Slovenian national telemedicine system for remote interpretation of red cell laboratory testing

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Aim of the presentation

To present:

- The use of telemedicine (TM) in Slovenian blood transfusion service (BTS)
- TM system named TeleTransfusion
- Impact of TM on:
  - patient safety
  - organisation of work
  - BTS – hospitals relationships

Blood transfusion service in Slovenia

- 2 million inhabitants
- BTS network consists of 3 main blood establishments and 8 remote Transfusion centers (TCs) and one Blood bank (BB):

  1. Blood Transfusion Centre of Slovenia (BTCS) with 6 affiliated remote TCs and 1 BB
  2. Centre for Transfusion Medicine (CTM) Maribor with 2 affiliated remote TCs
  3. CTM Celje

- Main data for 2014:

  - 62,000 blood donors (11% new donors)
  - 93,000 blood collections (45% mobile session)
  - 185,000 prepared components

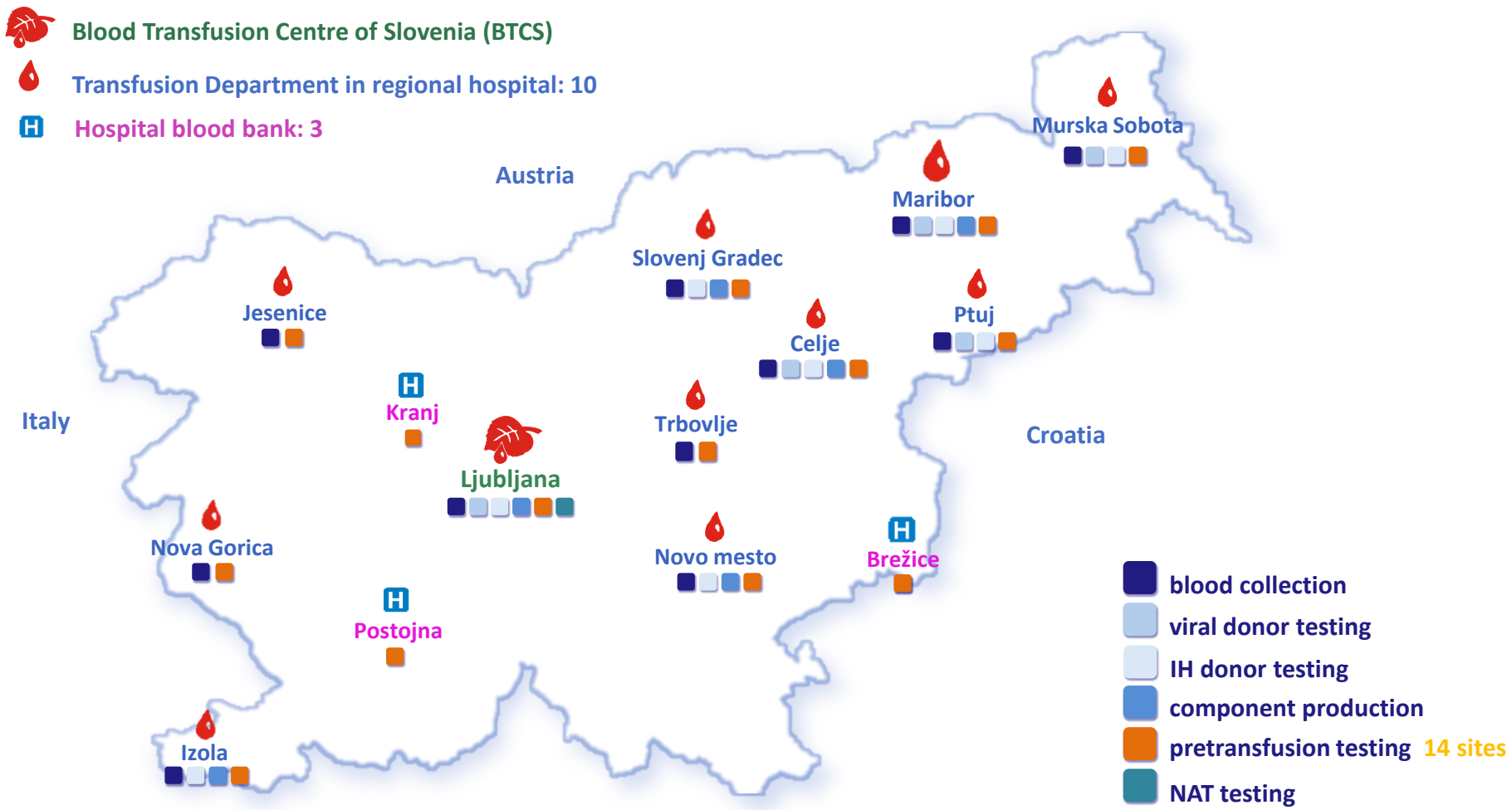
Telemedicine

Telemedicine (TM) is the delivery of healthcare services with the help of Information and Communication Technologies (ICT) in a situation where the actors are not at the same location.

- In Slovenia TM in transfusion medicine (**TeleTransfusion**) is used for centralised remote interpretation of pre-transfusion and prenatal tests in Transfusion centers (TCs), whenever transfusion medicine physician (TMP) is not on site

- Timeline of TM use:
  - 2005-2008 used as expert opinion for special patients
  - after 2008 used also for routine cases

Slovenian BTS before 2008



In 11/14 transfusion sites PTT was interpreted by:

- TMP on-site during the day or TMP on standby and called in when needed
- trained physicians of other specialities during out-of-routine hours: afternoons, nights, weekends, holidays

Development of TM system: objectives

- to allow an expert opinion to TMPs on other locations when solving special cases
- to advise clinicians on duty involved in interpretation of PTT for their patients
- to reduce sending blood samples to the reference laboratory by selecting cases
- TM system jointly developed by experts from BTCS and University of Ljubljana, Faculty of Electrical Engineering[1].

Teleconsultations between 2005–2008

[1]Meza M, Breskvar M, Kosir A, Bricl I, Tasic JF, Rozman P: Telemedicine in the blood transfusion laboratory-remote interpretation of pre-transfusion tests. J Telemed Telecare 2007; 13: 357-62

Reorganisation of BTS

- reorganisation of Slovenian BTS occurred between 2008 and 2013
- former Transfusion departments of regional hospitals gradually became remotely located Transfusion centers of BTCS Lj (7 TCs) and CTM Mb (2 TCs) [2]
- organisation of work at the remotely located TCs became responsibility of BTCS and CTM Maribor
- treating physicians from hospitals did not participate in the transfusion service any more (except for emergency cases)
- shortage of TMPs for continuous (24/7) organisation of work at 9 remotely located TCs

TM was a solution for interpretation of red cell laboratory testing in remote TCs

[2]Bricl I, Breskvar M, Tasic JF, Meza M, Jeras M, Rozman P: Telemedicine as a support system to blood transfusion service reorganisation in the Republic of Slovenia. Vox Sang 2010; 99: 126-7

Slovenian BTS in 2015

- In 3 main Blood establishements TMP is on site 24/7
- In 9 TCs TM is used for remote interpretation of PTT, when TMP is not on site

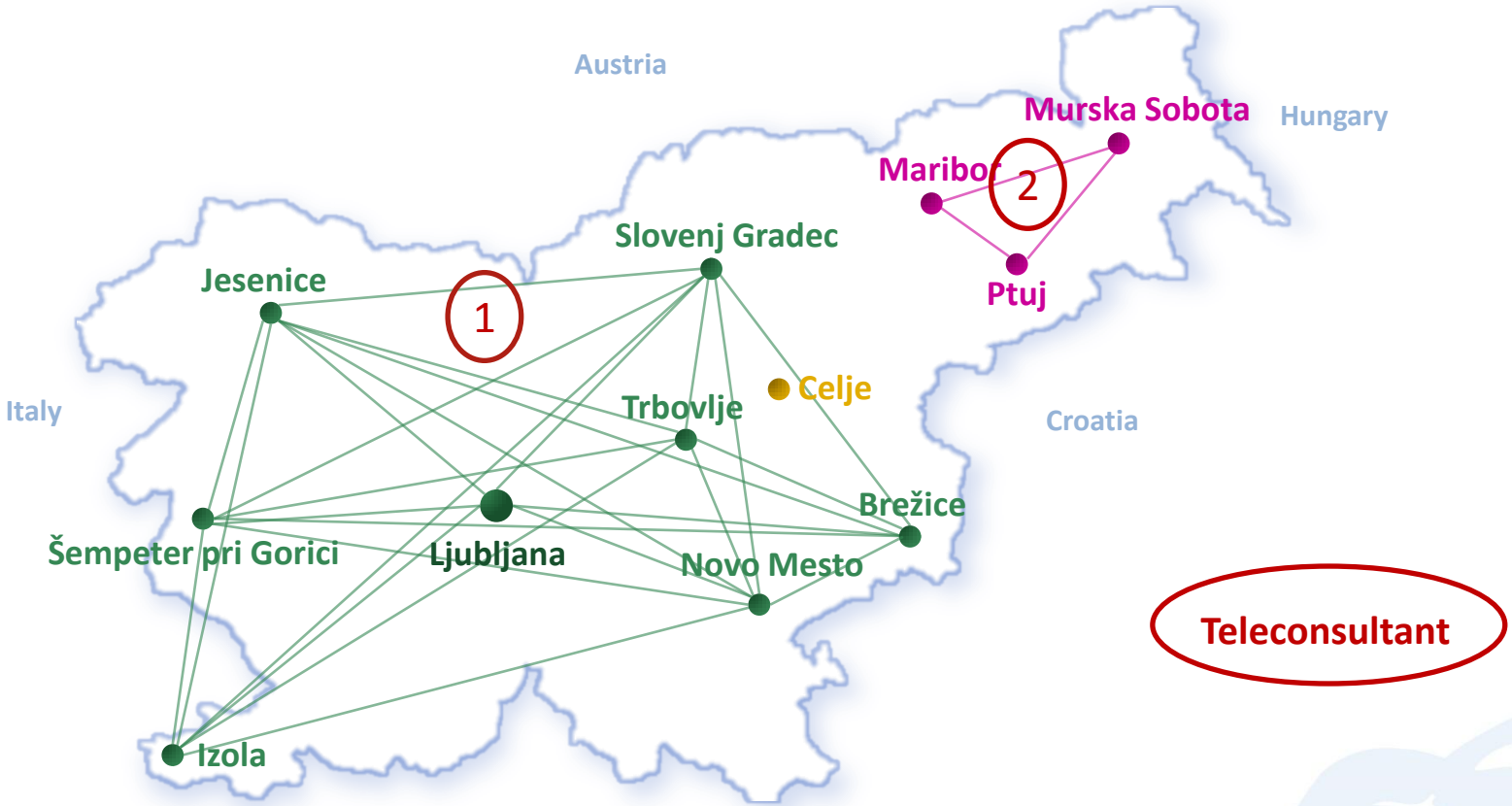
TM used routinely after 2008

- After 2008 TM system use extended from expert opinion in complex cases to **routine PTT** cases

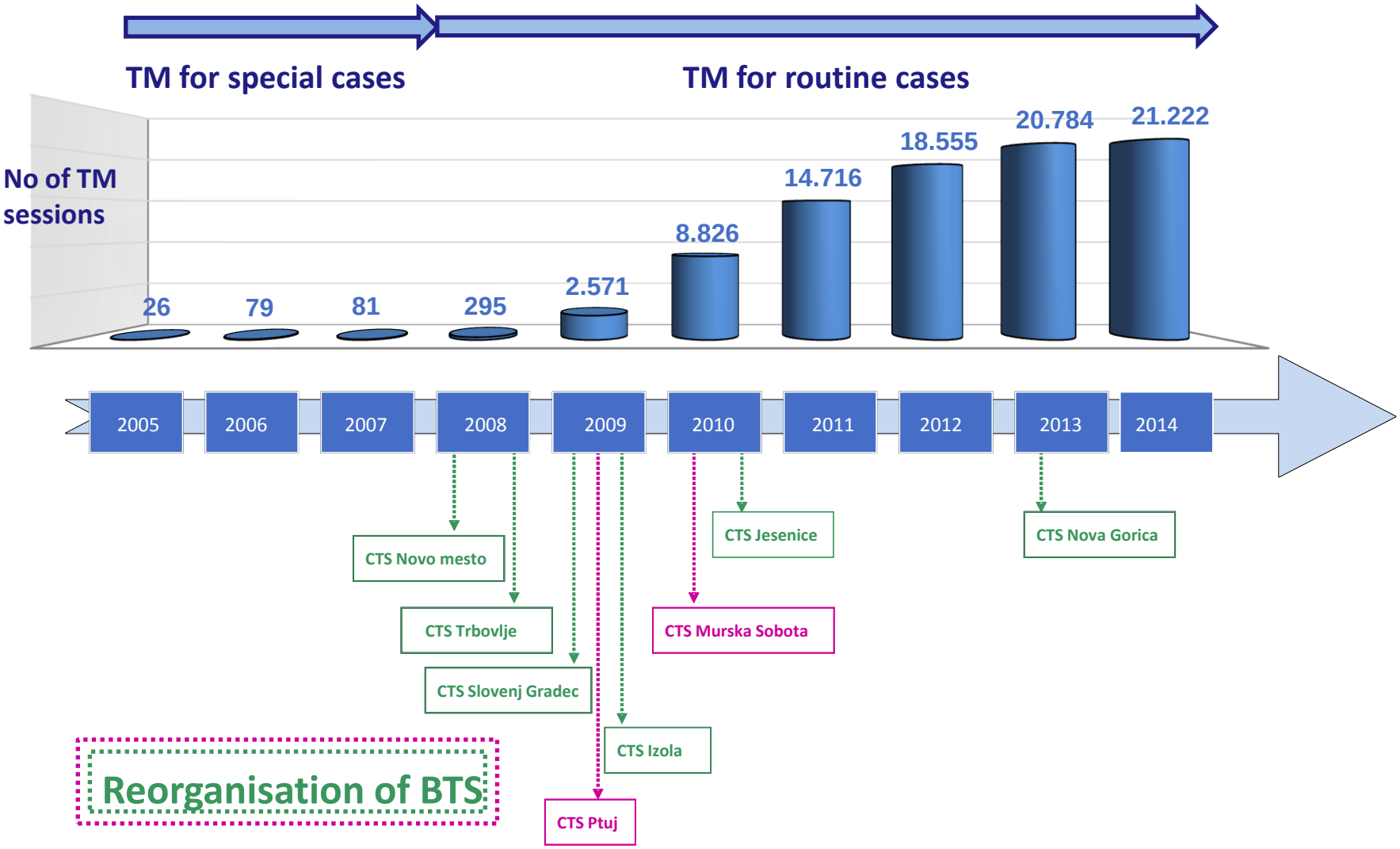
- Since July 2011 two TMPs work as teleconsultants on duty **24/7/365** for dislocated TCs in Slovenia:
  - one in the Ljubljana region and
  - one in the Maribor region

Number of TM sessions substantially increased

Two TM regions after 2008



Telemedicine use



Reorganisation of BTS

Remote units (TCs) became part of the BTCS Ljubljana

Remote units (TCs) became part of the CTM Maribor

Development of new version of TM system

- TM1 system not designed for up to 20,000 consultations a year
- Upgrade of existing (laboratory) platform no longer possible
- 2012: TM2 system developed by Slovenian IT company XLAB in cooperation with experts from BTCS[3]
- Feb 2013 – Launch of the upgraded TM2 system

[3]Breskvar M, Macek M, Tonejc M, Vavpotic M: "*The new telemedicine system in Slovenian blood transfusion service*". Informatica medica slovenica 2012; 17: 14-23.

Procedures performed in transfusion laboratory before issuing blood components

LABORATORY TECHNICIAN

- Acceptance of a request for blood
- Transfusion lab tests performance
- **Preparing TM session**
- **Sending question to a teleconsultant-TMP on duty**

↓

TMP

On site /on distant location

- Interpretation of laboratory results from gel cards
- Discussion on the case, optional order of additional tests
- **Digital signature**
- **Sending back the session with results**

↓

LABORATORY TECHNICIAN

- **Export of the results to transfusion IT system Datec**
- **Confirmation of the results in transfusion IS Datec**
- **Printing of the results with digital signature**
- Delivery of blood components

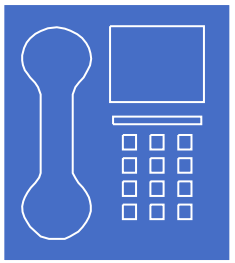
When TMP is not on-site, TM is used


Zavod Republike Slovenije
za transfuzijsko medicino

Patient data retrieveal from various sources

Scanned documents

Request, panel list, etc.



Telephone consulting

Patient data from hospital

Professional discussion

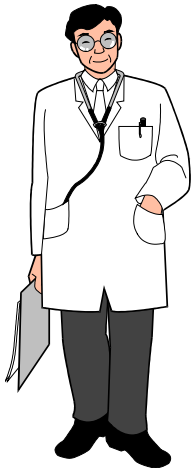
Images of laboratory tests

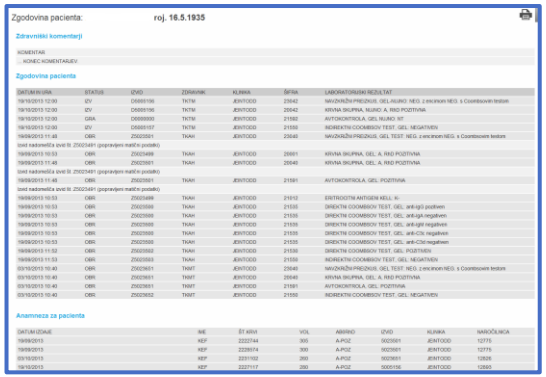
Pre-transfusion and prenatal tests

Bi-directional connection of TM system with host TIS DATEC

Imported patient history:

previous IH results, commentaries, issued units





Zgodovina pacienta: roj. 16.5.1935

Zdravniški komentarji

KOMENTAR:

KONEC KOMENTARJEV.

Zgodovina pacienta

DATUM IN URA	STATUS	IZVID	ZDRAVNIK	KLINIKA	ŠIFRA	LABORATORIJSKI REZULTAT
19/10/2013 12:00	IZV	D6669196	TKTM	JENTODD	20642	NAVZKRŽNI PREZNUS, GEL-NUNO: NEG. z encimom NEG. s Coombsovim testom
19/10/2013 12:00	IZV	D6669196	TKTM	JENTODD	20642	KRVNA SKUPINA, NUNO: A, RhD POZITIVNA
19/10/2013 12:00	GBA	D6669200	TKTM	JENTODD	21582	AVTOKONTROLA, GEL NUNO: NT
19/10/2013 12:00	IZV	D6669197	TKTM	JENTODD	21550	INDIREKTNI COOMBSOV TEST, GEL: NEGATIVEN
19/09/2013 11:48	OBR	Z5023501	TKAH	JENTODD	23648	NAVZKRŽNI PREZNUS, GEL TEST: NEG. z encimom NEG. s Coombsovim testom
(zad nadomešča izvid ID: Z5023491 (popravljeni matični podatki)						
19/09/2013 10:53	OBR	Z5023499	TKAH	JENTODD	20991	KRVNA SKUPINA, GEL: A, RhD POZITIVNA
19/09/2013 11:48	OBR	Z5023501	TKAH	JENTODD	23648	KRVNA SKUPINA, GEL: A, RhD POZITIVNA
(zad nadomešča izvid ID: Z5023491 (popravljeni matični podatki)						
19/09/2013 11:48	OBR	Z5023501	TKAH	JENTODD	21591	AVTOKONTROLA, GEL: POZITIVNA
(zad nadomešča izvid ID: Z5023491 (popravljeni matični podatki)						
19/09/2013 10:53	OBR	Z5023499	TKAH	JENTODD	21512	ERITROCITNI ANTIGEN KELL: K-
19/09/2013 10:53	OBR	Z5023598	TKAH	JENTODD	21535	DIREKTNI COOMBSOV TEST, GEL: anti-IgG pozitiven
19/09/2013 10:53	OBR	Z5023598	TKAH	JENTODD	21535	DIREKTNI COOMBSOV TEST, GEL: anti-IgA negativen
19/09/2013 10:53	OBR	Z5023599	TKAH	JENTODD	21535	DIREKTNI COOMBSOV TEST, GEL: anti-IgM negativen
19/09/2013 10:53	OBR	Z5023599	TKAH	JENTODD	21535	DIREKTNI COOMBSOV TEST, GEL: anti-C3c negativen
19/09/2013 10:53	OBR	Z5023599	TKAH	JENTODD	21535	DIREKTNI COOMBSOV TEST, GEL: anti-C3d negativen
19/09/2013 11:52	OBR	Z5023592	TKAH	JENTODD	21530	DIREKTNI COOMBSOV TEST, GEL: POZITIVEN
19/09/2013 11:53	OBR	Z5023593	TKAH	JENTODD	21550	INDIREKTNI COOMBSOV TEST, GEL: NEGATIVEN
03/10/2013 10:40	OBR	Z5023651	TKNT	JENTODD	23640	NAVZKRŽNI PREZNUS, GEL TEST: NEG. z encimom NEG. s Coombsovim testom
03/10/2013 10:40	OBR	Z5023651	TKNT	JENTODD	20649	KRVNA SKUPINA, GEL: A, RhD POZITIVNA
03/10/2013 10:40	OBR	Z5023651	TKNT	JENTODD	21591	AVTOKONTROLA, GEL: POZITIVNA
03/10/2013 10:40	OBR	Z5023652	TKNT	JENTODD	21550	INDIREKTNI COOMBSOV TEST, GEL: NEGATIVEN

Anamneza za pacienta

DATUM IZDAJE	IME	ŠT. ARVI	VOL	ABBRND	IZVID	KLINIKA	NAROČILNICA
19/09/2013	KEF	2222744	300	A-POZ	5023561	JENTODD	12775
19/09/2013	KEF	2229574	300	A-POZ	5023561	JENTODD	12776
03/10/2013	KEF	2231102	260	A-POZ	5023661	JENTODD	12826
16/10/2013	KEF	2237117	260	A-POZ	5000158	JENTODD	12905

Transfusion medicine physician

Technician prepares the TM session

Capturing images of gel cards by haemoscope

Scanning bar-code of the RBC unit tube

The sessions arrive to teleconsultant

TM2 [2013100701]

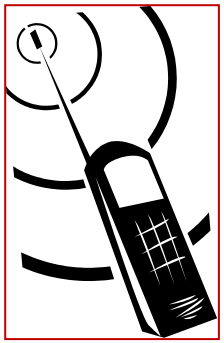
TeleMedicina2 | Pon, 28.10.2013 10:04 | mag. Marjeta Maček...

Moje nezaključene | Vse nezaključene 4 | Moje zaključene 5+ | Vse zaključene 5+ | Arhiv vseh sej | Napredno iskanje

STATUS	NUJNOST	ZAČETEK SEJE	ZADNJA SPREME...	PRIM...	ROJSTNI DATUM	MED. OP.	ŠTEVILO NP	NAROČILNICA	TIP SEJE	DATEC	LAB. INŽENIR	LOKACIJA	KONZULTANT
V odgovarjanju	Nujno	Danes, 10:00	Danes, 10:01	M...	26.5.1985		1		DATEC seja	V delu	Pogač Dragica	CTD Slovenj Gradec	Janka Černe, dr.med.
Prejeta	Redno	Danes, 09:43	Danes, 09:46	P...	9.2.1980	GG	0		DATEC seja	V delu	Amir Bešić	CTD Jesenice	Janka Černe, dr.med.
Prejeta	Redno	Danes, 09:36	Danes, 09:40	Ko...			0		Kontrola kakovosti		Jasna Vošner	CTD Slovenj Gradec	Janka Černe, dr.med.
V odgovarjanju	Redno	24.10.2013	24.10.2013	Pl...	9.2.1985		0		Posvetovanje		Saša Intihar Trček	ZTM Ljubljana	prim. Irena Bricl, dr.med.

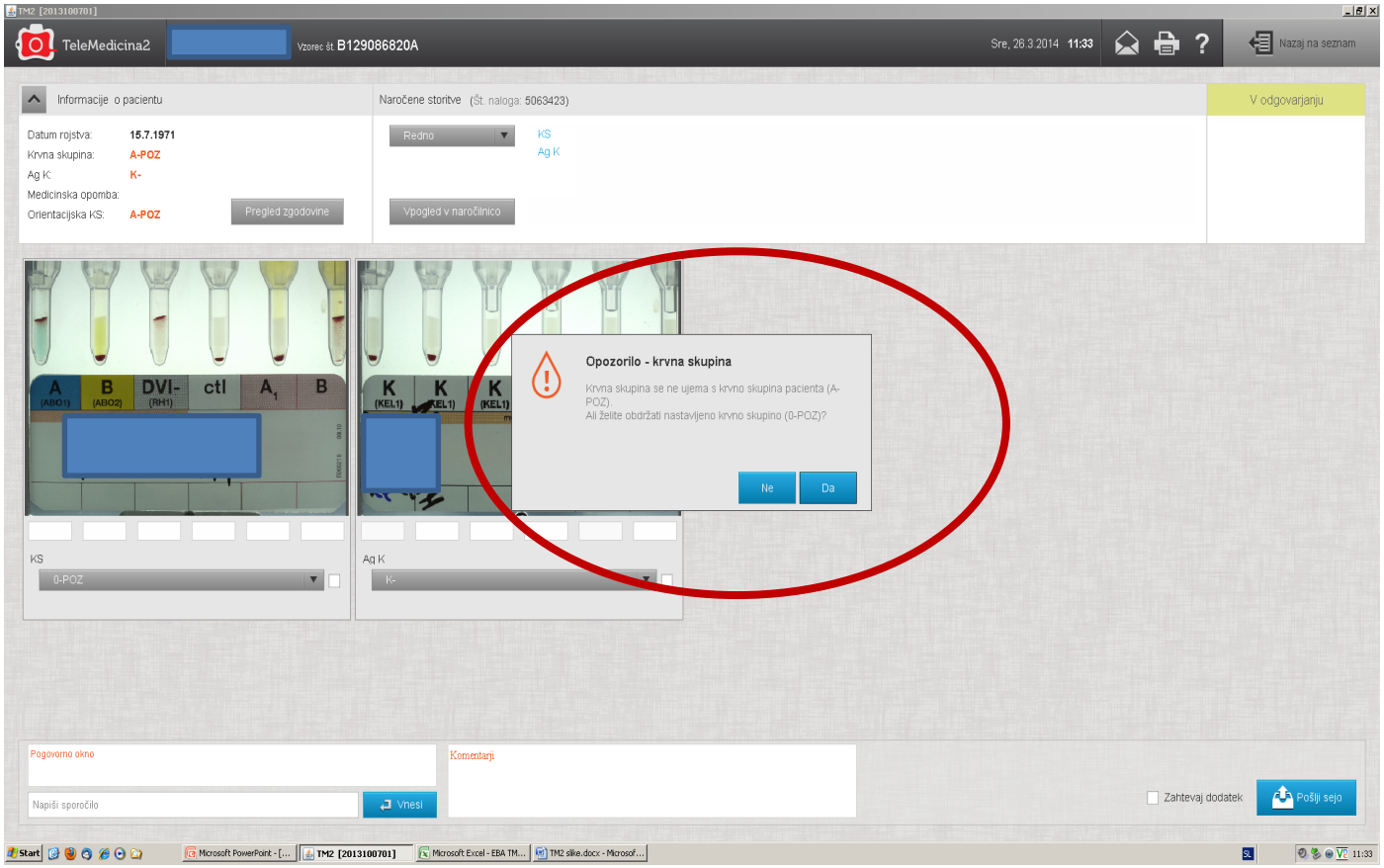
Medical remarks

Request form

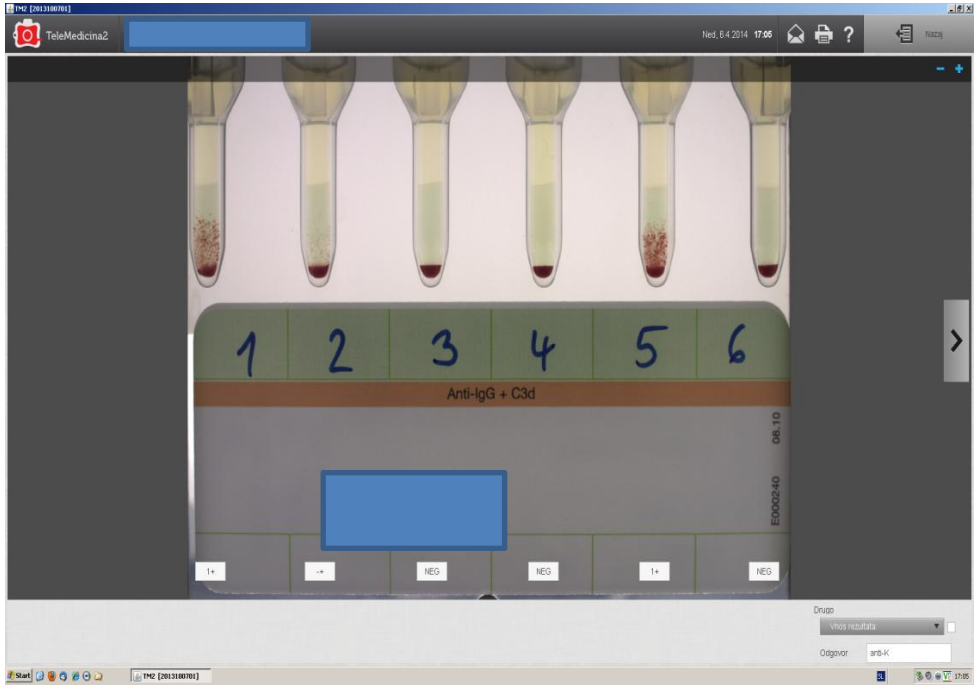


Število sej pogleda : 4 | 25 | 50 | 100 | 1 od 1

In-built control of AB0 with historical AB0



Interpretation of results



magnified images of gel card and columns

Digital signature

JasperViewer

Tip preiskave	NP 2231239 (0-POZ, K-)
Odgovor	ne izdati
mag. Marjeta Maček Kvanka, dr.med. 20.10.2013 ob 16:12	

Komentarji:

mag. Marjeta Maček Kvanka, dr.med. [20.10.2013 ob 17:24]
V plazmi so prisotna eritrocitna protitelesa nerazvidne specifičnosti, najverjetneje avtoprotitelesa. Priporočamo nadaljnje testiranje na ZTM.

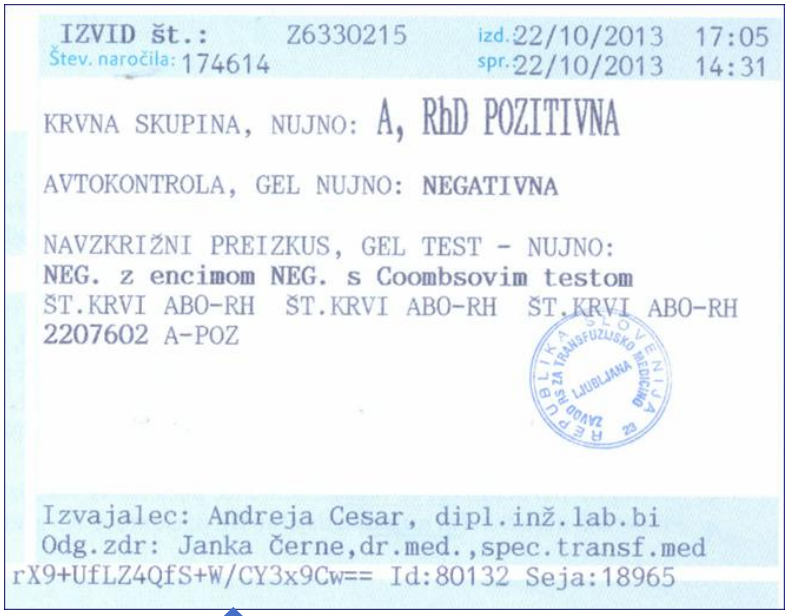
mag. Marjeta Maček Kvanka, dr.med. [21.10.2013 ob 06:50]
Pozitivni navzkrižni preizkusi z encimom so posledica nespecifične encimske motnje. Enote so skadne v fenotipu Rh in K.

E-Podpis:

Telekonzultant:
mag. Marjeta Maček Kvanka, dr.med.
Datum:
21.10.2013 ob 06:50
Izvleček iz e-podpisa:
SvlUAYLjygRBlZDtWz+dUYa88FStGXrQjDhPpn7UJy+o0aG0SIdkyttqloZfMeK2tjfUDQap3tEveLEOpxTqLiNSIdBm5Zc2JRjYJMx+xzoy9U9V+SrPeEkZ/692weyXAXi7Q9LuW2BSoK+rU1udnY4EQeF4j3J5ufp10ukJP5g=

TeleMedicina2 Stran 6 / 6

Page 6 of 6



IZVID št.: Z6330215 izd. 22/10/2013 17:05
Štev. naročila: 174614 spr. 22/10/2013 14:31

KRVNA SKUPINA, NUJNO: A, RhD POZITIVNA

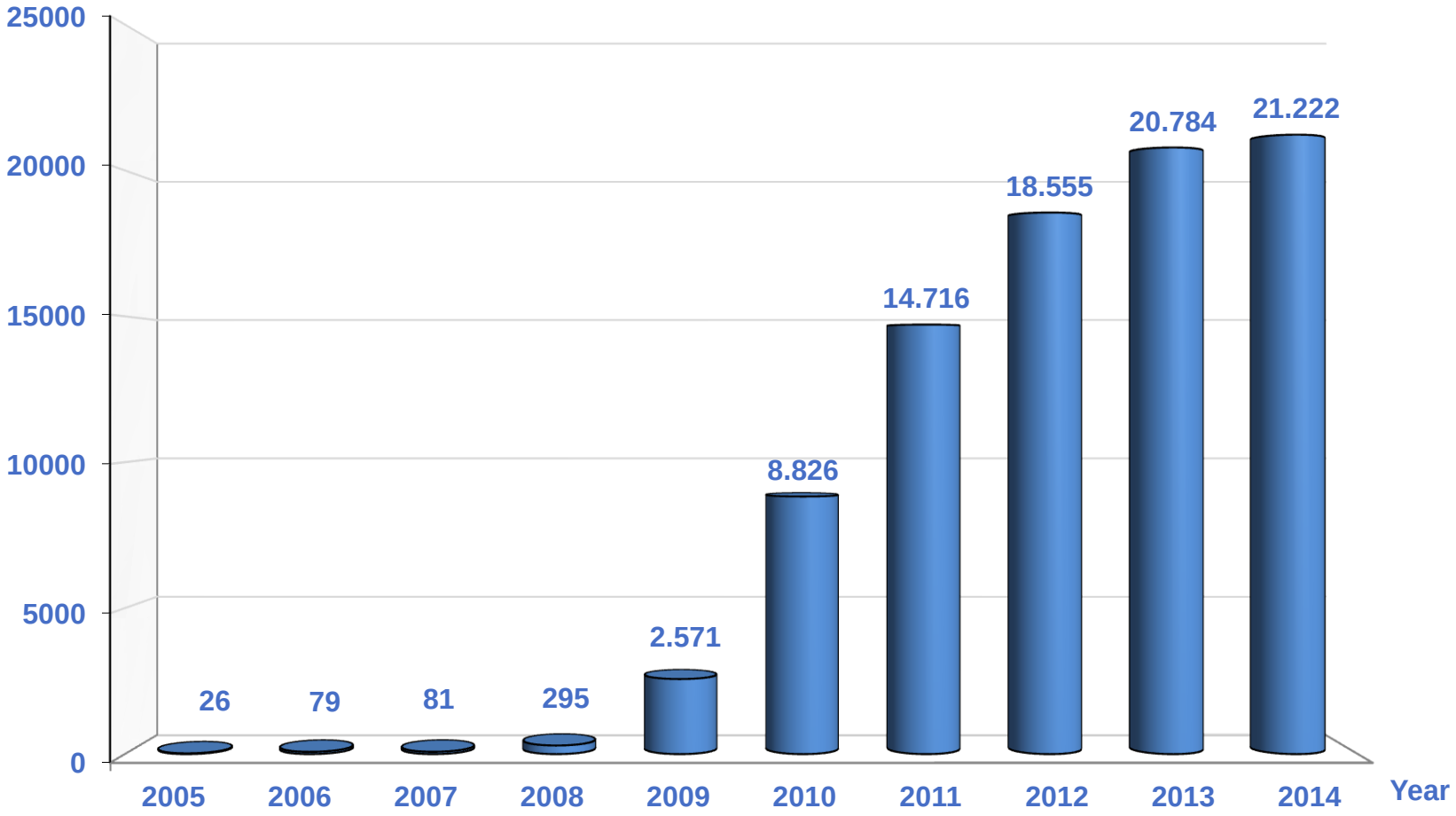
AVTOKONTROLA, GEL NUJNO: NEGATIVNA

NAVZKRIŽNI PREIZKUS, GEL TEST - NUJNO:
NEG. z encimom NEG. s Coombsovim testom
ŠT.KRVI ABO-RH ŠT.KRVI ABO-RH ŠT.KRVI ABO-RH
2207602 A-POZ

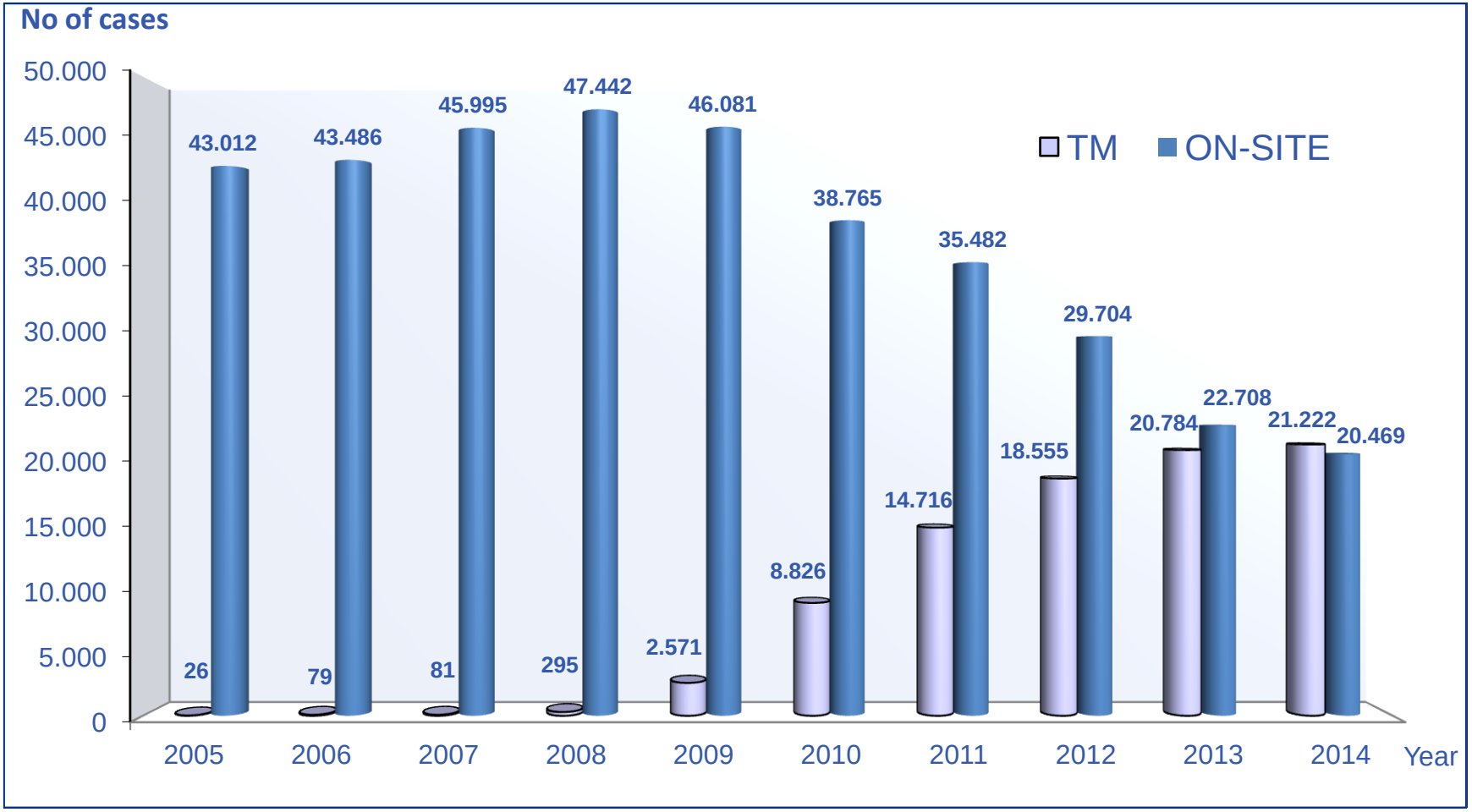
Izvajalec: Andreja Cesar, dipl.inž.lab.bi
Odg.zdr: Janka Černe,dr.med.,spec.transf.med
rX9+UfLZ4QfS+W/CY3x9Cw== Id:80132 Seja:18965

Digital signature (hash extraction)

Number of TM sessions 2005-2014



Extended use of TM



Outcomes of TM

- Improved patient safety
- Improved organisation of work at remotely located TCs
- Satisfaction of TM users (consultants and technicians)
- Rationalisation of activities in Slovenian BTS
- Better transfusion service to clinicians without their involvement in PTT
- Cost savings[4]

[4]Breskvar M., Vavpotic V.T., Veluscek I. Economic assesment and key success factors of nationwide telemedicine in Slovenian blood transfusion service. IsfTeH-GlobalTelemedicine and eHealth Updates: Knowledge Resources 2015; 8:106-10.

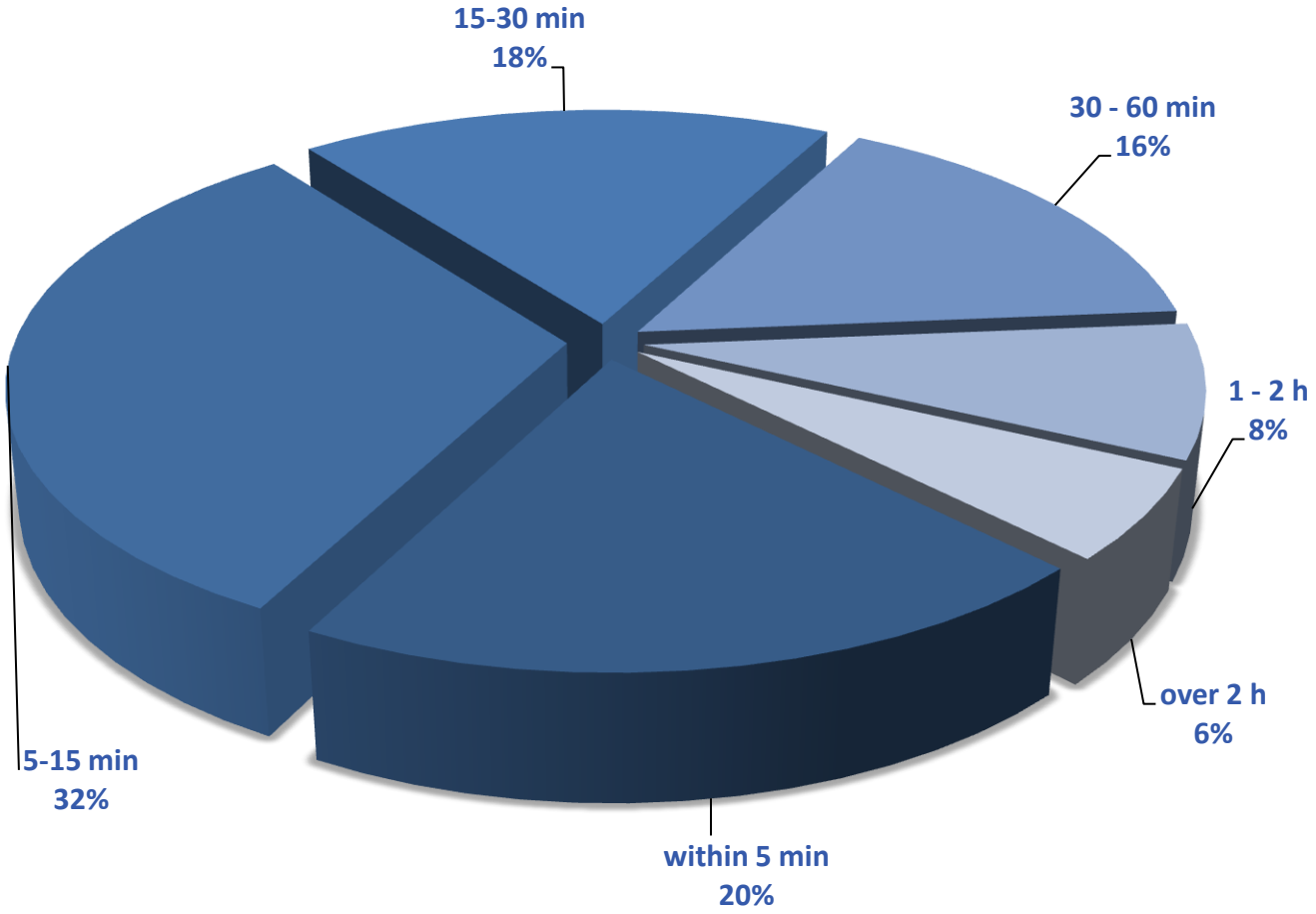
TM and patient safety

- PTT supervised by TMPs 24/7 nation-wide

Safer pre-transfusion practice for sensitised patients:
from issuing XM-negative units to Ag-negative XM-negative units

- More equal transfusion service provided for all patients nation-wide
- Quicker response, especially in patients with unexpected antibodies
- More cases solved on site
- Fewer samples transported to the Reference laboratory
- Haemovigilance data between 2002-2014 are too limited to prove significant decrease in SARs due to haemolysis (0-2 cases per year)

Responding time to TM sessions: 86% < 1h



Rationalisation of activities

- Four TMPs responsible for all TCs 24/7:
  - **Teleconsultant in Ljubljana region (**for 6 TCs and 1BB)
  - **Teleconsultant in Maribor region (**for CTM Mb and 2 TCs)
  - TMD in BTCS Ljubljana
  - TMD in CTM Celje
- Teleconsultant can work from any location: all TMPs can be engaged
- Reduction in the number of TMPs in TCs
- Allocation of some TMPs to the BTCS Lj and CTM Mb

Discussion

- A unique experience of using a national TM system for remote interpretation of RC tests, connecting BTS and hospitals nation-wide
- Comparable experiences from other countries: limited[5]
- Patient safety improvement: likely, although Haemovigilance data are too limited to show a significant decrease in SARs
- Satisfaction surveys proved that technicians and teleconsultants highly appreciate using TM and TM system functionalities

[5]Berti P, Verlicchi F, Fiorin F, Guaschino R, Cangemi A: The use of telemedicine in Italian Blood Banks: a nationwide survey. Blood Transfus 2014; 12 Suppl 1: 131-6.

Conclusions

- Effective use of national TM system in transfusion medicine expanding in the last decade
- TM enables continuous centralised remote interpretation of RC tests by TMPs
- 24/7 availability of TMP: safer blood supply for patients and timely response in every distant location
- Hospital physicians provided with improved transfusion service without their involvement in PTT
- TeleTransfusion was the first TM system in Slovenia that succesfully operates routinely






Thank you for your attention!

Questions?