

Generalizability of Dutch Prediction Models for Low Hemoglobin Deferral: A Study on External Validation and Updating in Swiss Whole Blood Donors

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Supplemental Material

Appendix I

Appendix I Logistic regression coefficients of the original Dutch prediction models to calculate the risk of Hb deferral*

Predictor	Value or coding	Beta [†]	
		Men	Women
Age, per year [‡]	age	0.01	-0.03
	(age-22.5) ^{+^3}		1.22x10 ⁻⁴
	(age-34.6) ^{+^3}		-5.22x10 ⁻⁴
	(age-45.0) ^{+^3}		9.05x10 ⁻⁴
	(age-54.0) ^{+^3}		-6.79x10 ⁻⁴
Seasonality	(age-65.0) ^{+^3}		1.73x10 ⁻⁴
	winter	0	0
	spring	0.49	0.25
	summer	0.41	0.28
Previous Hb level, per mmol/L below sex specific cutoff level [§]	fall	-0.20	-0.14
	men: Hb-8.4, women: Hb-7.8	-2.27	-2.10
Previous Hb level, per mmol/L at or above sex specific cutoff level [§]	men: Hb-8.4, women: Hb-7.8	-3.77	-3.31
Delta Hb, per mmol/L equal to or smaller than 0 mmol/L [§]	delta Hb	1.35	1.04
	delta Hb	1.24	1.37
Delta Hb, per mmol/L greater than 0 mmol/L [§]	delta Hb	1.24	1.37
Time since previous visit, per month smaller than 1 year [§]	months-12	-0.18	-0.16
Deferral at previous visit	no deferral	0	0
	due to low Hb	-0.62	-0.53
	due to other reasons than low Hb	-0.96	-0.93
Number of whole blood donations in past 2 years	nr of donations	-0.05	-0.17
Intercept		-2.77	-0.70

* With those regression coefficients the linear predictor can be calculated. The risk of Hb deferral equals: risk (Hb deferral) = 1/(1+e^{-linear predictor}).

† Beta = regression coefficient, shows the strength and the direction of the variable's influence.

‡ In men the association between age and risk of Hb deferral was linear, in women the association showed several curves that were modeled with a restricted cubic spline function (see figure 1). Negative values of the cubic terms become 0; e.g. (age - 22.5)⁺ indicates age - 22.5 for positive values, 0 for negative values.

§ Nonlinear association with risk of Hb deferral.

|| Winter and no deferral are reference categories, other categories: 1 if true, 0 if false.

Appendix II. Distribution of predictors at the intended visit in deferred and approved donors*

Predictor	Swiss validation data		Dutch development data	
	Hb deferral [†]	Hb approval	Hb deferral [†]	Hb approval
Men	n=1065	n=31419	n=4568	n=107923
Age, years	50 (11)	46 (12)	52 (12)	49 (12)
Seasonality				
Winter	157 (14.7)	5991 (19.1)	775 (17.0)	22014 (20.4)
Spring	278 (26.1)	8106 (25.8)	1399 (30.6)	27641 (25.6)
Summer	324 (30.4)	8445 (26.9)	1477 (32.3)	29838 (27.6)
Fall	306 (28.7)	8877 (28.3)	917 (20.1)	28430 (26.3)
Previous Hb level, mmol/L	8.8 (0.5)	9.6 (0.6)	8.6 (0.5)	9.4 (0.6)
Delta Hb, mmol/L	-0.1 (-0.4 - 0.3)	0 (-0.4 - 0.4)	-0.1 (-0.4 - 0.2)	0 (-0.4 - 0.4)
Time since previous visit, days	171 (118 - 258)	179 (119 - 317)	86 (70 - 124)	113 (78 - 217)
Deferral at previous visit				
Due to low Hb	191 (17.9)	693 (2.2)	683 (15.0)	2924 (2.7)
Due to other reason than low Hb	19 (1.8)	1170 (3.7)	52 (1.1)	3623 (3.4)
Number of whole blood donations in past 2 years	3 (2 - 4)	3 (2 - 4)	5 (3 - 7)	4 (2 - 6)
Hb intended visit, mmol/L	8.1 (0.4)	9.5 (0.6)	7.9 (0.3)	9.4 (0.6)
Women	n=2063	n=19225	n=8297	n=100158
Age, years	39 (13)	43 (13)	40 (12)	45 (13)
Seasonality [†]				
Winter	381 (18.5)	3591 (18.7)	1452 (17.5)	19035 (19.0)
Spring	521 (25.3)	5165 (26.9)	2364 (28.5)	25725 (25.7)
Summer	660 (32.0)	5293 (27.5)	2682 (32.3)	28963 (28.9)
Fall	501 (24.3)	5176 (26.9)	1799 (21.7)	26435 (26.4)
Previous Hb level, mmol/L	8.1 (0.5)	8.6 (0.6)	7.9 (0.5)	8.5 (0.6)
Delta Hb, mmol/L	-0.1 (-0.4 - 0.3)	0 (-0.4 - 0.4)	-0.1 (-0.5 - 0.3)	0 (-0.4 - 0.4)
Time since previous visit, days	178 (125 - 273)	210 (139 - 364)	137 (117 - 185)	158 (121 - 266)
Deferral at previous visit				
Due to low Hb	446 (21.6)	1316 (6.8)	1683 (20.3)	4975 (5.0)
Due to other reason than low Hb	41 (2.0)	843 (4.4)	131 (1.6)	4180 (4.2)
Number of whole blood donations in past 2 years	2 (2 - 3)	2 (2 - 3)	3 (2 - 4)	3 (2 - 4)
Hb intended visit, mmol/L	7.4 (0.4)	8.6 (0.5)	7.3 (0.3)	8.5 (0.5)

* Data are reported as mean (\pm SD), n (%) or median (25th - 75th percentile).

[†] Hb < 8.4 mmol/L (= 135 g/L) for men and < 7.8 mmol/L (=125 g/L) for women.

Appendix III. Logistic regression coefficients of the recalibrated and revised prediction models to calculate the risk of Hb deferral*

Predictor	Value or coding	Beta [†]				
		Recalibrated model		Revised model		
		Men	Women	Men	Women	
Age, per year [‡]	age	0.01	-0.03	0.01	-0.06	
	(age-22.5) ₊ ³		0.91x10 ⁻⁴		2.23x10 ⁻⁴	
	(age-34.6) ₊ ³		-3.99x10 ⁻⁴		-4.15x10 ⁻⁴	
	(age-45.0) ₊ ³		6.88x10 ⁻⁴		2.89x10 ⁻⁴	
	(age-54.0) ₊ ³		-5.01x10 ⁻⁴		-2.42x10 ⁻⁴	
	(age-65.0) ₊ ³		1.21x10 ⁻⁴		1.45x10 ⁻⁴	
Seasonality	winter	0	0	0	0	
	spring	0.36	0.19	0.40	0.05	
	summer	0.30	0.21	0.33	0.26	
	fall	-0.15	-0.11	-0.16	0.00	
Previous Hb level, per mmol/L	below sex specific cutoff level [§]	men: Hb-8.4, women: Hb-7.8	-1.68	-1.60	-1.84	-0.82
	at or above sex specific cutoff level [§]	men: Hb-8.4, women: Hb-7.8	-2.79	-2.52	-3.05	-2.60
Delta Hb, per mmol/L	equal to or smaller than 0 mmol/L [§]	delta Hb	1.00	0.79	1.09	0.87
	greater than 0 mmol/L [§]	delta Hb	0.92	1.04	1.00	0.96
Time since previous visit, per month smaller than 1 year [§]	months-12	-0.13	-0.12	-0.14	0.10	
Deferral at previous visit	no deferral	0	0	0	0	
	due to low Hb	-0.46	-0.40	-0.50	-0.15	
	due to other reasons than low Hb	-0.71	-0.71	-0.78	-1.06	
Number of whole blood donations in past 2 years	nr of donations	-0.04	-0.13	-0.04	-0.09	
Intercept		-2.23	-0.45	-1.55	0.48	

* With those regression coefficients the linear predictor can be calculated. The risk of Hb deferral equals: risk (Hb deferral) = 1/(1+e^{-linear predictor}).

[†] Beta = regression coefficient, shows the strength and the direction of the variable's influence.

[‡] In men the association between age and risk of Hb deferral was linear, in women the association showed several curves that were modeled with a restricted cubic spline function. Negative values of the cubic terms become 0; e.g. (age - 22.5)₊ indicates age - 22.5 for positive values, 0 for negative values.

[§] Nonlinear association with risk of Hb deferral.

^{||} Winter and no deferral are reference categories, other categories: 1 if true, 0 if false.