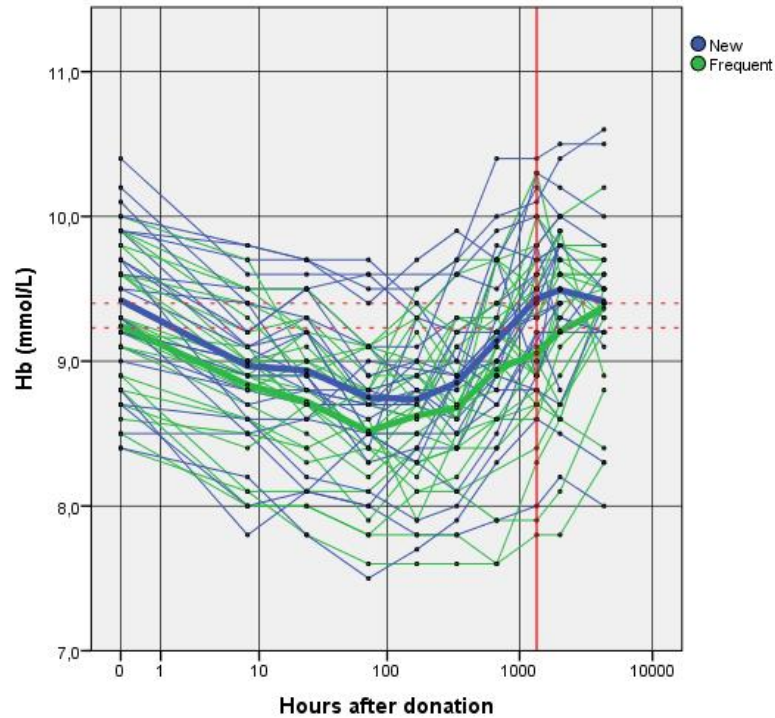
Is the donation interval of 56 days adequate to recover from changes in iron homeostasis?



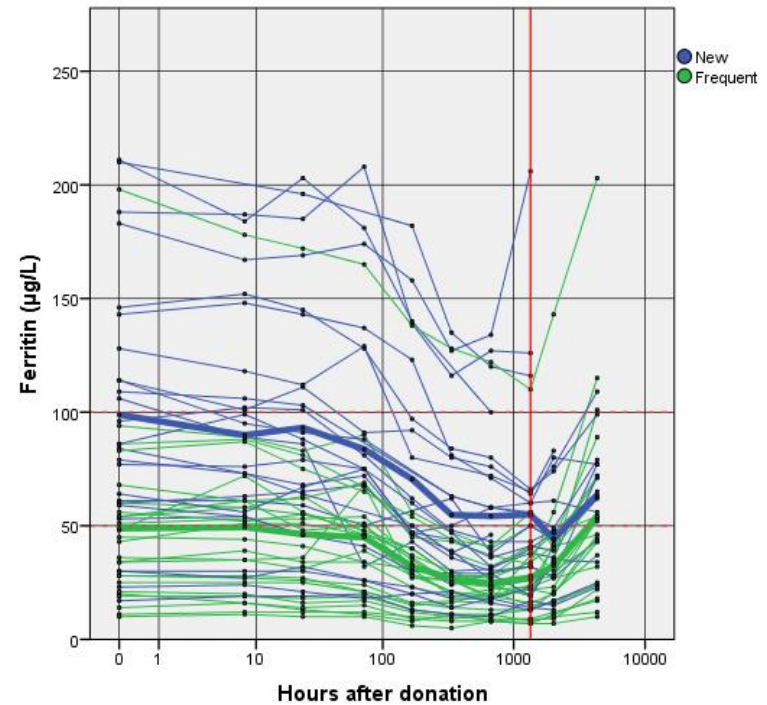
Hours	Days
0	
8	
24	Day 2
72	Day 4
168	Day 8
336	Day 15
672	Day 29
1344	Day 57
2016	Day 85
4320	Day 180

Kinetics of IronN after Donation (KIND)

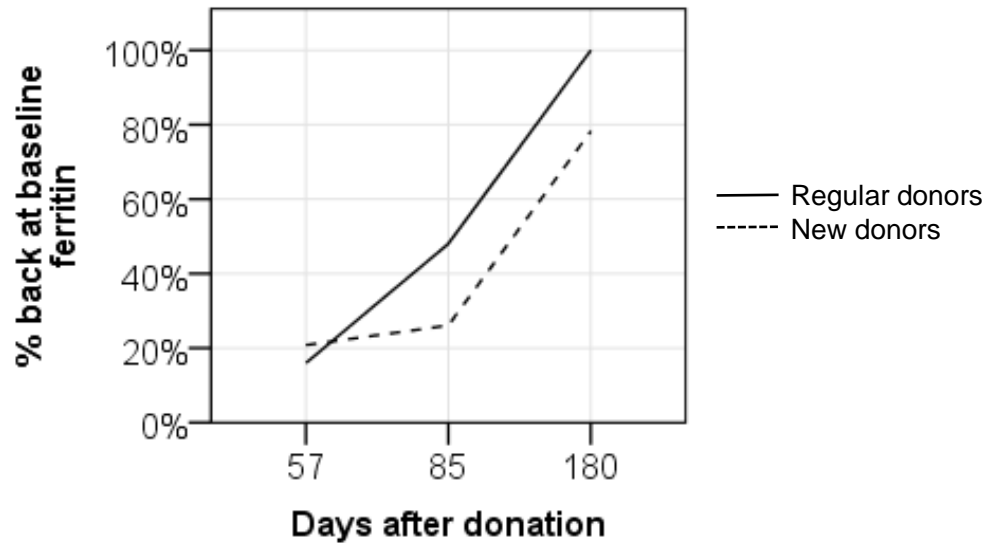
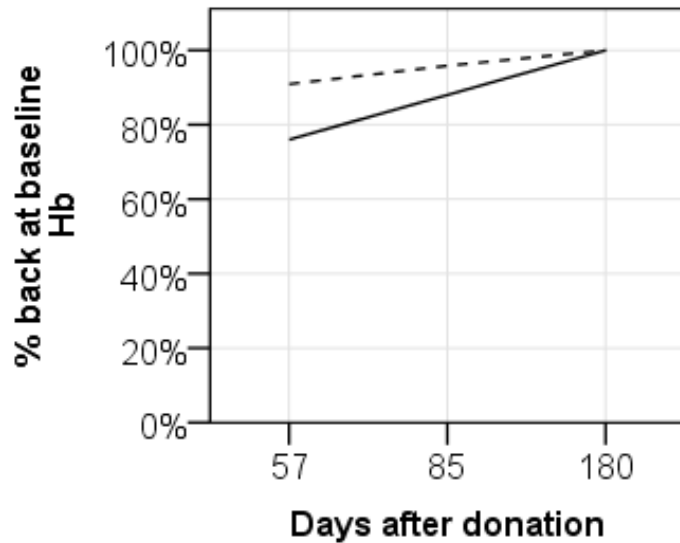
Hemoglobin



Ferritin

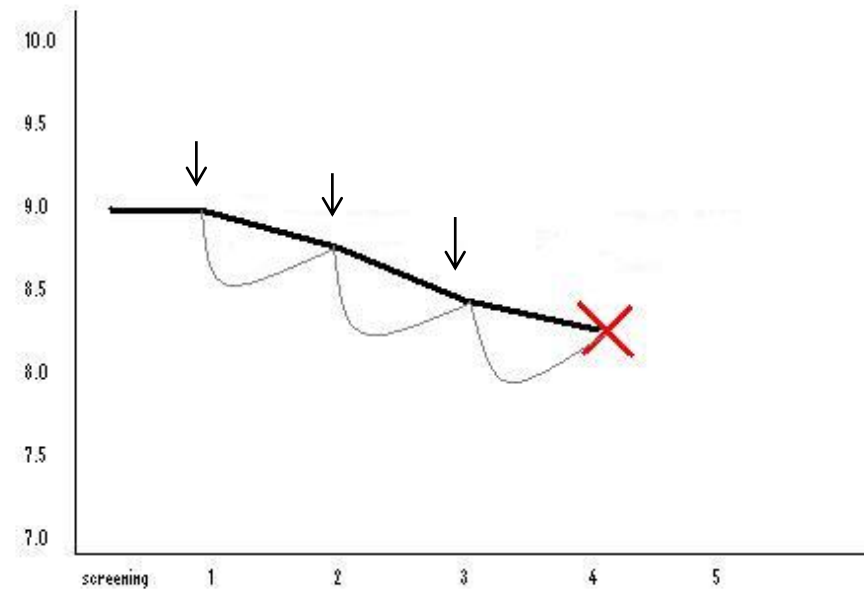
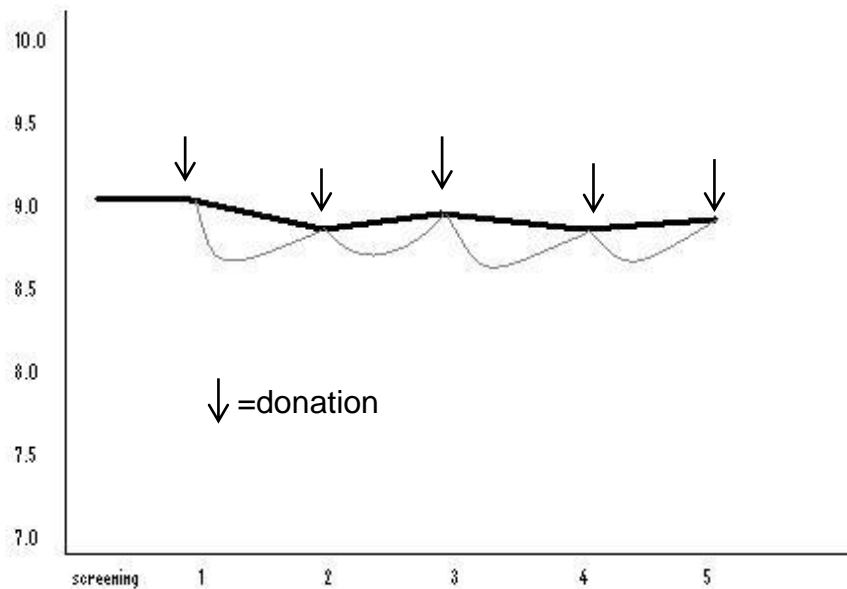


Percentage back at baseline levels



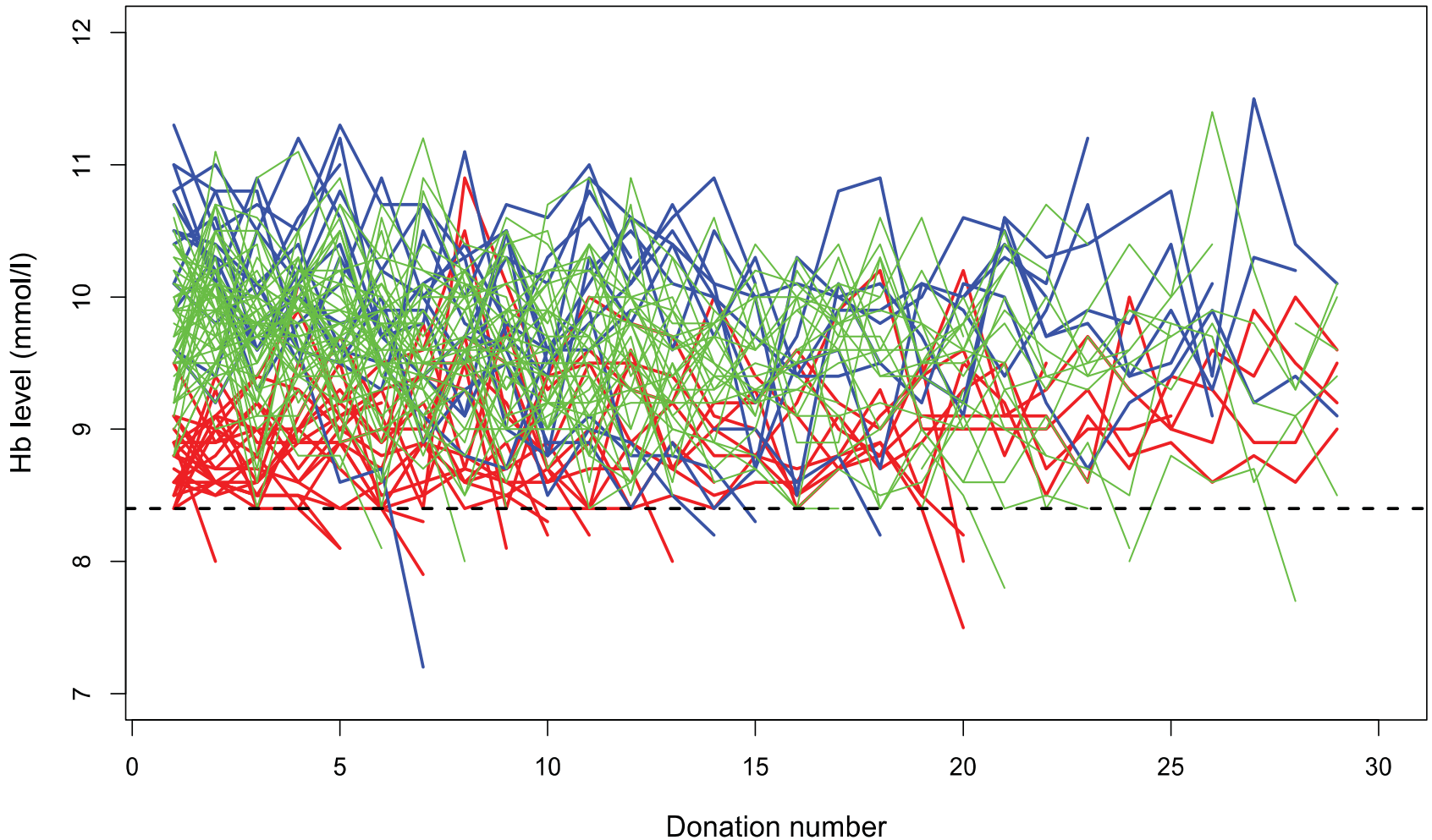
Hb trajectories in donors

- Hemoglobin measured each donation (HemoCue)
- Hypothesis: diverse Hb trajectory after donation in donors – how come?

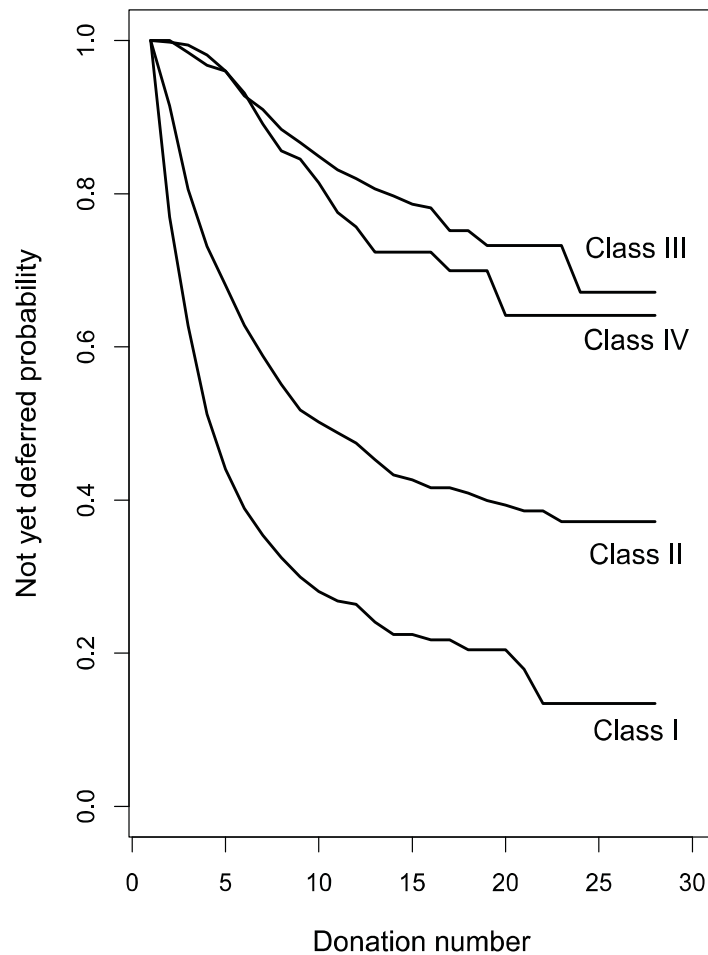
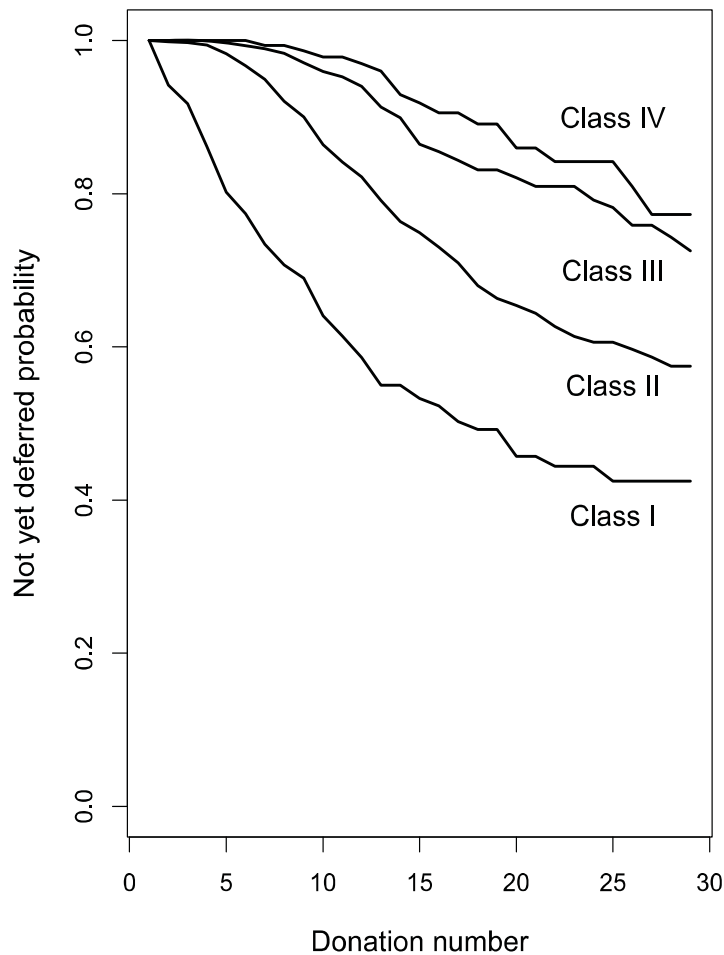


Male Hb profiles (three groups)

Donor groups based on most similar Hb trajectory



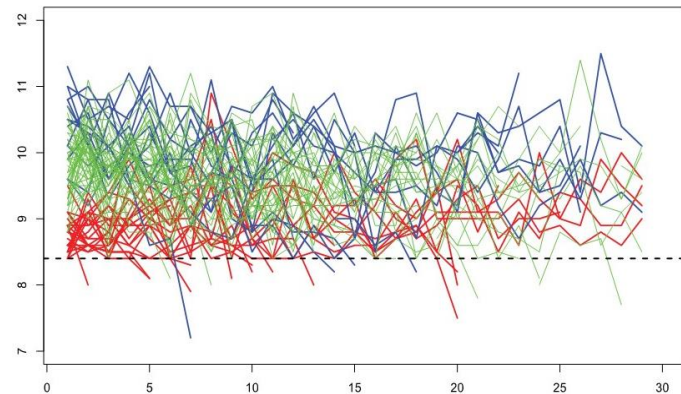
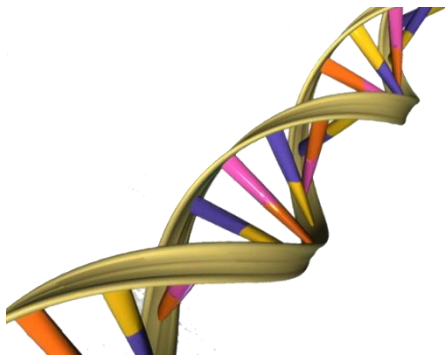
Donors deferred proportion Kaplan-Meier curves of the latent classes



Donor InSight (DIS)-III

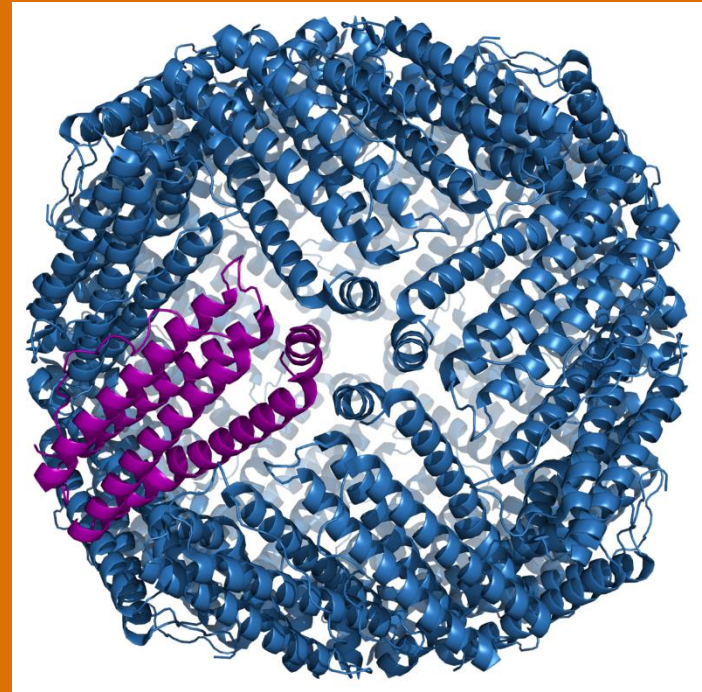
PhD project Tiffany Timmer

Aim: To identify genetic determinants of Hb trajectories
To study symptoms of iron deficiency in donors



+ questionnaires: 3.000 donors

Ferritin measurement in whole blood donors



Ferritin levels in Donor InSight

Ferritin

%<15 %<26 %<30

MAN

0 "Geen volbloeddonaties"			
1 "1 volbloeddonatie"	0,0%	0,0%	0,0%
2 "2 -10 volbloeddonaties"	0,0%	0,0%	0,0%
3 "11-20 volbloeddonaties"	7,7%	18,7%	20,9%
4 "21-30 volbloeddonaties"	9,2%	30,6%	35,7%
5 "31-40 volbloeddonaties"	13,4%	31,7%	43,9%
6 "41-50 volbloeddonaties"	12,2%	24,5%	32,7%
7 ">50 volbloeddonaties".	7,5%	25,0%	32,5%

VROUW <45 JAAR

0 "Geen volbloeddonaties"			
1 "1 volbloeddonatie"			
2 "2 -10 volbloeddonaties"	14,0%	34,0%	48,0%
3 "11-20 volbloeddonaties"	26,1%	47,8%	58,0%
4 "21-30 volbloeddonaties"	36,4%	59,1%	68,2%
5 "31-40 volbloeddonaties"	0,0%	40,0%	40,0%

VROUW >= 45 JAAR

0 "Geen volbloeddonaties"			
1 "1 volbloeddonatie"			
2 "2 -10 volbloeddonaties"	14,3%	25,0%	32,1%
3 "11-20 volbloeddonaties"	18,2%	33,8%	44,2%
4 "21-30 volbloeddonaties"	13,6%	39,4%	45,5%
5 "31-40 volbloeddonaties"	21,9%	50,0%	53,1%
6 "41-50 volbloeddonaties"	0,0%	33,3%	41,7%
7 ">50 volbloeddonaties".	0,0%	40,0%	40,0%



Ferritin measurement in whole blood donors

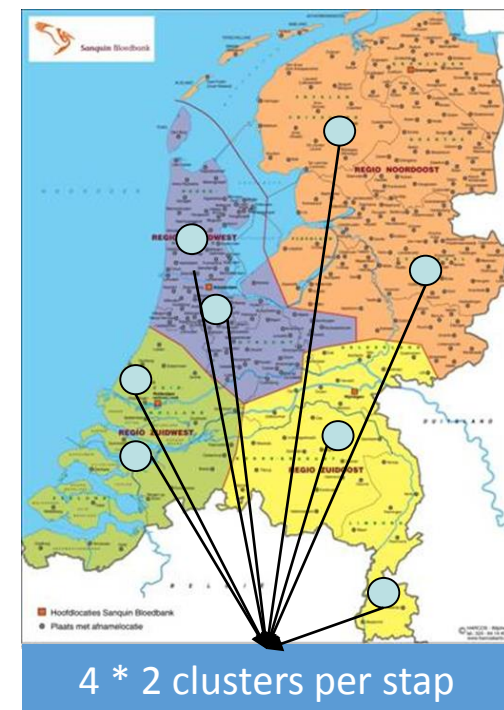
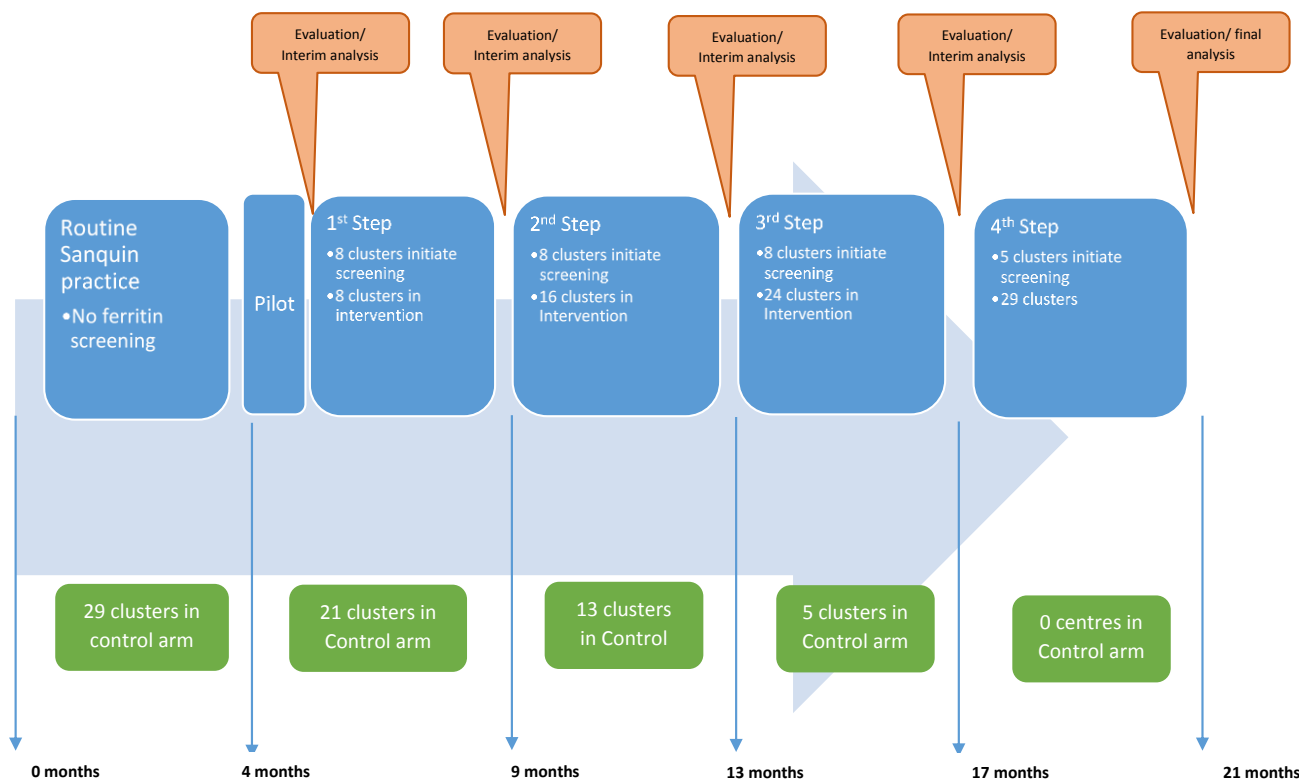
Short-term

- Preventing iron loss in whole blood donors and untoward effects
- Lowering deferral rates for low Hb

Long-term

- Personalized intervals (based on longitudinal Hb and ferritin measurements)
- Improved donor retention

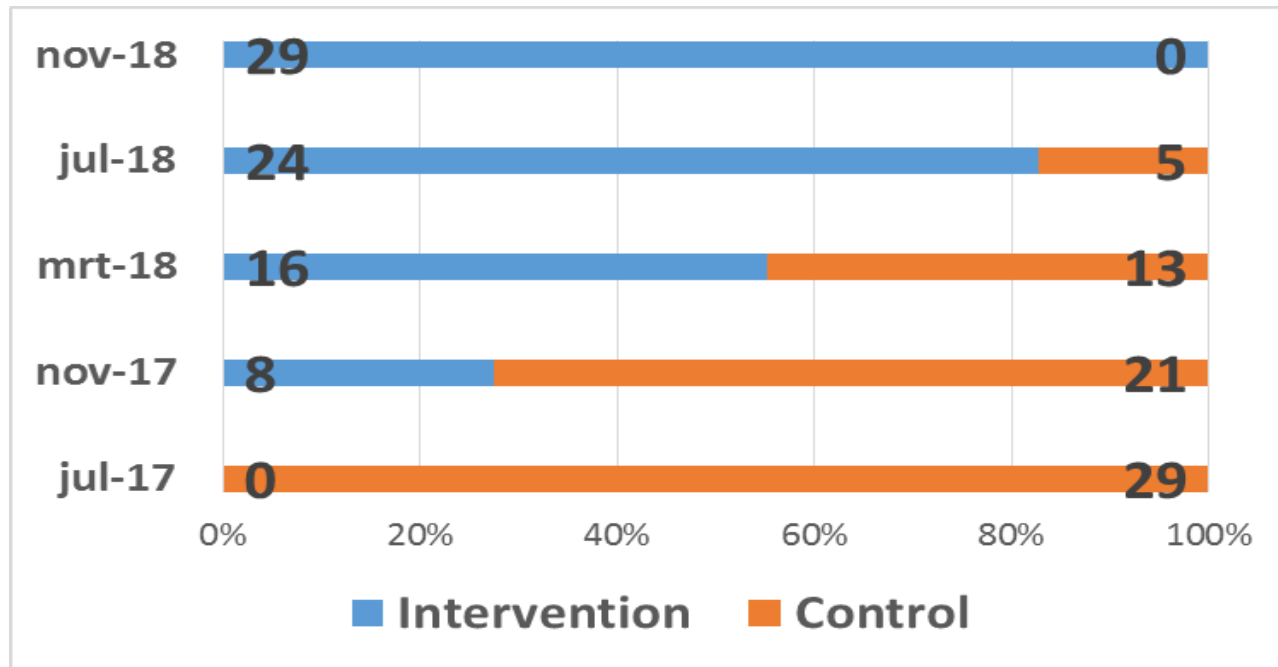
Stepped wedge approach



Sept 2017

FIND'EM stepped wedge cluster-randomized trial

Ferritin measurement IN Donors – Effectivity of iron Monitoring



Outcomes:

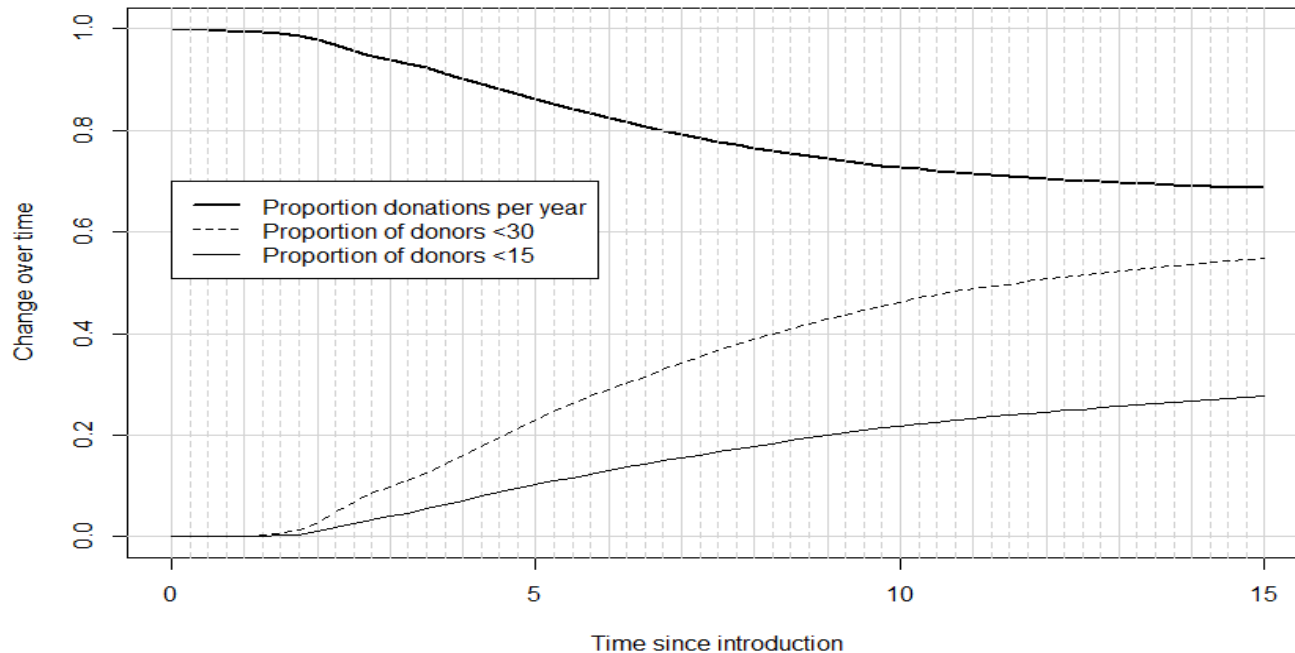
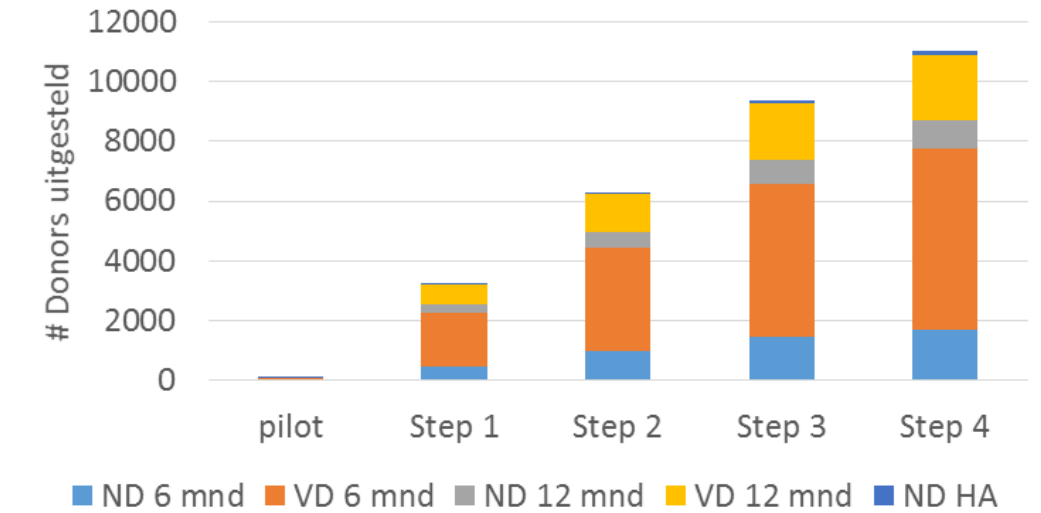
- Ferritin and Hb levels + deferral percentages
- Donor availability
- Costs

Donor deferral thresholds

- Who tested for ferritin?
 - all new whole blood donors
 - repeat donors: every 5th donation
- When deferred?
 - ferritin ≤ 15 ng/ml: 1 year
 - ferritin between 15 and 30 ng/ml: 6 months

Loss of donors

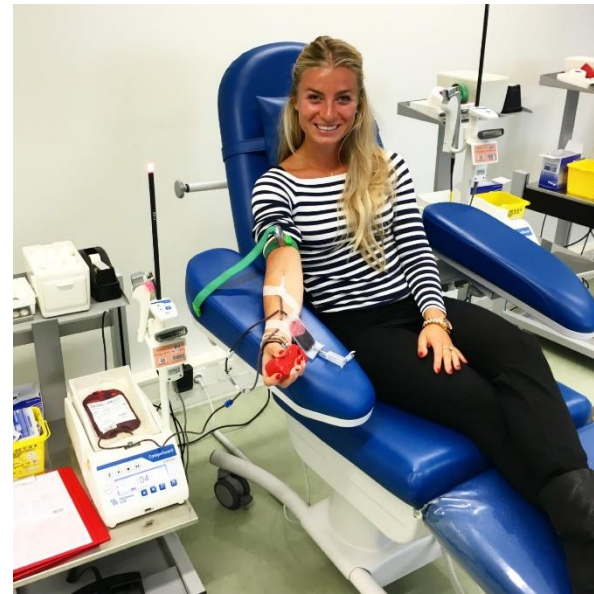
A priori estimated deferral numbers per step



Deferral of donors – April 2018

	New donors	Repeat donors (tested every 5th donation)	All tested donors (new + repeat)	All donors donating at included centers	8-mrt-'18	15-feb-'18	8-jan-'18	23-nov-'17	19-okt-'17
<15	4.1%	15.3%	11.8%	2.7%					
15-30	14.5%	33.4%	27.5%	6.4%					
N	4,197	9,146	13,343	57,592					
Total % deferred:				9.1%	9.4%	9.7%	9.7%	10.2%	9.8%

Take home



Iron depletion unwanted effect of (repeated) donations:

Effectivity of ferritin-guided donation intervals currently under study.

Thank you! Merci bien!

