Avoidable, Delayed and Under or Overtransfusion (ADU)

FIGURES FROM THE ANNUAL SHOT REPORTS 2016-2024

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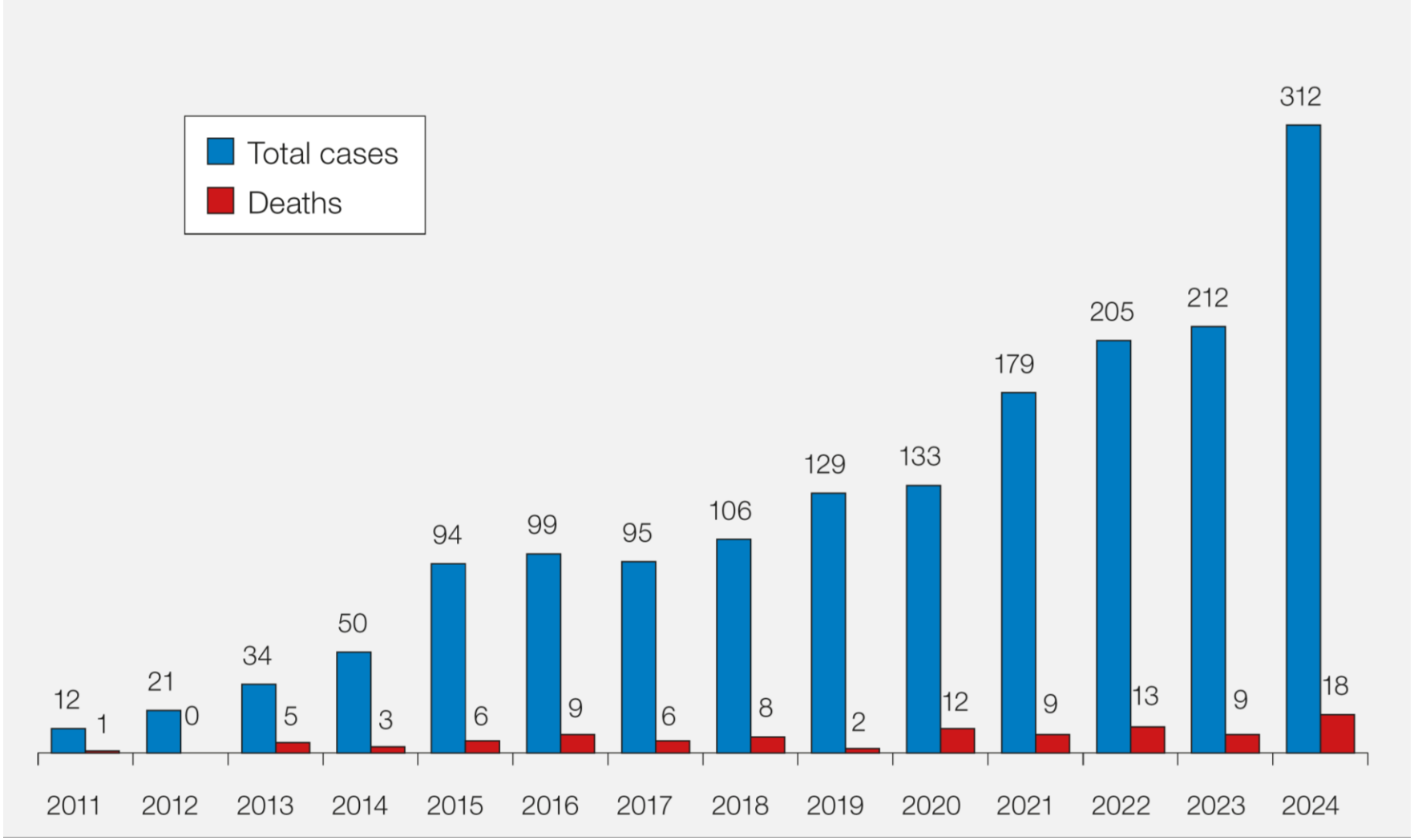
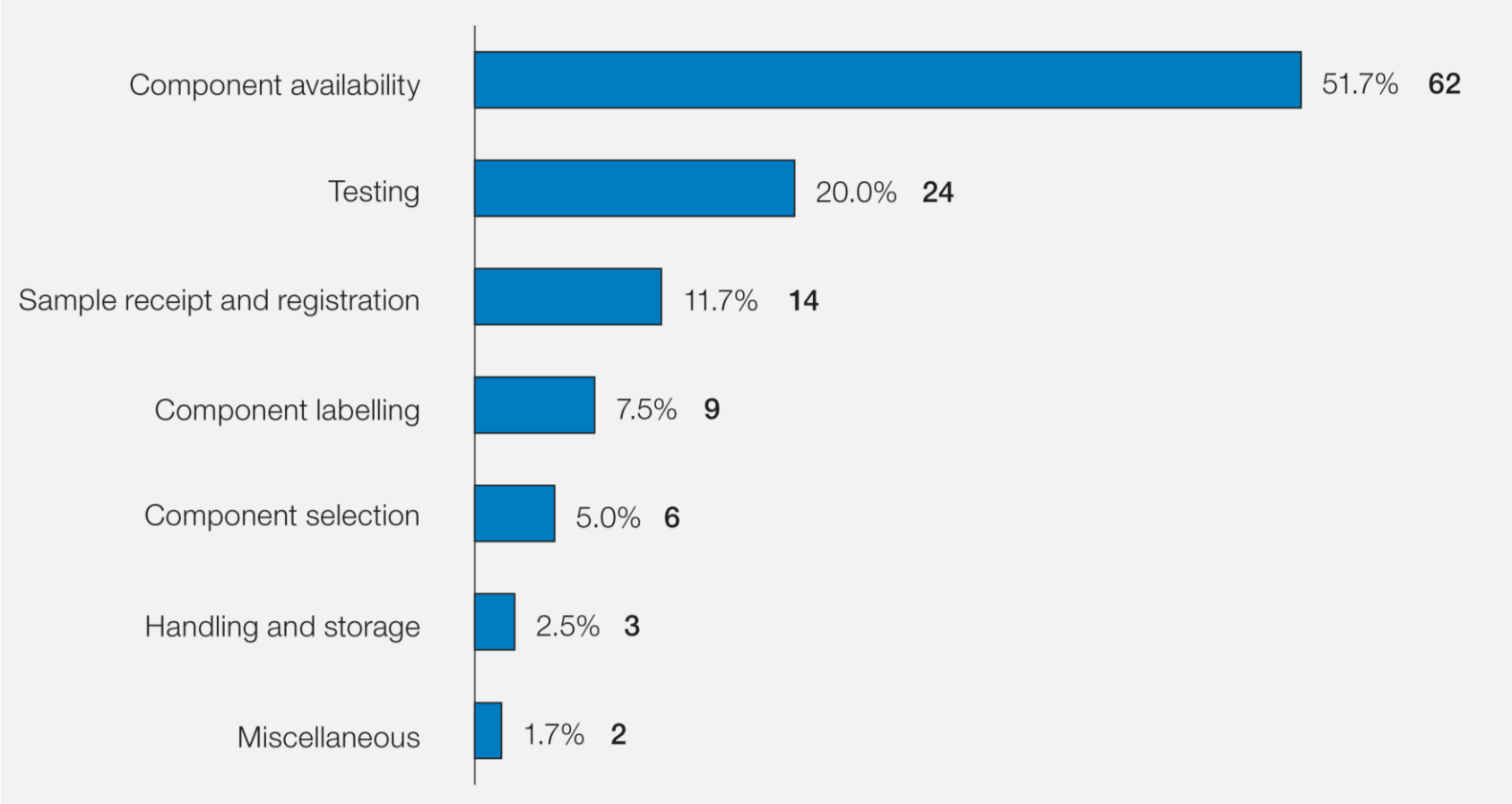
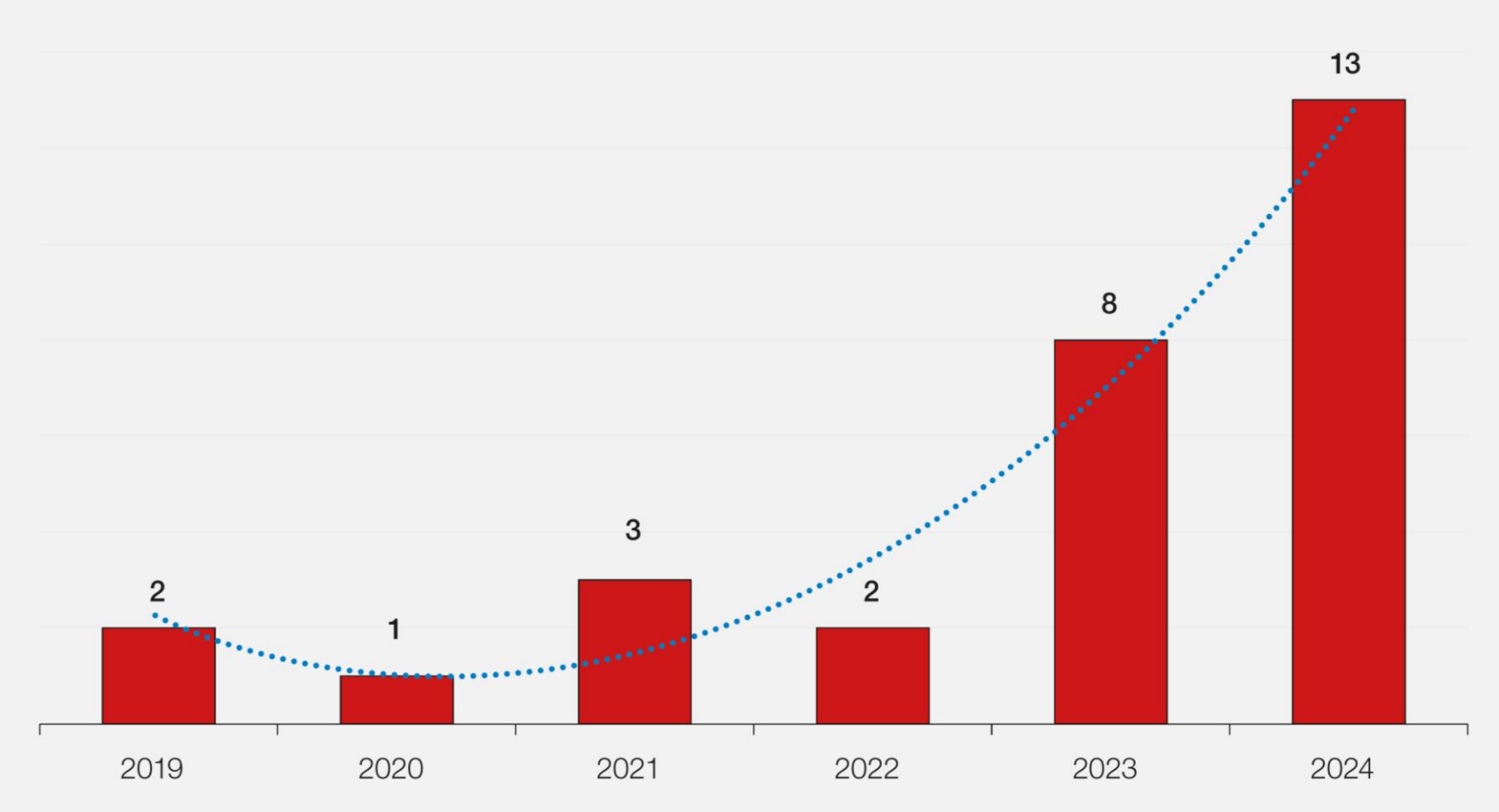
Delayed transfusion reports and deaths by year 2011 to 2024



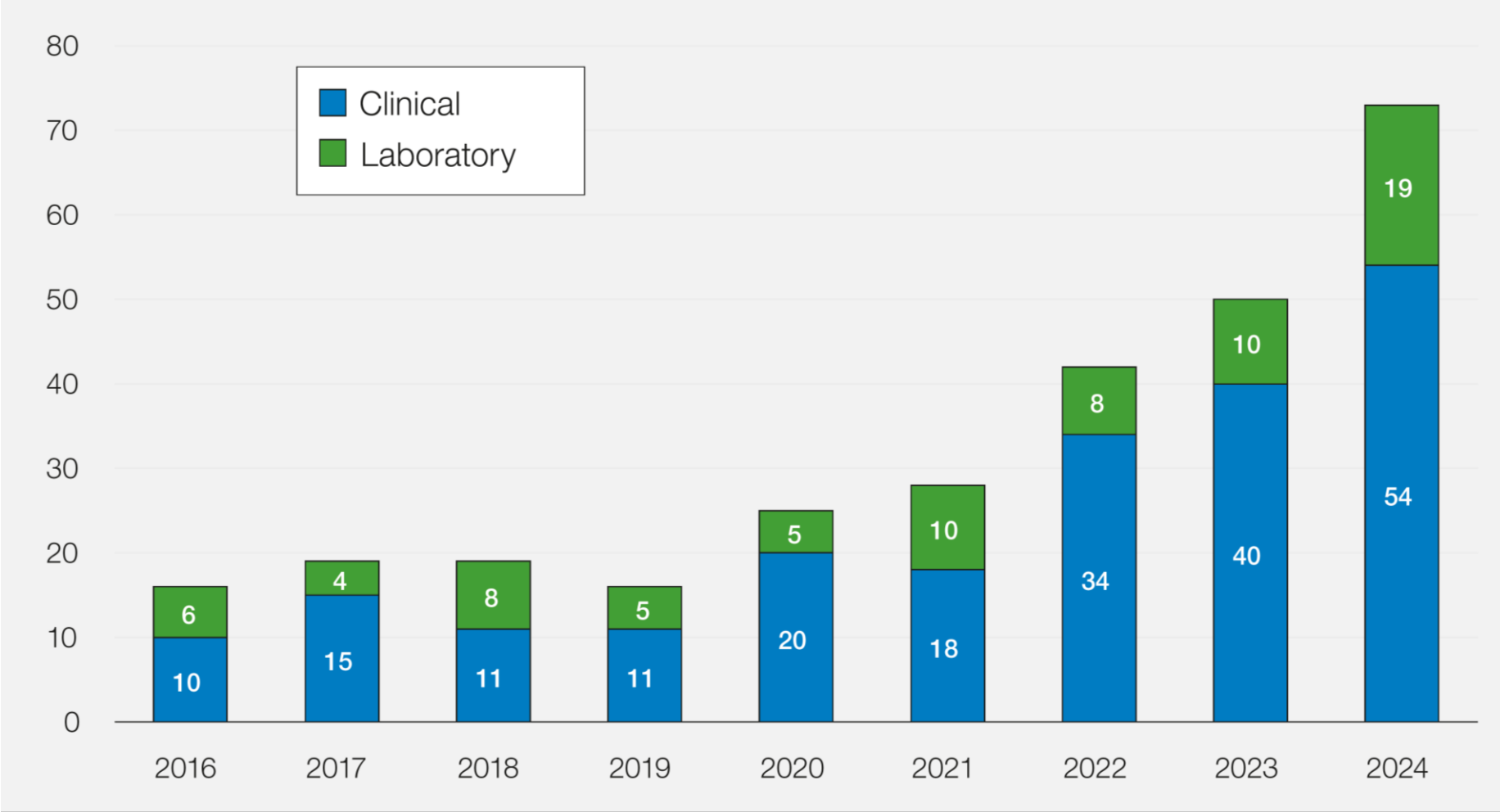
Transfusion process step where laboratory errors occurred resulting in transfusion delays in 2024 (n=120)



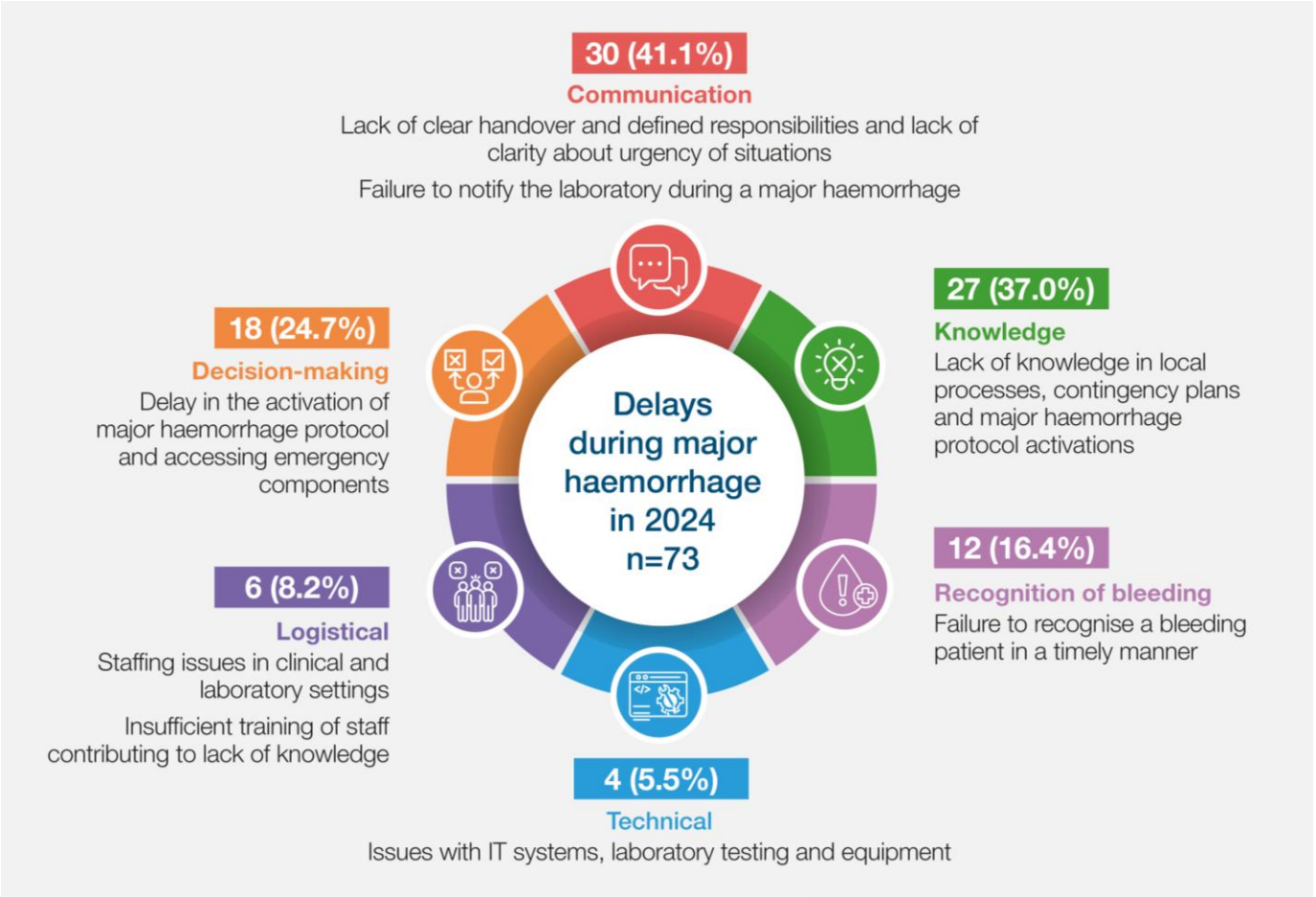
Trend in delayed transfusions due to errors in Blood Services 2019-2024



Delays associated with major haemorrhage protocol (MHP) 2016-2024

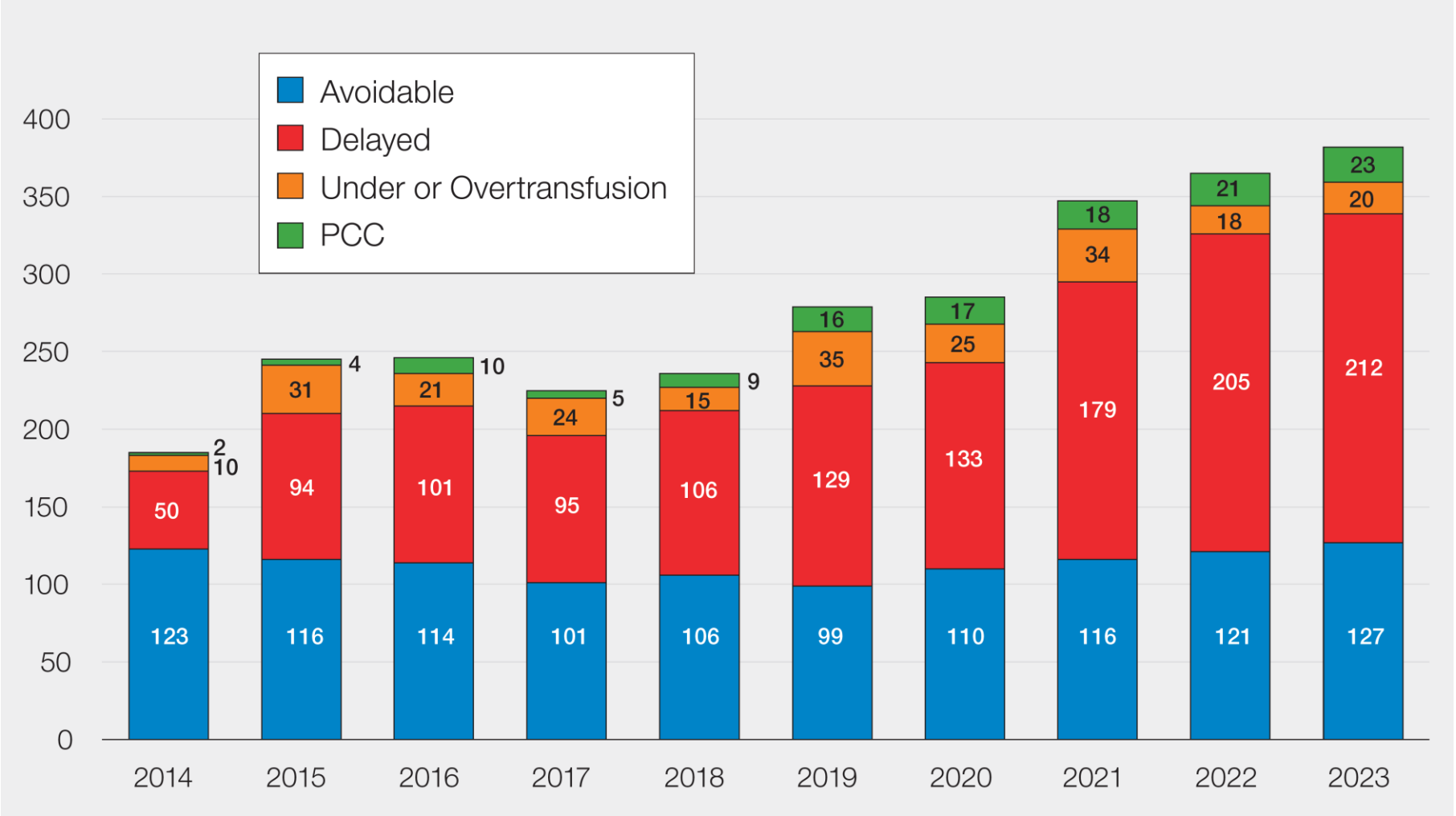


The multiple contributing factors that resulted in delays during major haemorrhage in 2024 (n=73)



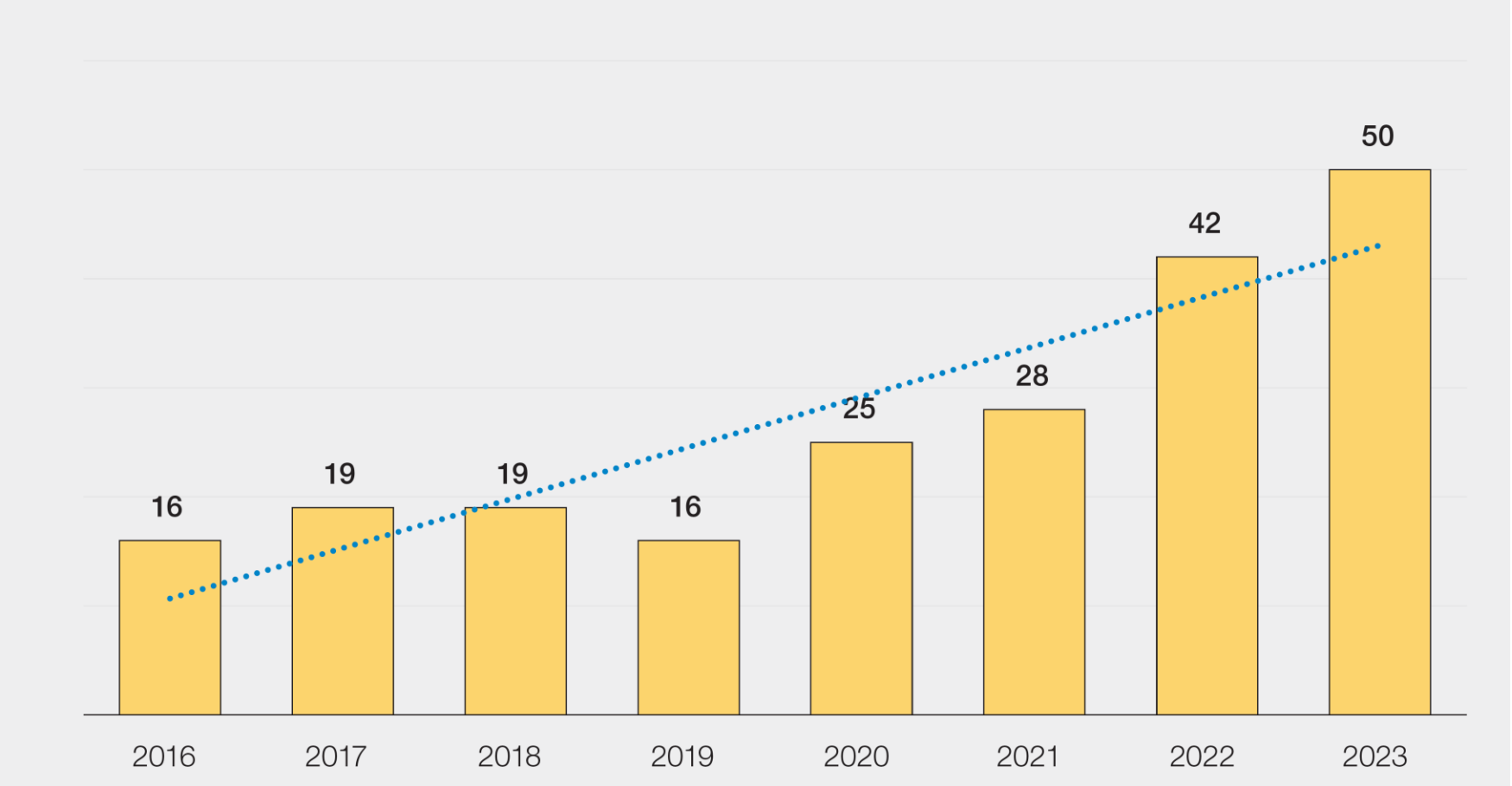
IT=information technology; MH=major haemorrhage; MHP=major haemorrhage protocol

ADU reports by category 2014-2023

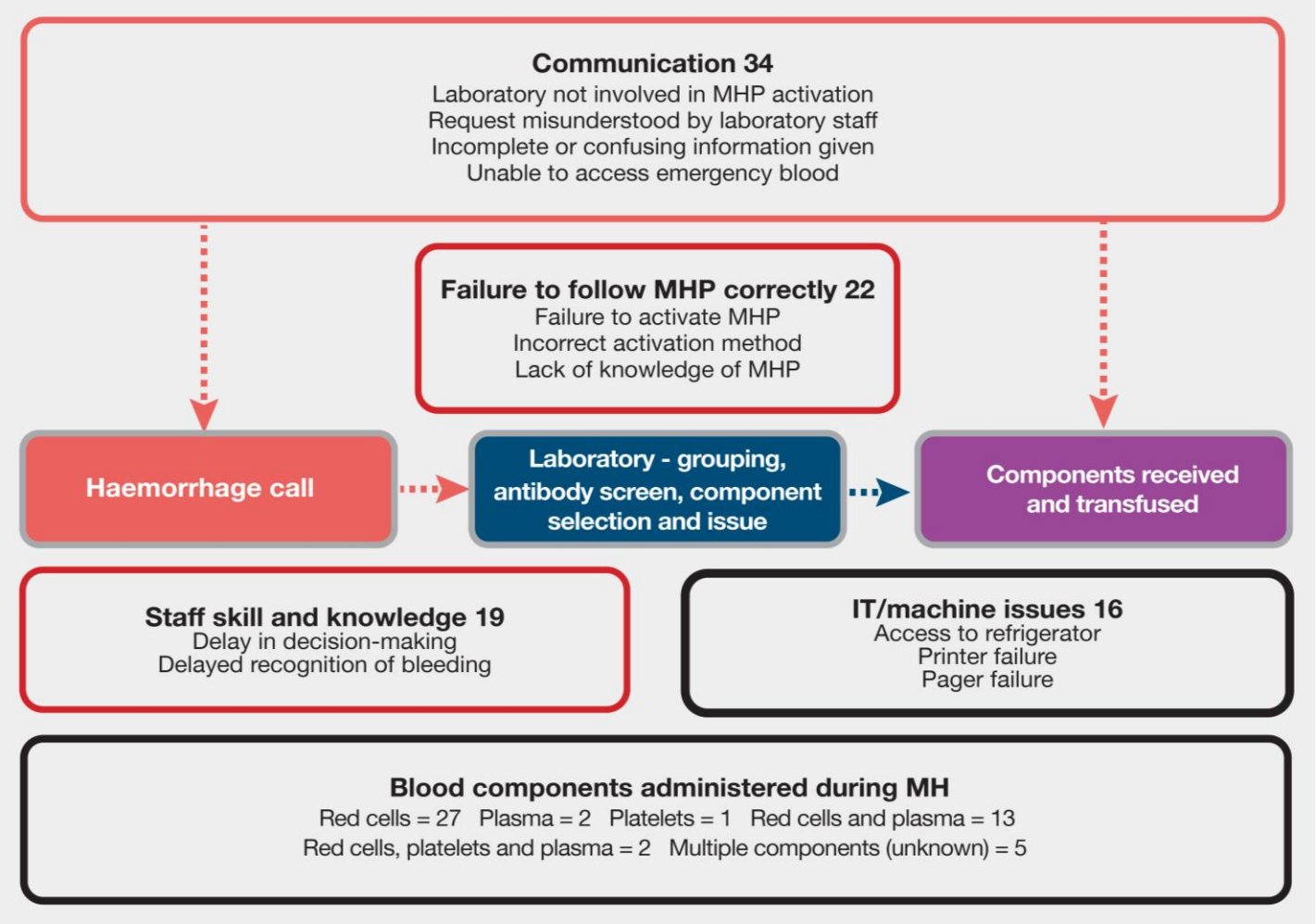


SHOT Serious Hazards of Transfusion

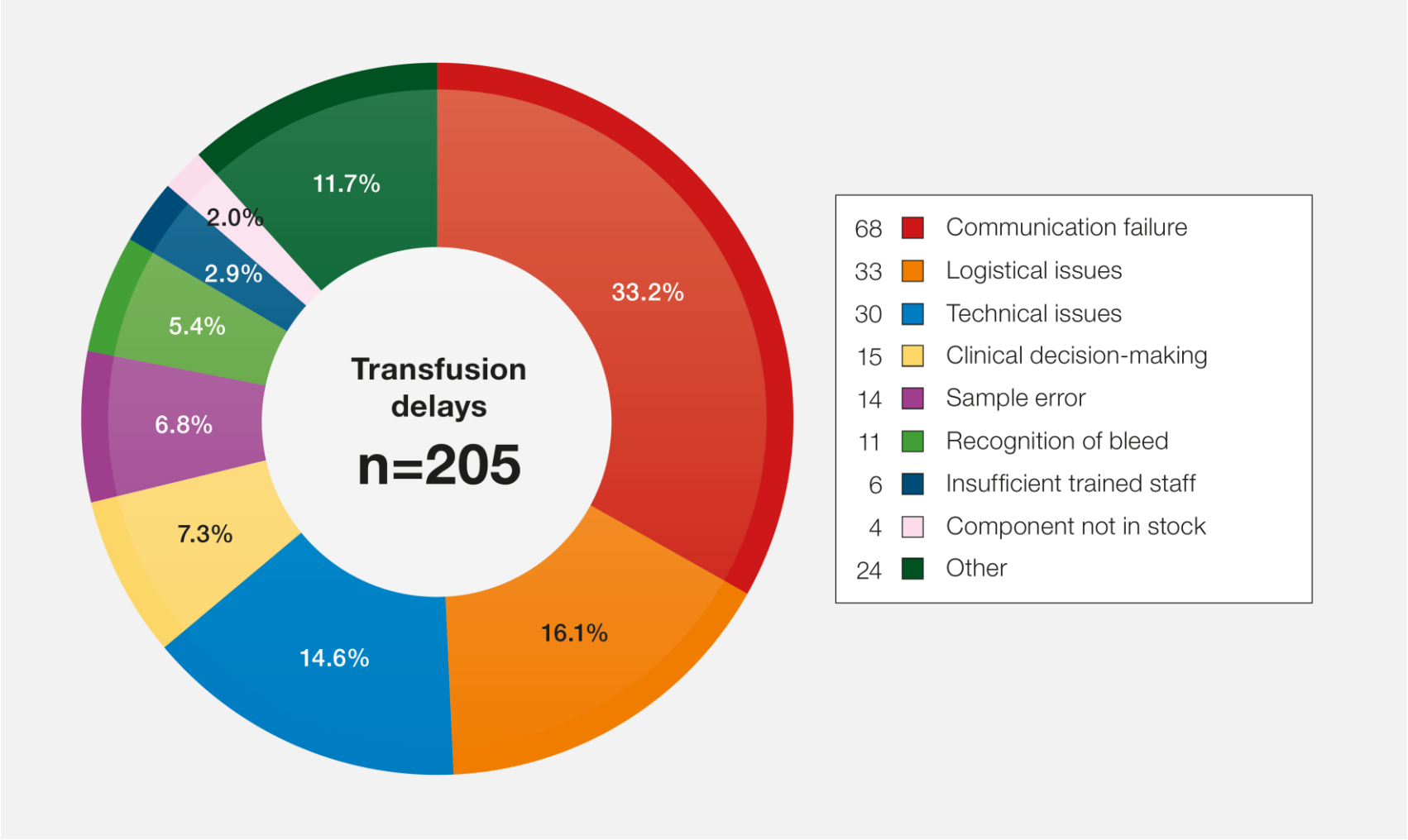
Number of delayed transfusions associated with MHP 2016-2023



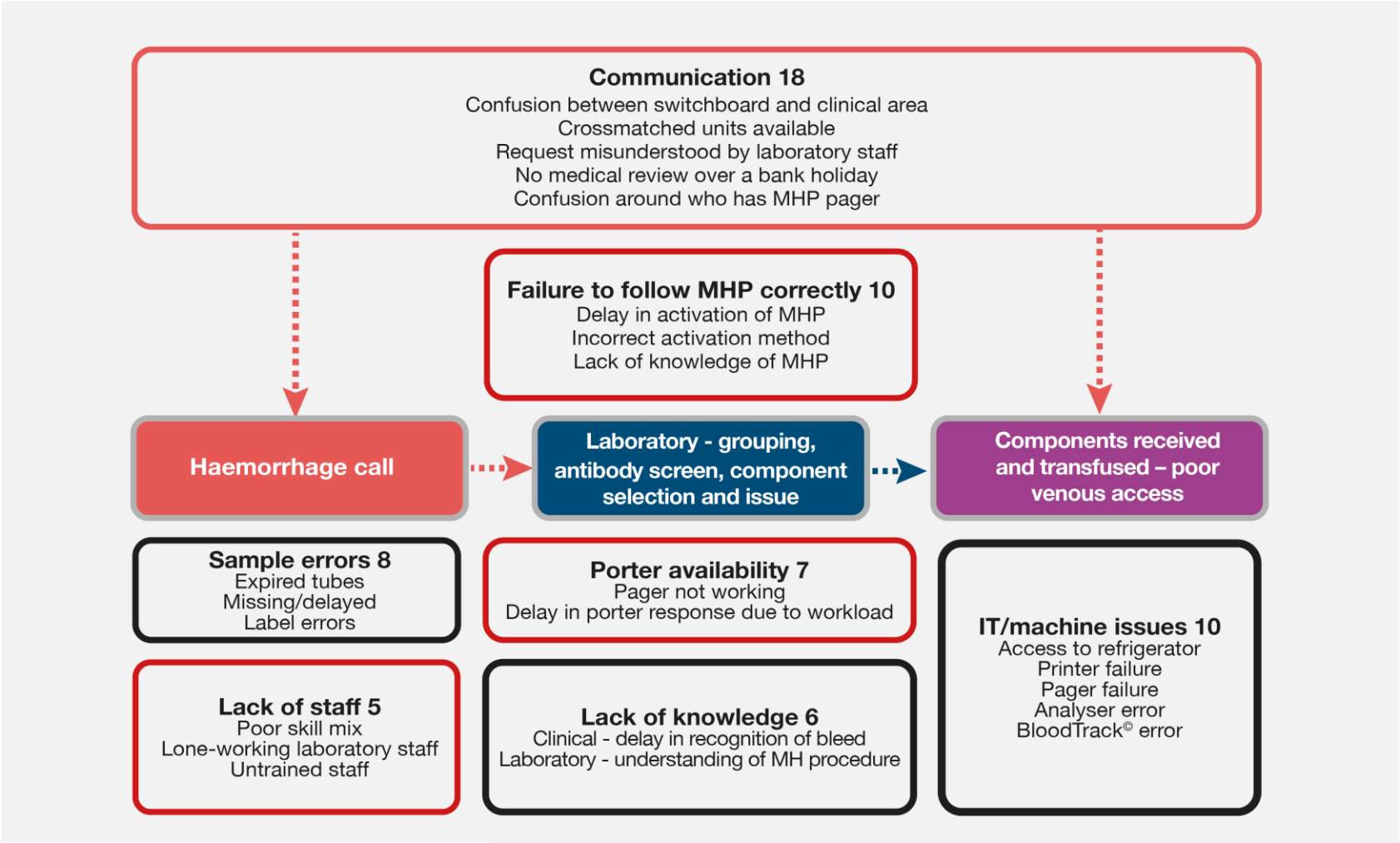
Key factors contributing to delayed transfusions in major haemorrhage in 2023 (n=50)



Primary causes of delayed transfusions in 2022 (n=205)

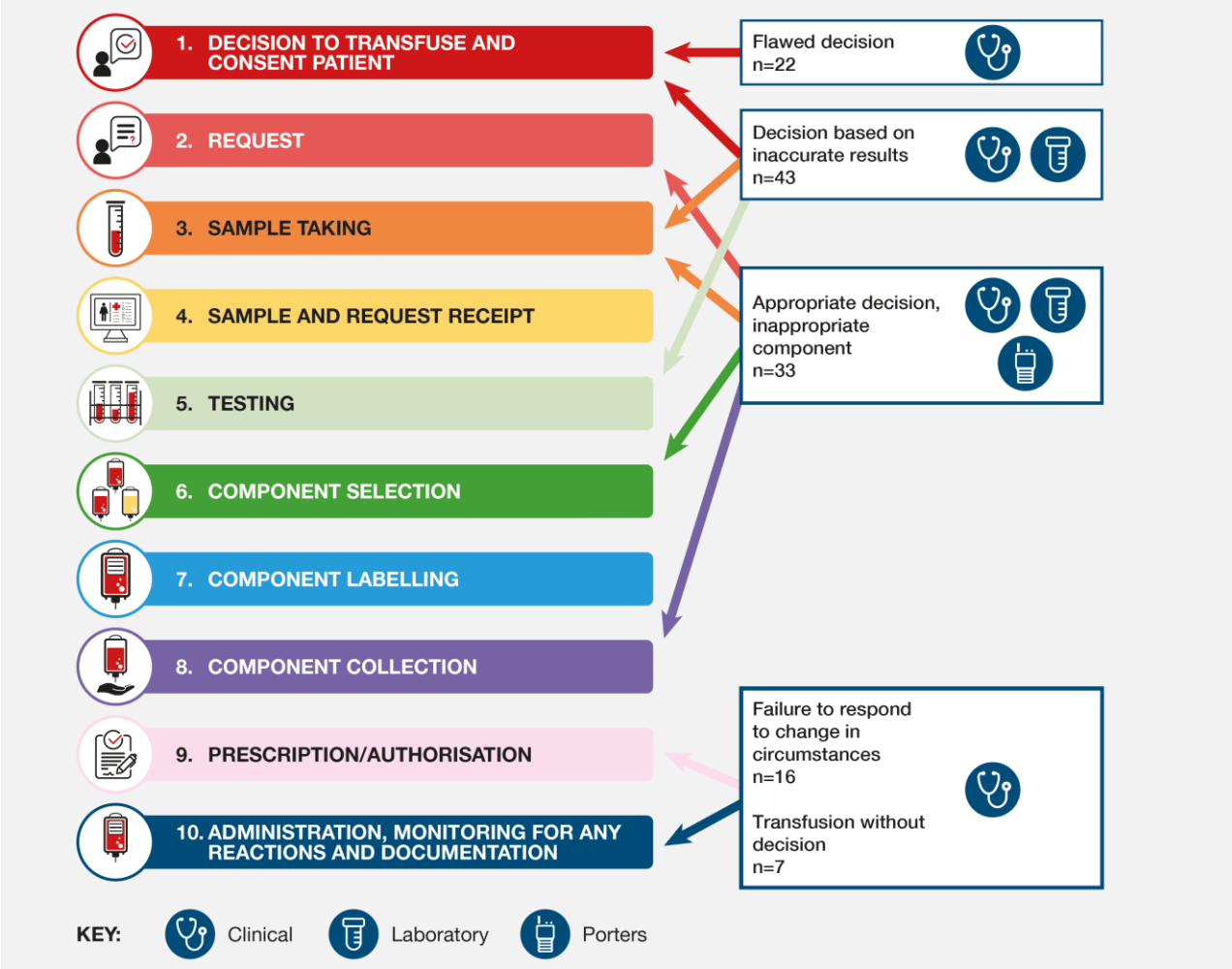


Key factors contributing to delayed transfusions in 41 cases of major haemorrhage in 2022

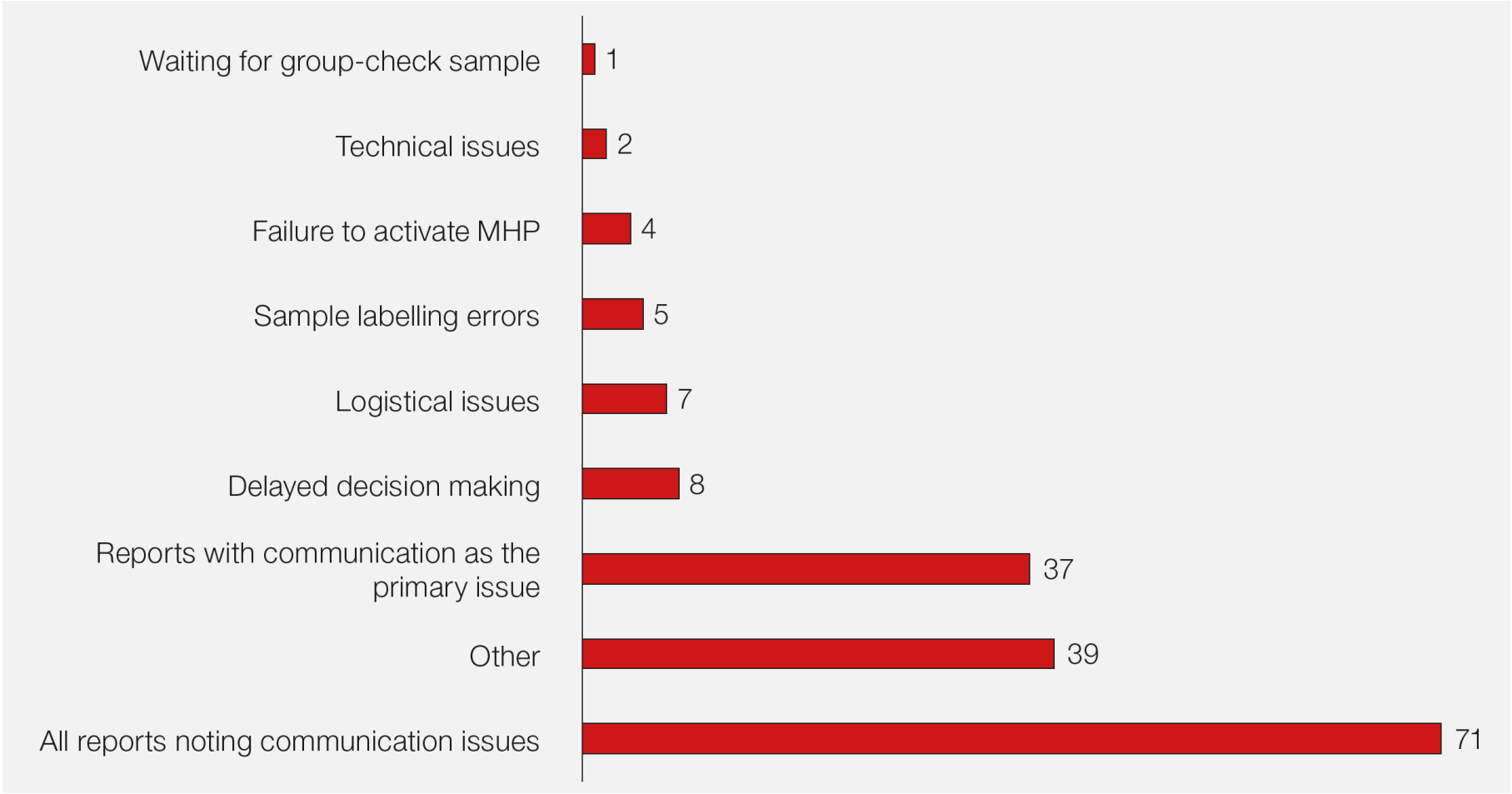


MHP=major haemorrhage protocol; IT=information technology

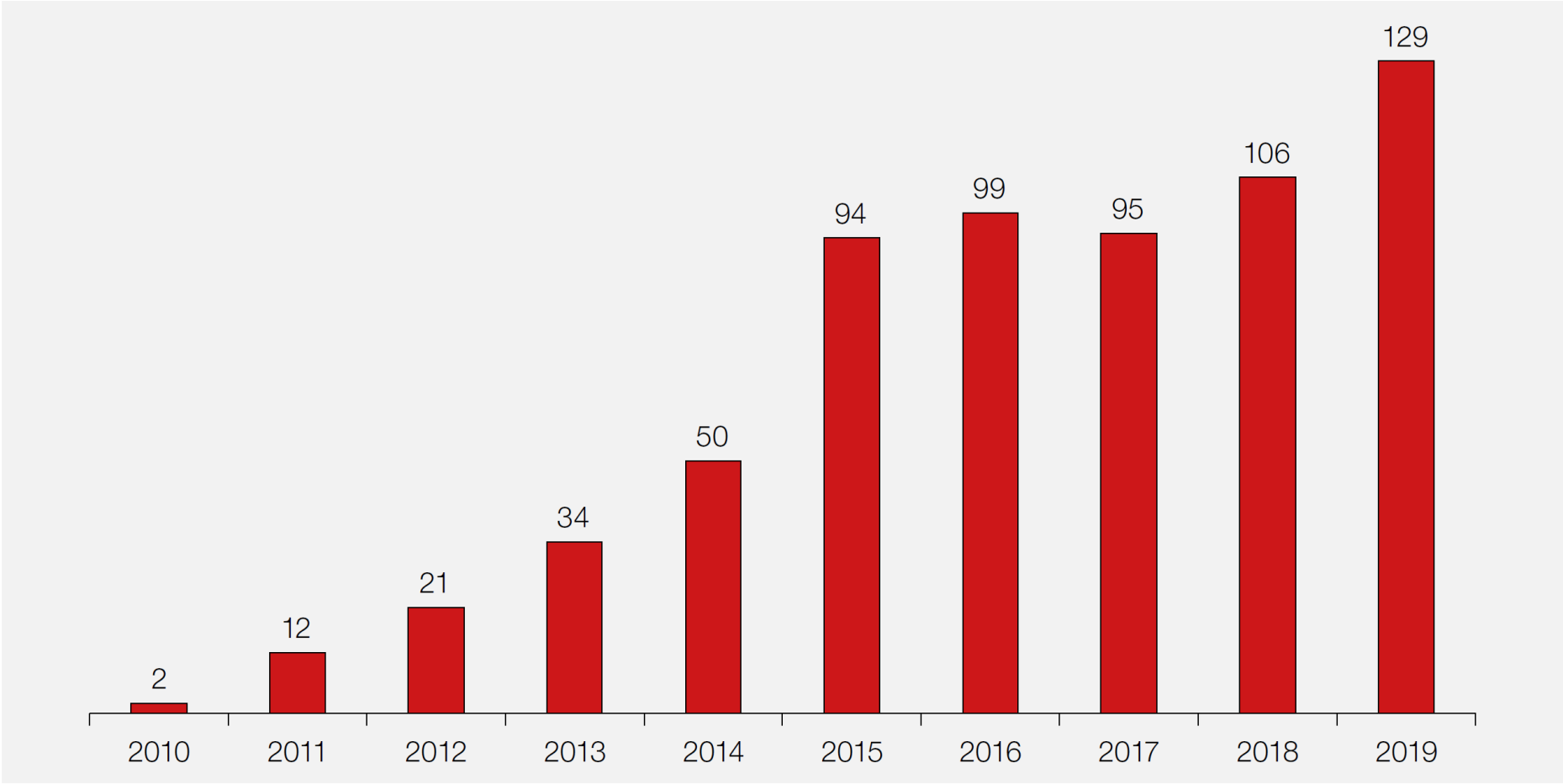
Avoidable transfusions: Step in transfusion process with associated errors in 2022



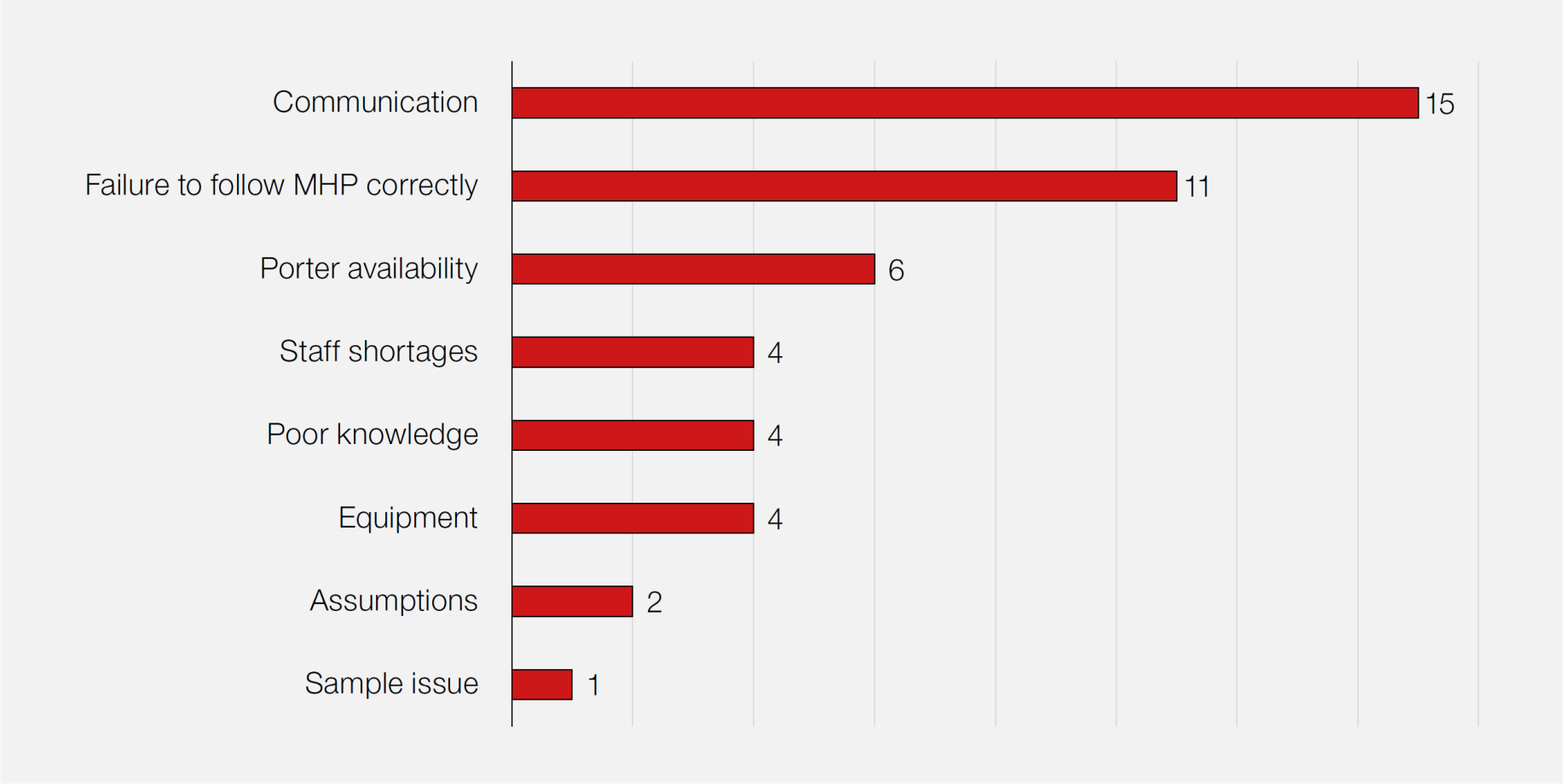
Errors contributing to delayed transfusion 2020



Delayed transfusion reports by year 2010 to 2019



Factors contributing to delayed transfusion in 16 major haemorrhage cases in 2019

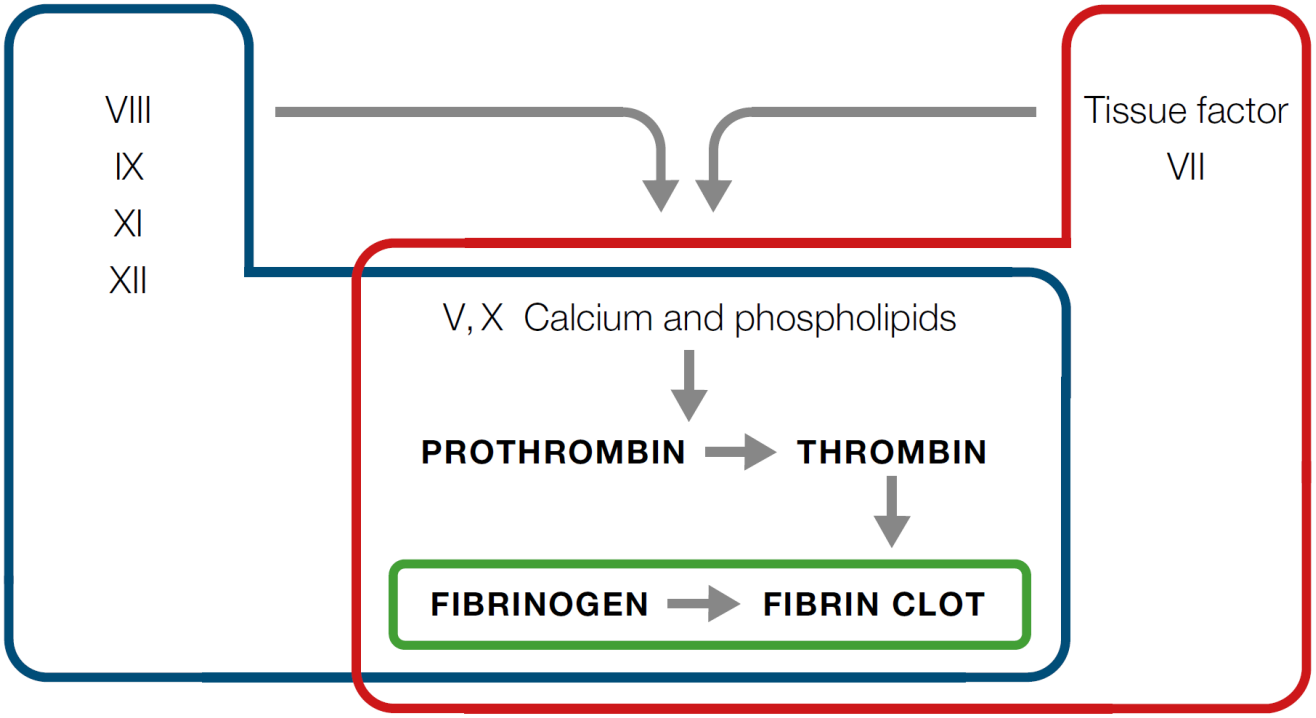


MHP=major haemorrhage protocol

Mechanisms of the coagulation screen to show which coagulation factors affect the standard tests

Activated partial thromboplastin time (APTT) tests for deficiency of factors (single or multiple) in the blue box

Prothrombin time (PT) tests for deficiency of factors in the red box



Thrombin time only looks at this final conversion and depends on adequate amount of fibrinogen

Interpretation of the coagulation screen

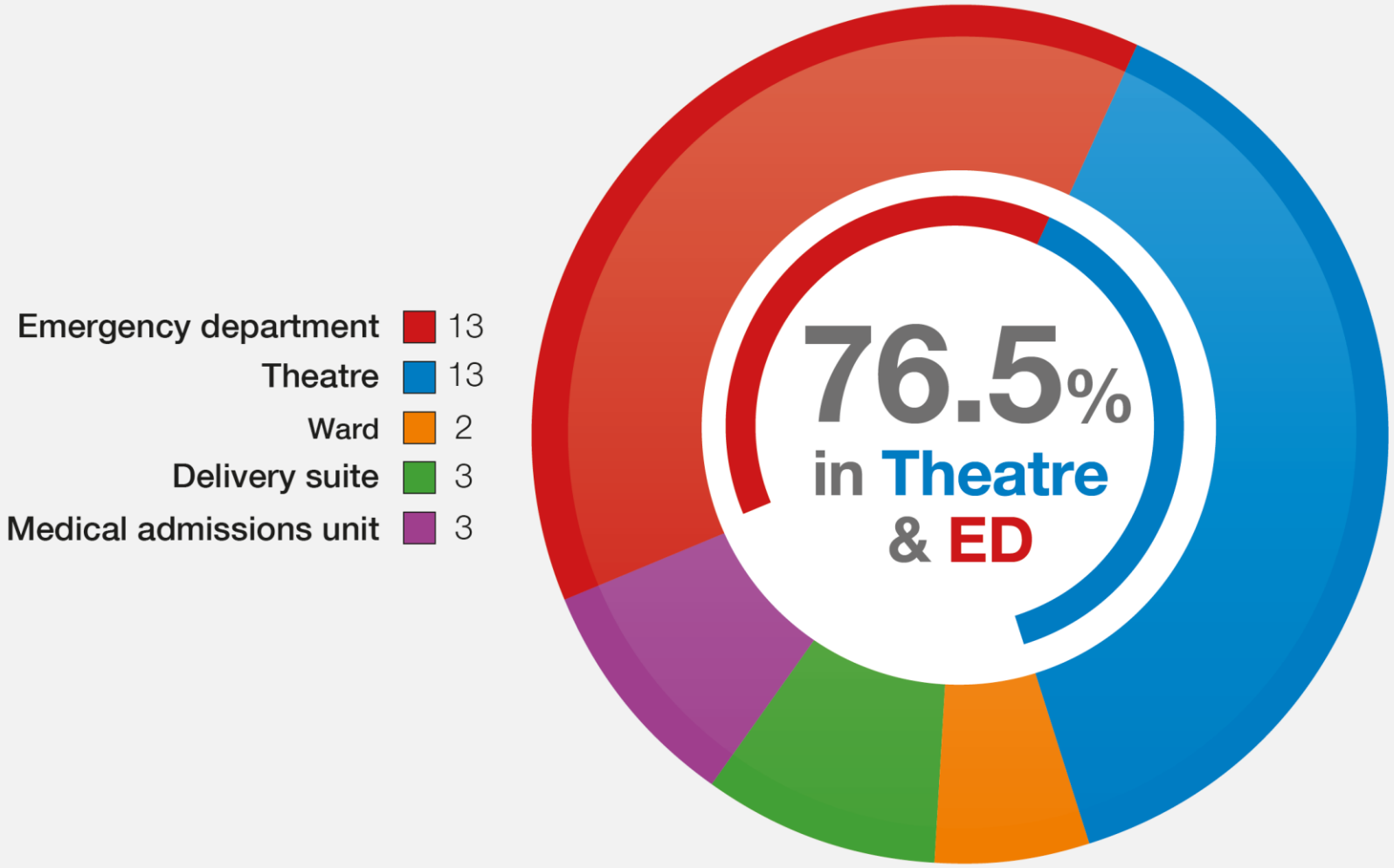
Prothrombin time	Activated partial thromboplastin time	Thrombin time	Interpretation
Abnormal	Normal	Normal	Factor VII deficiency
Normal	**Abnormal**	Normal	Deficiency of FXII, XI, **IX, VIII** (single or multiple)
Abnormal	Abnormal	Normal	Deficiency in the common pathway, isolated V or X deficiency. Multiple factors e.g. liver disease, warfarin therapy

Notes: *many sick patients have disturbances of coagulation tests that* ***do not predict bleeding (and in some cases are associated with a thrombotic risk)****. These tests were introduced in the 1960s to screen for congenital factor deficiencies. The PT is very sensitive to FVII deficiency and is used for warfarin monitoring but note that the APTT will also be prolonged (because FIX is reduced) but to a lesser extent. The sample must be taken carefully (good venepuncture, free flow) to avoid activation and in the correct volume (as it is taken into a specific volume of anticoagulant citrate) to avoid erroneous and misleading results.*

Isolated prolongation of the APTT can be due to haemophilia A (FVIII deficiency) or B (FIX deficiency,) where the need for diagnosis and treatment is urgent. It is also prolonged in FXII deficiency (common but of no clinical significance) and factor XI deficiency (uncommon and usually not associated with serious bleeding). The thrombin time does not depend on other coagulation factors as thrombin is added to the test system. Many laboratories measure the amount of fibrinogen rather than the thrombin time. (Prolongation of standard coagulation tests can also be caused by inhibitors).

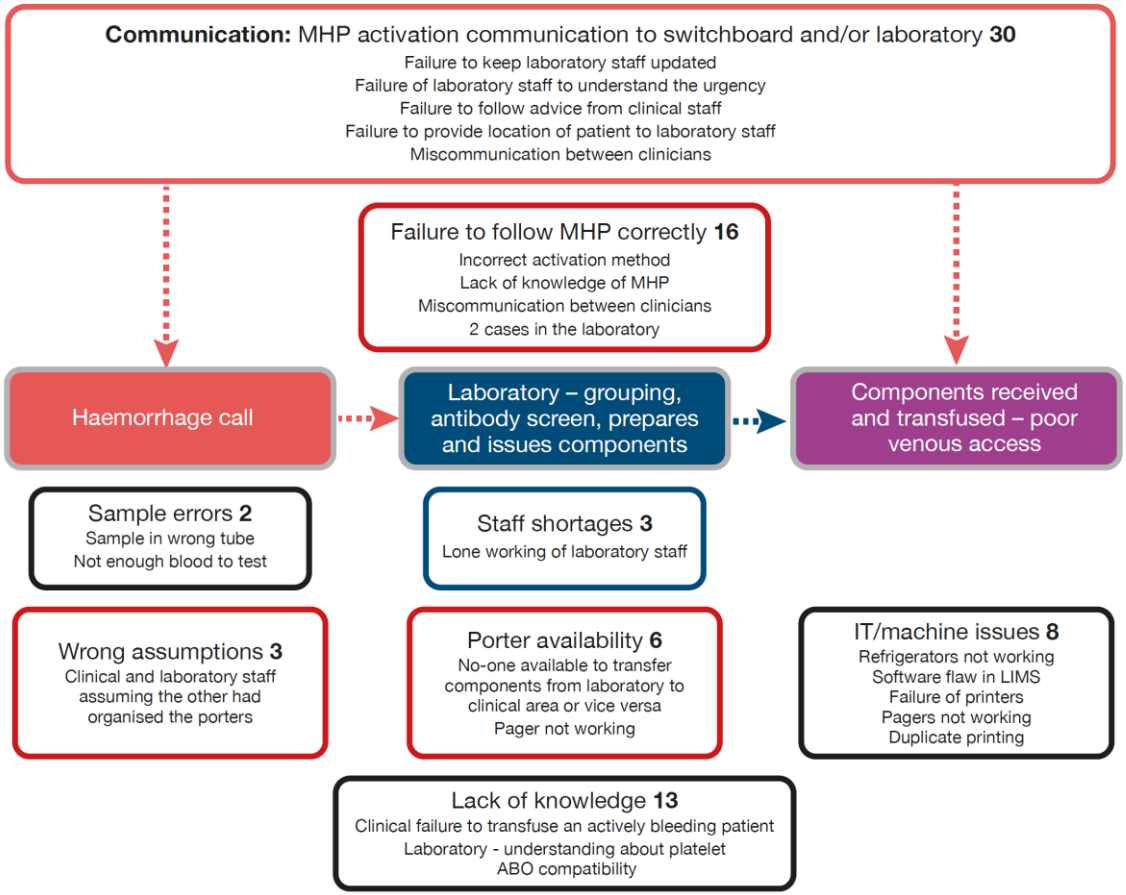
Vitamin K results in increased synthesis of factors II, VII, IX and X so will correct the PT but not FVIII, FXI, V or X deficiency. Normal ranges are different in childhood and any hospital with paediatric patients must use an age-appropriate normal range to avoid unnecessary investigation and treatment.

Location of major haemorrhages in 2018



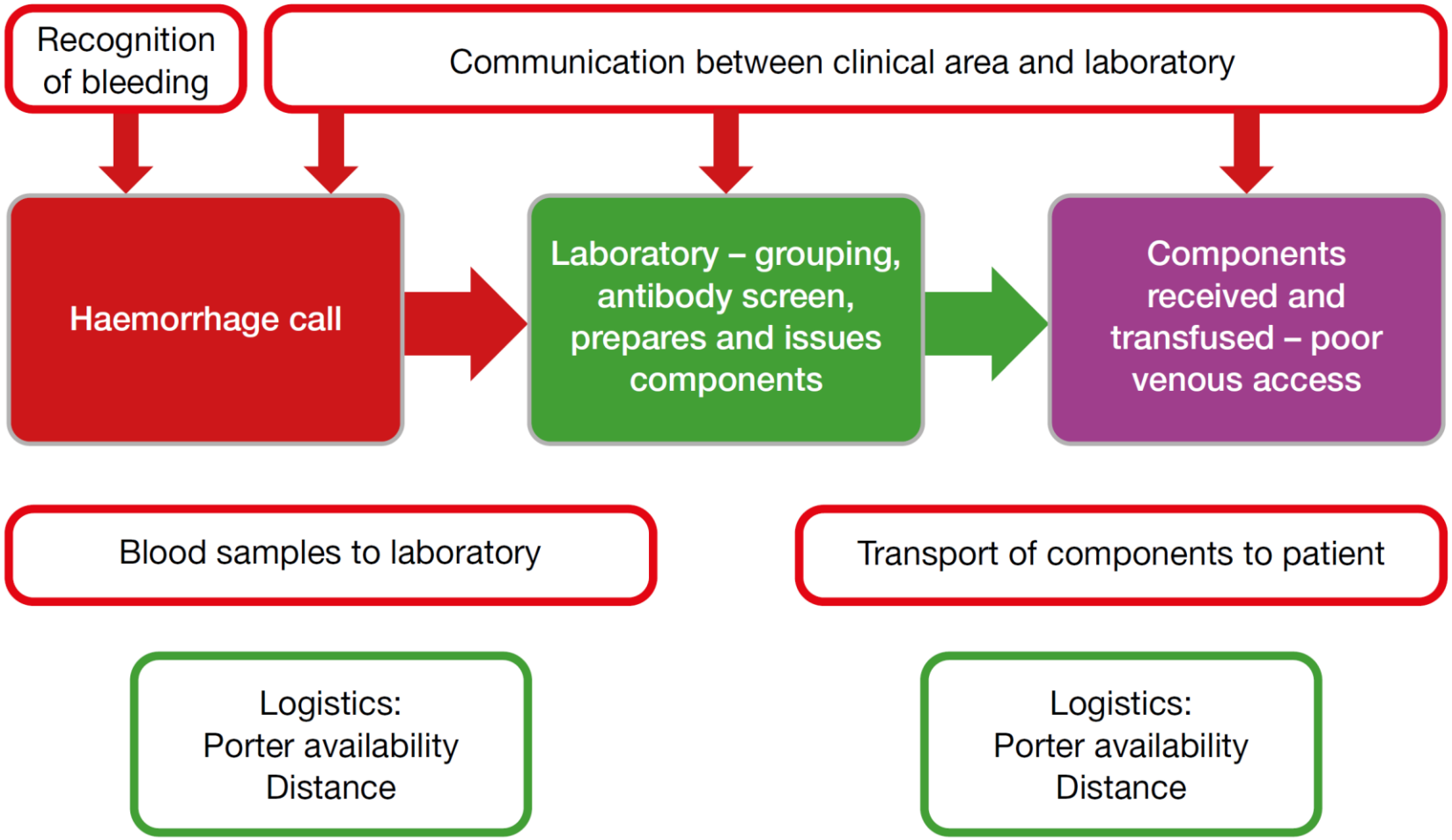
Holdup points identified in the major haemorrhage transfusion pathway in 2018

Factors identified in 34 major haemorrhage cases (27 MHP calls) n=81 (often more than one per case)

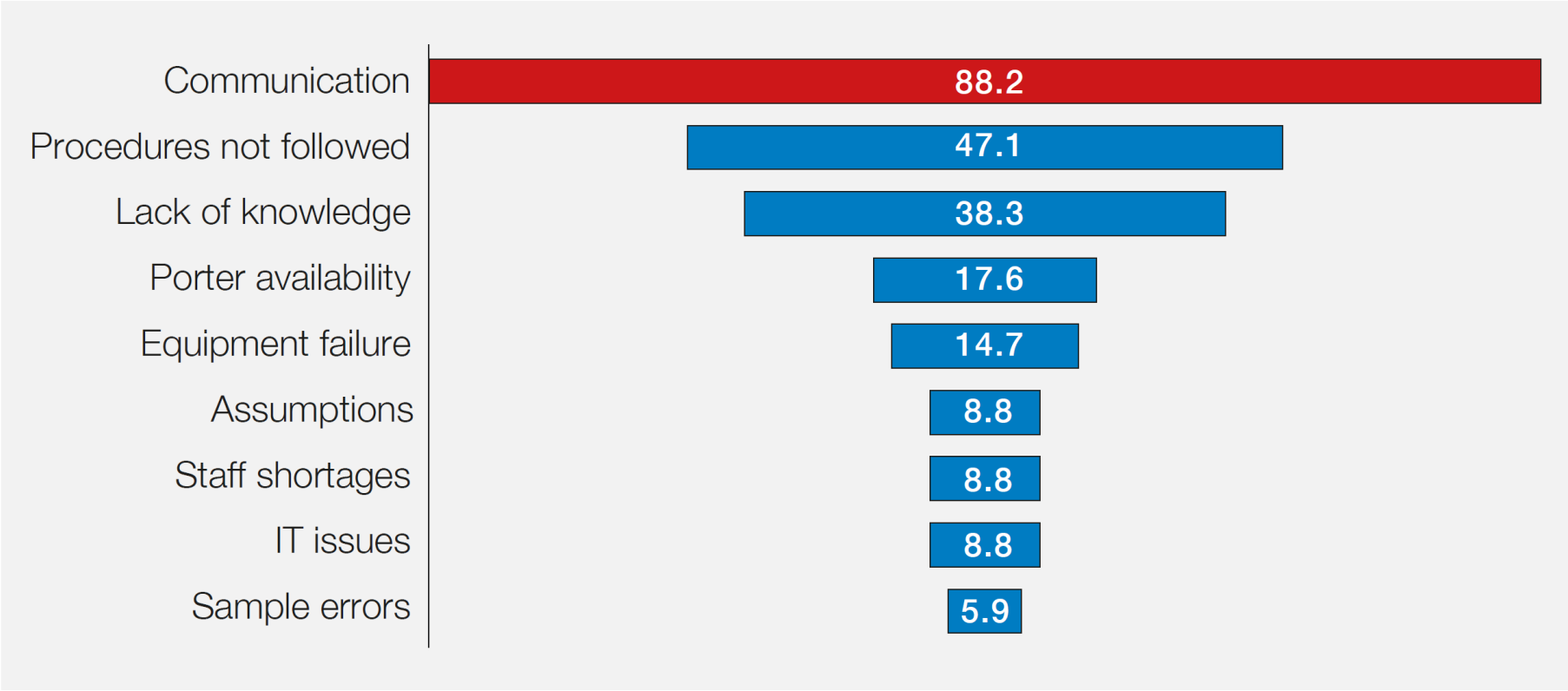


MHP=major haemorrhage protocol; IT=information technology; LIMS=laboratory information management system

Potential holdup points in the transfusion pathway (2017)

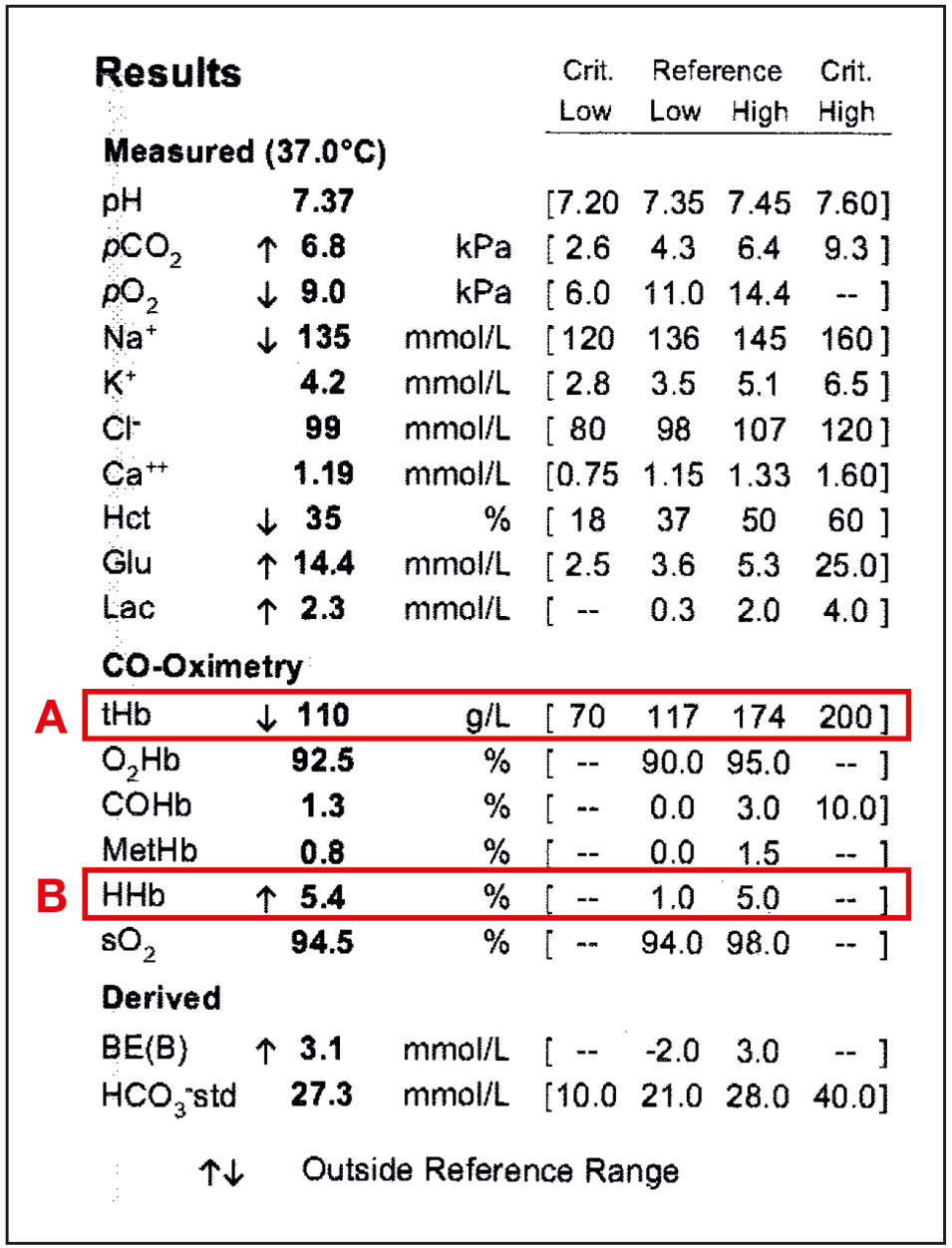


Poor communication is the most common factor contributing to errors in MHP-related reports in 2018 (results as %)



IT=information technology

Errors in reading blood gas results: HHb wrongly taken as the total Hb result



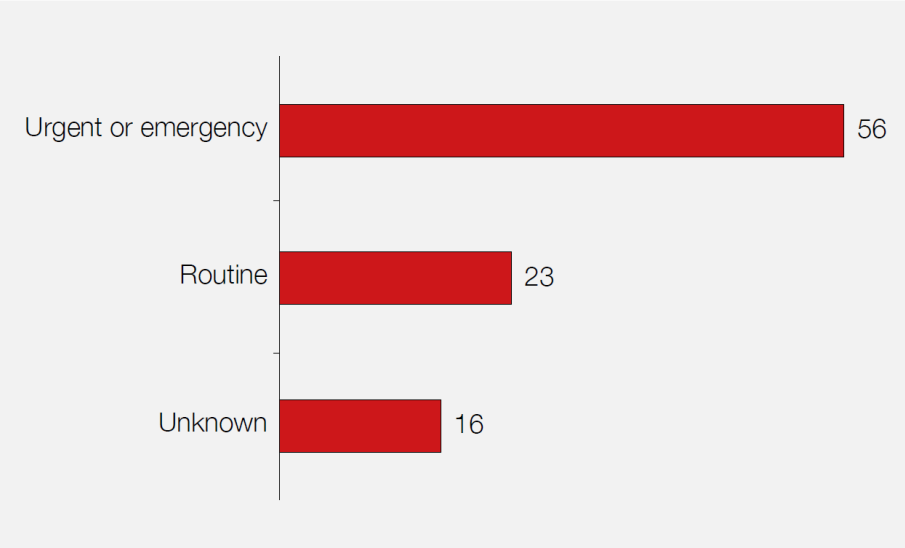
Results

				Crit. Low	Reference Low	Reference High	Crit. High
Measured (37.0°C)							
pH		**7.37**		[7.20	7.35	7.45	7.60]
pCO_2	↑	**6.8**	kPa	[2.6	4.3	6.4	9.3]
pO_2	↓	**9.0**	kPa	[6.0	11.0	14.4	--]
Na^+	↓	**135**	mmol/L	[120	136	145	160]
K^+		**4.2**	mmol/L	[2.8	3.5	5.1	6.5]
Cl^-		**99**	mmol/L	[80	98	107	120]
Ca^{++}		**1.19**	mmol/L	[0.75	1.15	1.33	1.60]
Hct	↓	**35**	%	[18	37	50	60]
Glu	↑	**14.4**	mmol/L	[2.5	3.6	5.3	25.0]
Lac	↑	**2.3**	mmol/L	[--	0.3	2.0	4.0]
CO-Oximetry							
A tHb	↓	**110**	g/L	[70	117	174	200]
O_2Hb		**92.5**	%	[--	90.0	95.0	--]
COHb		**1.3**	%	[--	0.0	3.0	10.0]
MetHb		**0.8**	%	[--	0.0	1.5	--]
B HHb	↑	**5.4**	%	[--	1.0	5.0	--]
sO_2		**94.5**	%	[--	94.0	98.0	--]
Derived							
BE(B)	↑	**3.1**	mmol/L	[--	-2.0	3.0	--]
HCO_3^-std		**27.3**	mmol/L	[10.0	21.0	28.0	40.0]

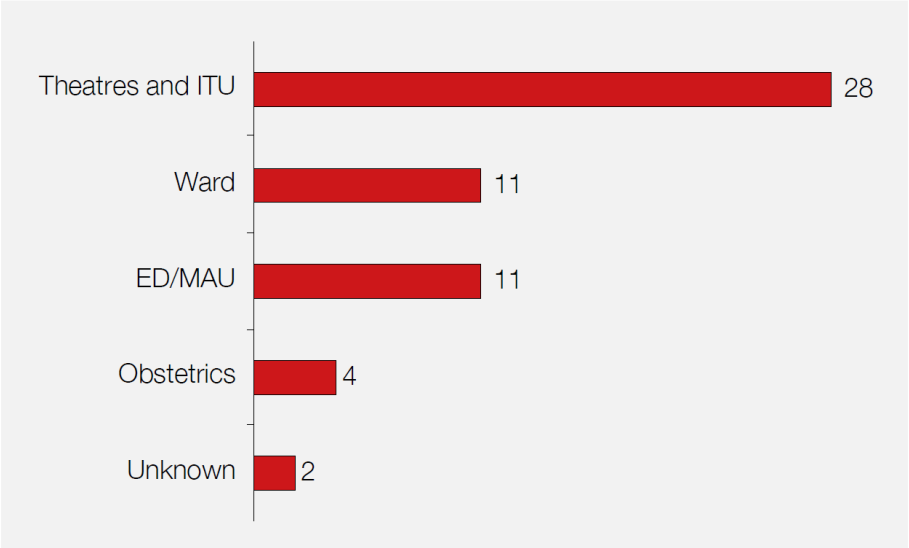
↑↓ Outside Reference Range

Delayed transfusions in 2017

Urgency of delayed transfusions n=95

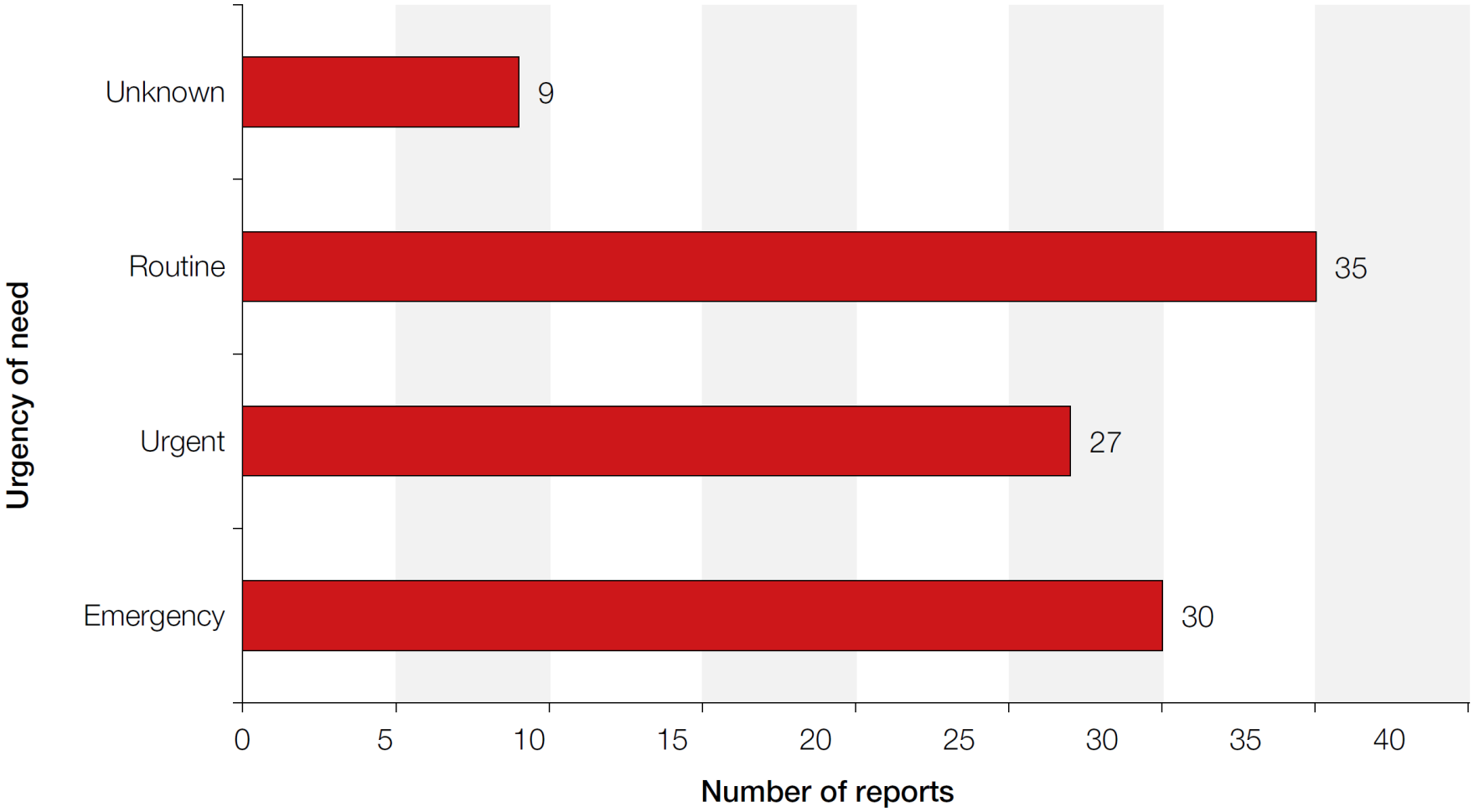


Location of emergency and urgent transfusions n=56

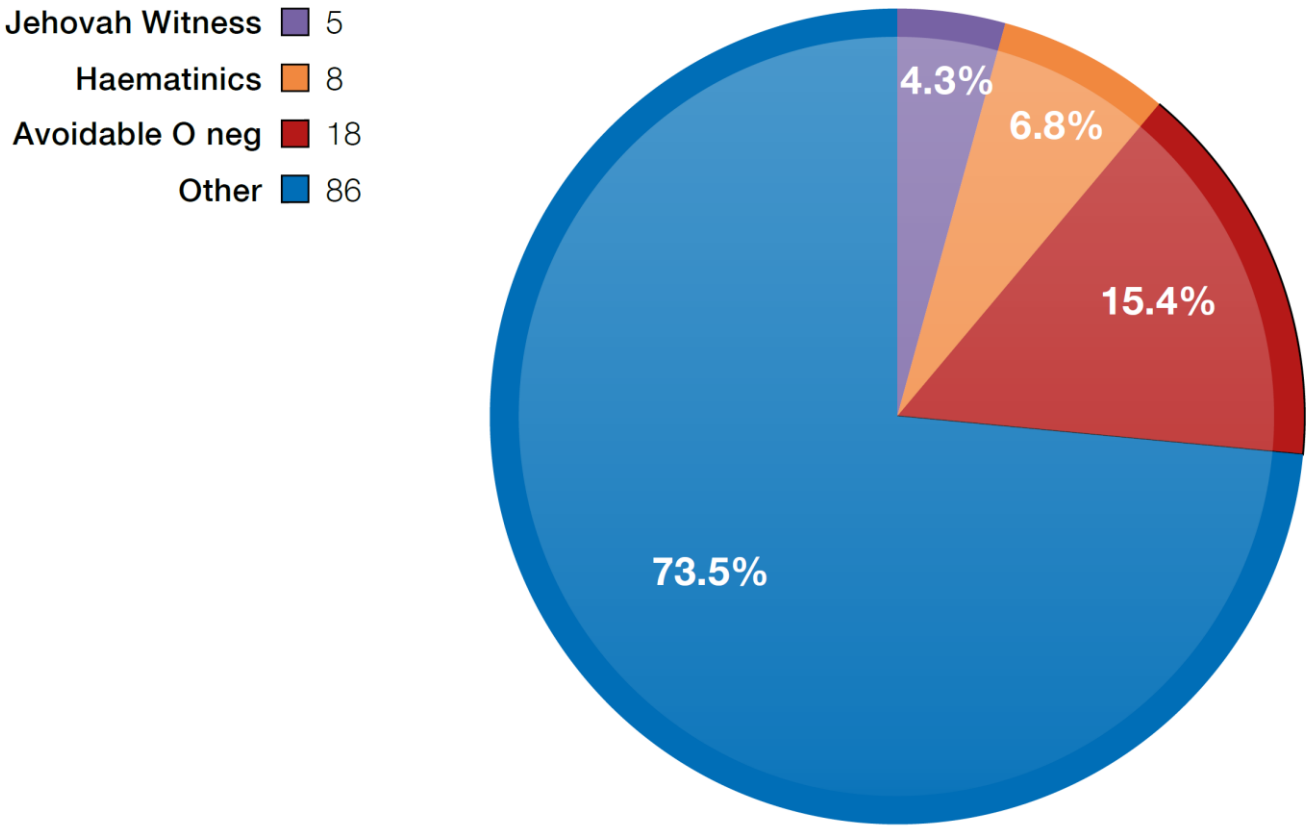


ED=emergency department; MAU=medical admissions unit; ITU=intensive therapy unit (all types)

Urgency of delayed transfusions in 2016



Reasons for avoidable transfusions in 2016 n=117 (3 cases added from TACO*)



*Additions from TACO: megaloblastic anaemia n=1; inappropriate FFP for anticoagulant reversal n=2