

TELEMEDICINA - IZZIVI V URGENCI IN NA ČEZMEJNEM OBMOČJU

TELEMEDICINA - SFIDE NELLA MEDICINA D'URGENZA E NELL'AREA TRANSFRONTALIERA

Vloga telemedicine pri učinkovitejšem povezovanju transfuzijske službe z bolnišnicami v Sloveniji

L'utilizzo della telemedicina nello sviluppo della collaborazione tra gli offerenti dei servizi di trasfusione del sangue e tra gli ospedali in Slovenia.

Javni razpis št.02/2009 / IntegrAid - Integriran pristop k izboljšanju nujne medicinske pomoči na čezmejnem območju

Bando pubblico N.02/2009 / IntegrAid - Approccio integrato al miglioramento dell'assistenza medica d'urgenza nell'area transfrontaliera

Marjeta Maček Kvanka, Marko Breskvar, Mojca Šimc
Portorož - Portorose, 20.6.2014

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Using telemedicine to develop relationships between BTS and hospitals in Slovenia

Aim of the presentation

To present:

- Background: past and present organisation of blood transfusion service (BTS) in Slovenia (SI)
- Implementation and use of telemedicine (TM) system in SI
- Impact of TM on:
 - organisation
 - BTS – hospitals relationships
 - patient safety

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Background: BTS in Slovenia

- 2 million inhabitants
- BTS consists of 3 main blood establishments:
 - Blood Transfusion Centre of Slovenia (BTCS) with its 6 remote units Centers for transfusion service (CTSs)
 - Centre for Transfusion Medicine (CTM) Maribor with 2 remote CTSs
 - CTM Celje
- Main data for 2013:
 - 62,000 blood donors (11% new donors)
 - 93,000 blood collections (45% mobile session)
 - 185,000 prepared components

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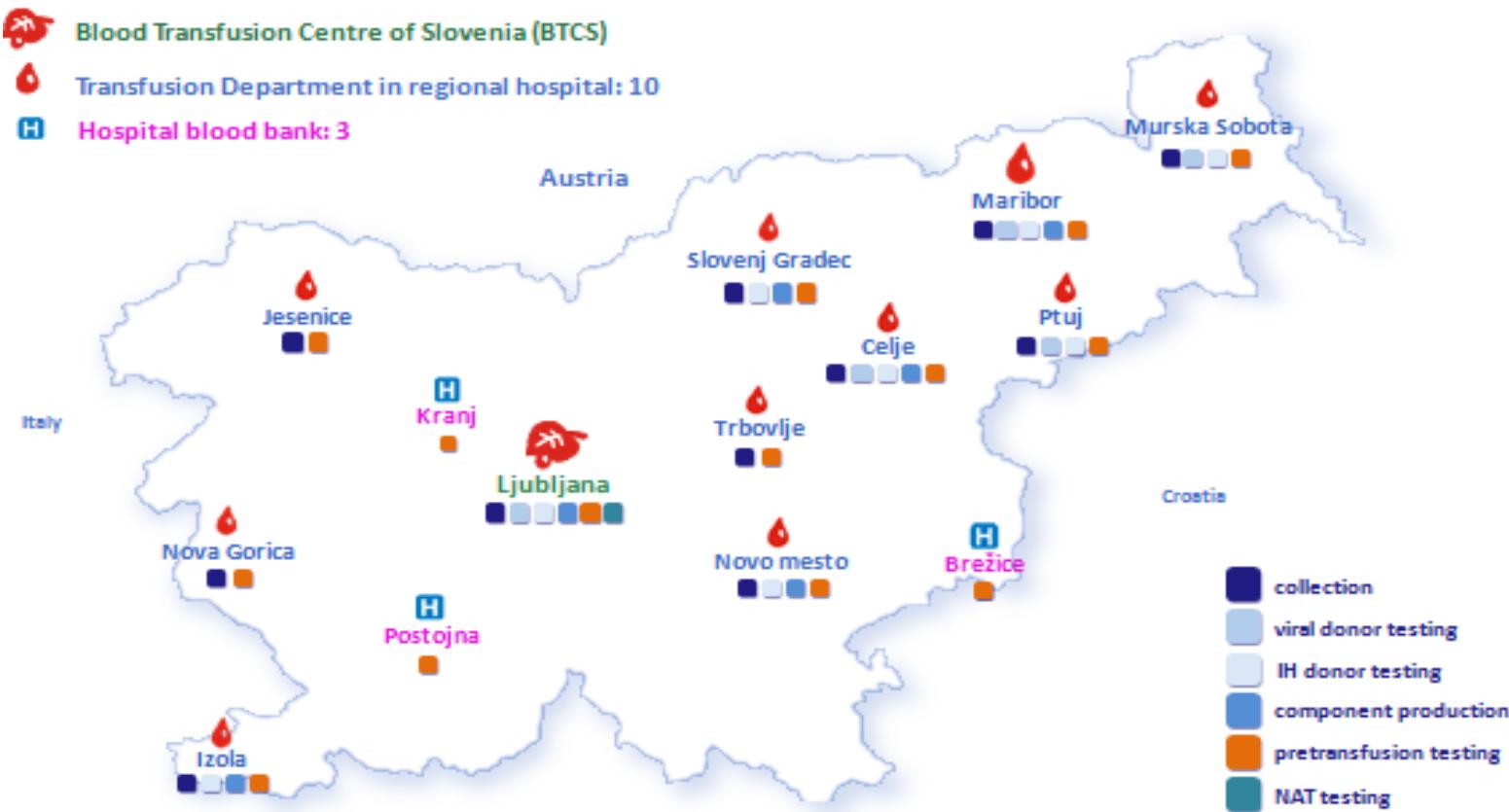
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Slovenian BTS before 2008



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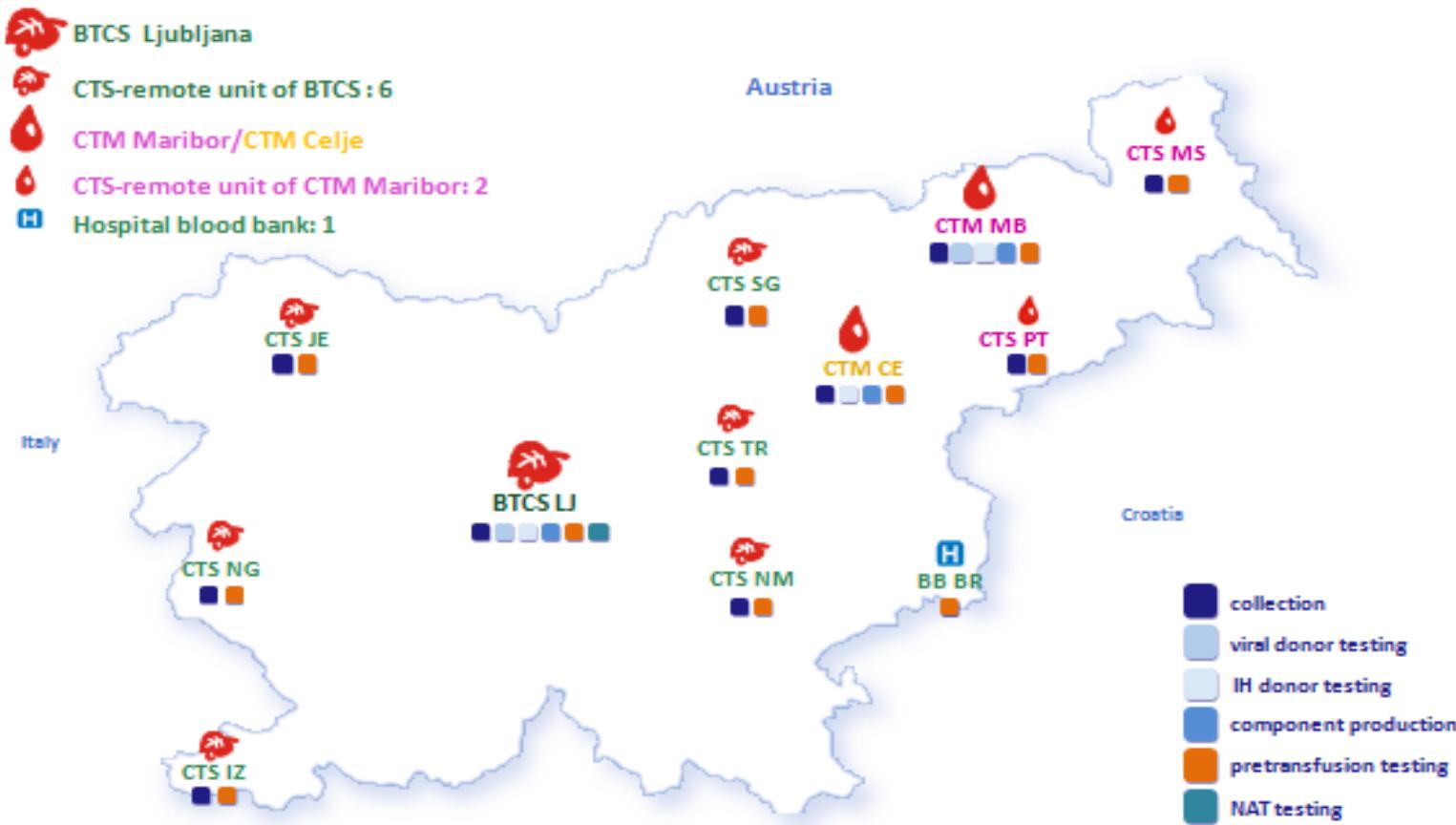
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Slovenian BTS in 2014



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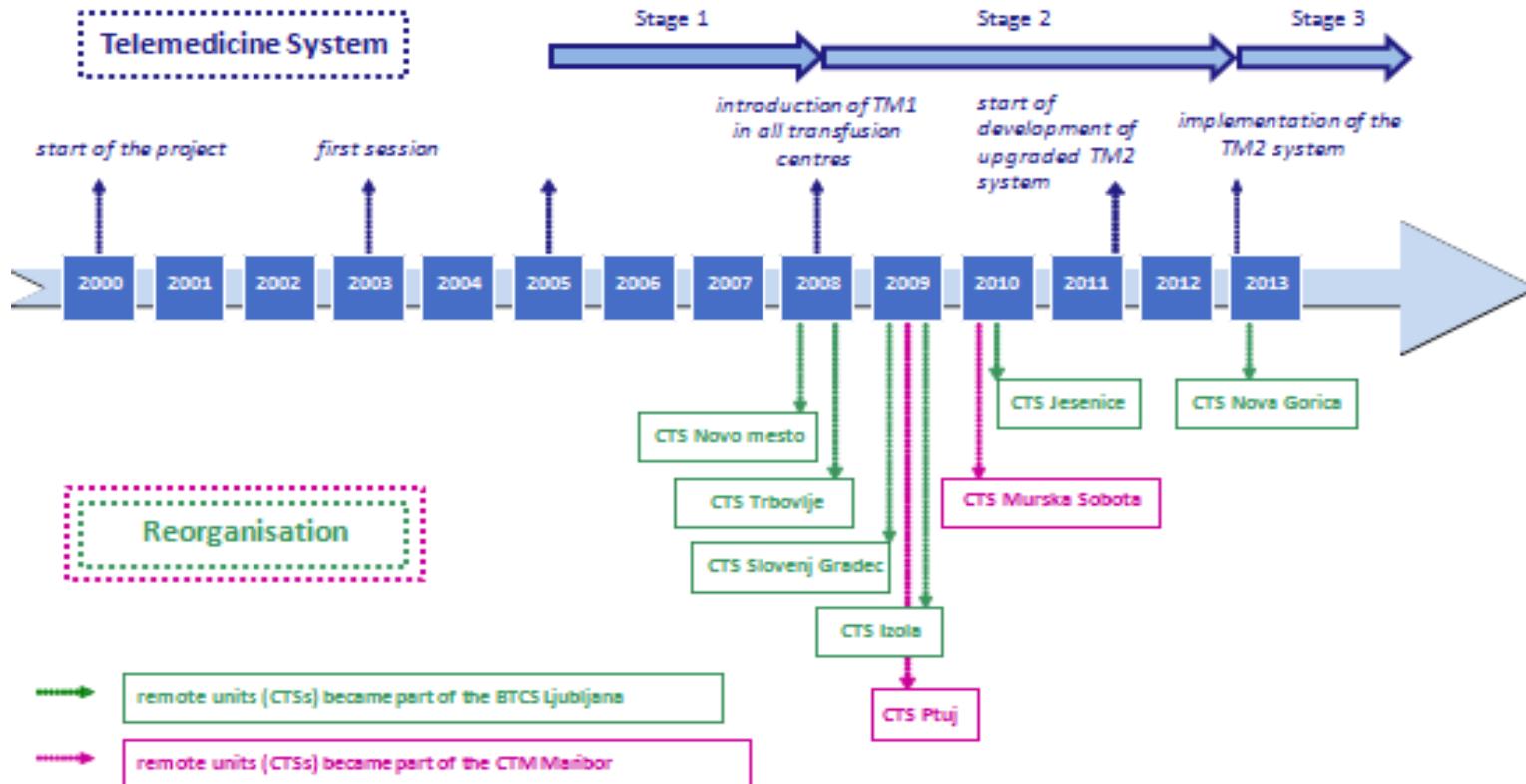
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TM and reorganisation of BTS: timelines



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Pre-transfusion testing (PTT) before 2008

- Before reorganisation PTT was performed at **14 locations**:
 - 1 BTCS
 - 10 hospital-associated Transfusion departments
 - 3 hospital blood banks
- Results were interpreted and validated by
 - transfusion medicine specialists (TMS) during the day
 - trained clinicians from hospitals during out-of routine hours (nights, weekends, holidays)
- Clinicians were educated and trained in two weeks` Transfusion medicine course to release negative and expected PTTs results
- In cases of positive or unexpected results, lack of clinicians` experience could delay transfusions: samples sent to BTCS LJ or CTM MB

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Problems after 2008

- Reorganisation of Slovenian BTS occurred between 2008 and 2013
- After 2008: organisation of work at the remote CTDs gradually became responsibility of BTCS and CTM Maribor
- Clinicians from hospitals did not participate in the transfusion service any more (except for emergency cases)
- *Competent authority* required equal service 24/365
- At 9 remote sites, TMSs were needed 24/365, but only few were available

TM system in CTSs: a solution for safer pretransfusion testing

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Development of TM system: objectives

- To use remote interpretation of immunohaematological PTTs
 - to allow for expert opinion from another TMS when solving special cases
 - to advise clinicians on duty involved in interpretation and validation of PTT for their patients
 - to reduce sending blood samples to the Reference laboratory by selecting cases
 - to speed up the blood components issuing/delivery

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Stage 1 Development and implementation of TM

Teleconsultations between 2005–2008

- TM1 system jointly developed by experts from BTCS and University of Ljubljana, Faculty of Electrical Engineering¹.
- By 2008, implemented in all CTs.
- 2005 – 2008: a few hundred expert opinion sessions per year sent to Reference lab.



¹Meza 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

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Stage 2

TM1 routinely used after reorganisation²

- After 2008: TM1 system use extended from complex cases to **routine PTT cases until 3 pm**
- TM1 used only when TMS in remote CTS not on site
- Since 2009: TM1 use extended **until 8 pm**
- Since July 2011: two TMS consultants on duty **24/7/365** to cover remote CTSs in Slovenia:
 - one in Ljubljana region and
 - one in Maribor region

Number of TM sessions substantially increased

²Bricl 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

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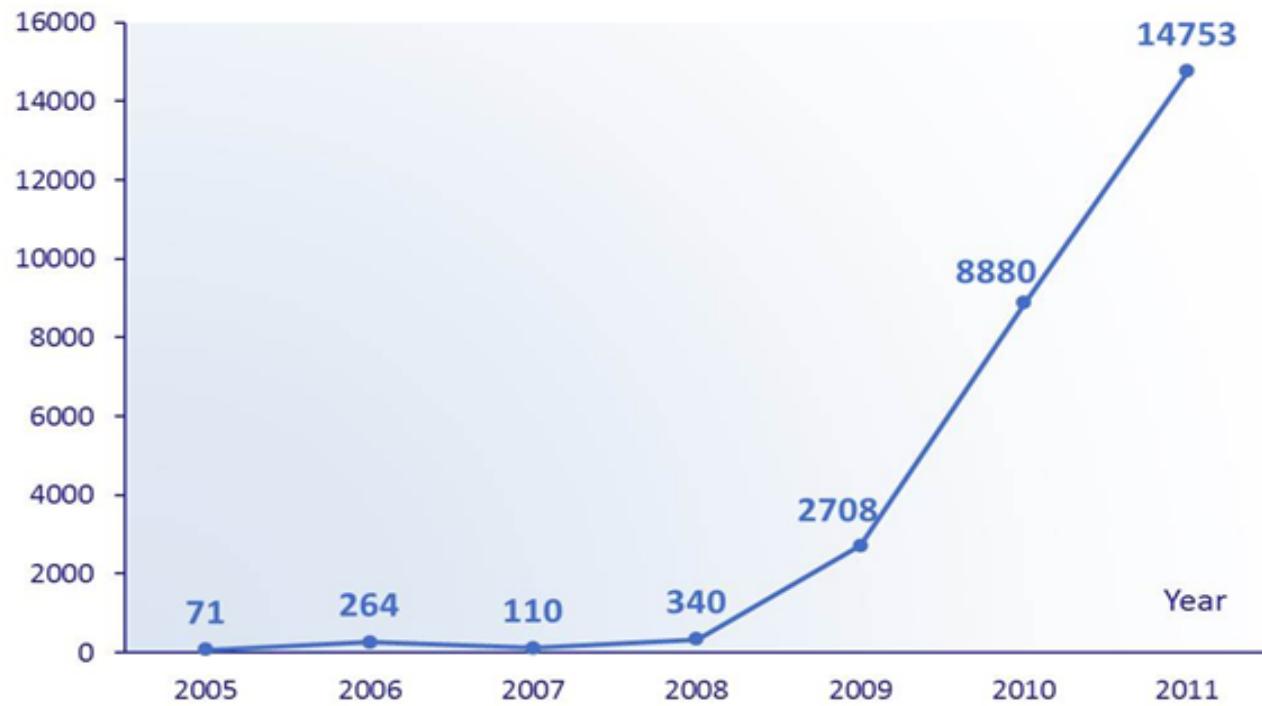
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Number of TM sessions until 2011

Number of TM sessions



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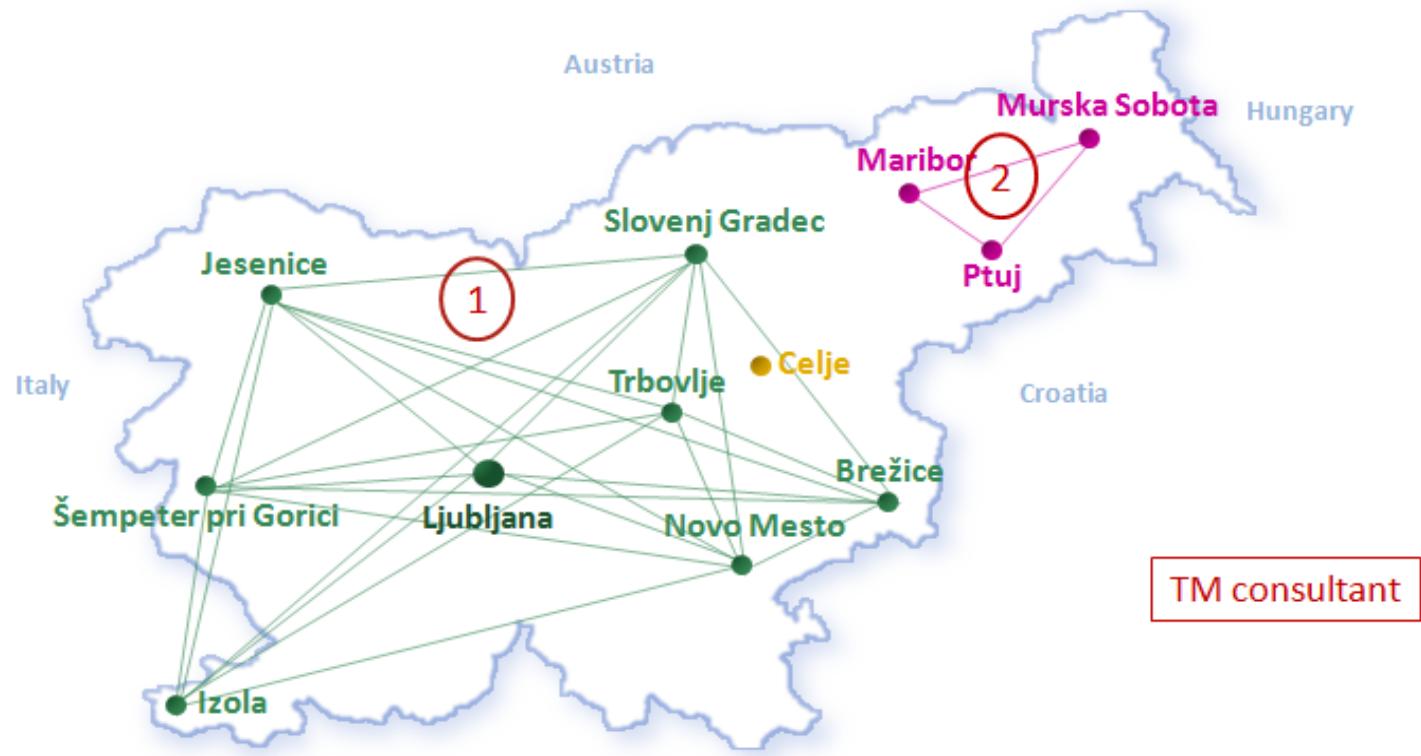
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Stage 2 Two TM regions after 2008



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Reasons for upgrading TM1 system

- TM1 system not designed for up to 20,000 consultations a year
- Upgrade of existing (laboratory) platform no longer possible
- New professional TM system with redundancy needed
- New professional requirements
- Need to improve safety and security

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Stage 3

Development and implementation of TM2

- End of 2011: Public tender for development of TM2 system awarded to Slovenian IT company XLAB Ltd
- 2012: TM2 system developed in cooperation with experts from BTCS³
- End of 2012: testings, validation and training of consultants and technicians
- Feb 2013 – Launch of TM2 system in all CTs
 - New professional functionalities
 - Maintenance & support 24/7
 - CE certification



³Breskvar M, Macek Kvanka M, Tonejc M, Vavpotic M: Novi telemedicinski sistem v slovenski transfuzijski sluzbi. Infor Med Slov: 2012; 17(1): 14-23.

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Bi-directional connection of TM system with host transfusion IS DATEC

Import:

Patient data

- AB0, D and K
- Sample ID
- Medical remarks-short history of the patient
- Previous IH results
- History of transfused units
- Previous commentaries from IS

Blood donor's data

- AB0, D and K

Export:

- IH results
- Commentaries
- Digital signature

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TM functionalities

- Possibility to retrieve patient data from various sources
- In-built control of ABO with historic ABO
- State of urgency: urgent/regular
- 3 types of sessions: DATEC session, consultation, quality control
- Defined tests and results
- Consecutive adding of tests within one session for additional request
- Digital signature
- Redundancy and traceability
- Safety and security
- Photo-archive: storage of all data, results and images
- Statistical analysis of data

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Patient data retrieval from various sources

Scanned documents

Request, panel list, ...



Laboratory IH tests

Pretransfusion, prenatal tests:
ABO-RhD, Ab screening, XM...



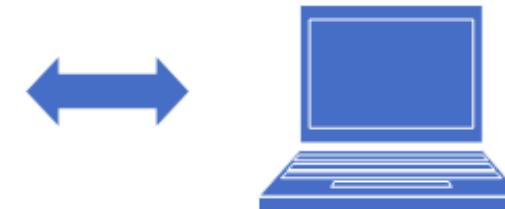
Telephone consulting

Patient data from hospital
Professional discussion



Data from host TIS Datec

Patient history, laboratory tests history
Donors data: ABO-RhD, K, ...



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Technician prepares the TM session

Capturing images
of gel cards by haemoscope



Scanning bar-code
of the RBC unit tube



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The sessions arrive to consultant

Screenshot of the TeleMedicina2 software interface showing a list of medical sessions. A blue circle highlights the 'GG' code in the MED. OP. column of the second row. A blue arrow points from this circle to an oval labeled 'Medical remarks'. Below the list is a small icon of a stethoscope.

| STATUS | MUNOST | ZAČETEK SEJE | VZDALINA SPREHE | PRIM. | ROJSTNO DATUM | MED. OP. | ŠTEVLO NP | NAROČNICA | TP SEJE | DATEC | LAB. INŽENIR | LOKACIJA | KONSULTANT |
|-------------|--------|--------------|-----------------|-------|---------------|----------|-----------|-----------|--------------------|--------|-------------------|--------------------|----------------------------|
| Vzdrževanje | Nujno | Danes, 10:00 | Danes, 10:01 | M... | 26.5.1985 | GG | 1 | | DATEC seje | V delu | Poglav Dragica | CTD Slovenj Gradec | Janka Čeme, dr.med. |
| Prejeta | Redno | Danes, 09:40 | Danes, 09:46 | P... | 9.2.1980 | | 0 | | DATEC seje | V delu | Amir Belic | CTD Jesenice | Janka Čeme, dr.med. |
| Prejeta | Redno | Danes, 09:36 | Danes, 09:40 | Ko... | | | 0 | | Kontrola kakovosti | | Janez Volner | CTD Slovenj Gradec | Janka Čeme, dr.med. |
| Vzdrževanje | Redno | 24.10.2013 | 24.10.2013 | Pl... | 9.2.1985 | | | | Posvetovanje | | Safa Inthar Trček | ZTM Ljubljana | prim. Irena Brcic, dr.med. |

Število tej pogleda: 4 50 | 100 < | > 1 od 1

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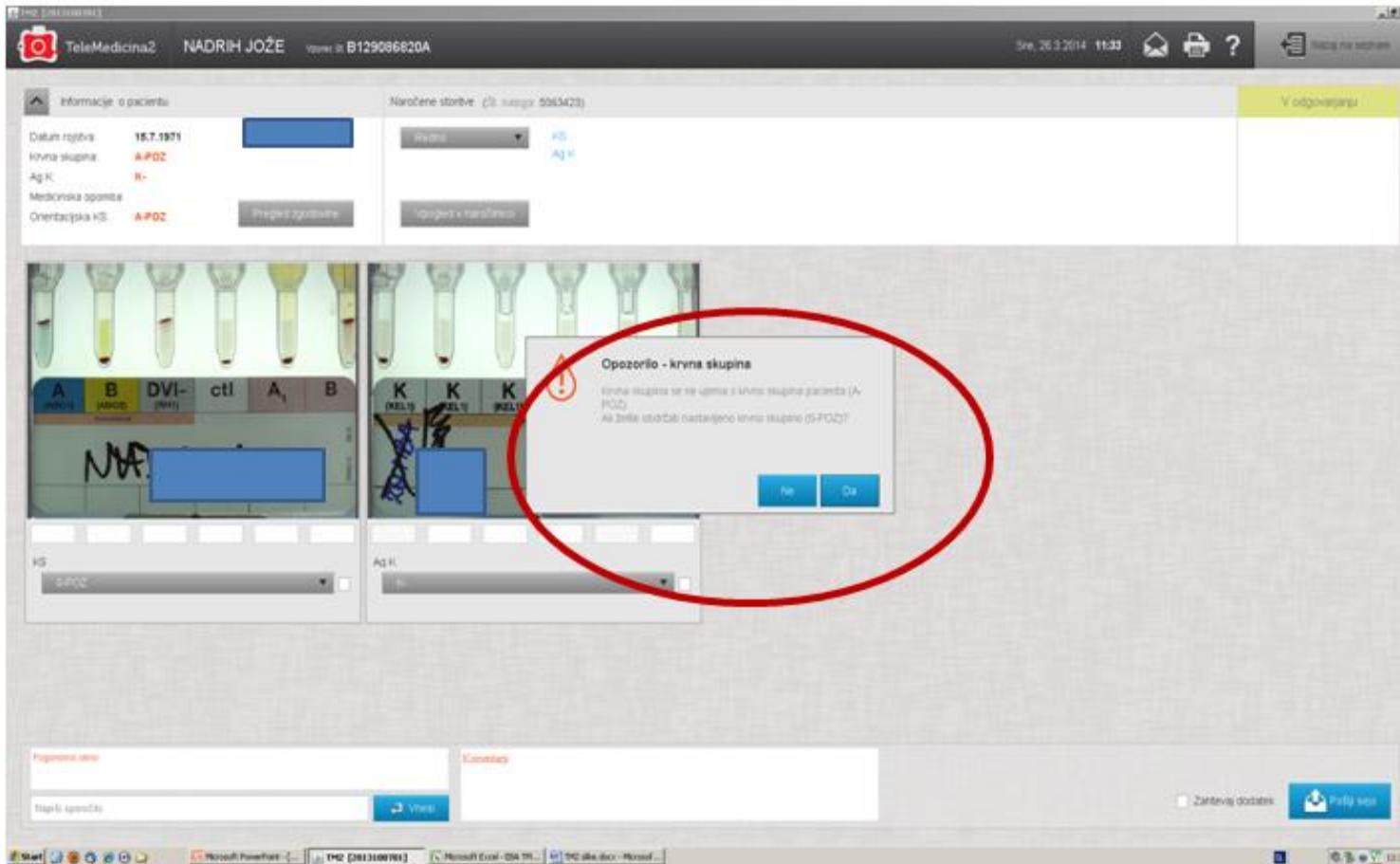
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In-built control of ABO with historic ABO



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Attached documents

Request for patient

Panel of testing cells

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Patient history: previous IH results and issued units

Zgodovina pacienta:

roj. 16.5.1935



Commentaries

KOMENTAR

KONEC KOMENTARJEV

Previous IH results

| DATUM IN URA | STATUS | IZVID | ZDRAVNIK | KLINIKA | ŠIFRA | LABORATORIJSKI REZULTAT |
|--|--------|-----------|----------|----------|-------|---|
| 19/10/2013 12:00 | IZV | D5005156 | TKTM | JEINTODD | 23042 | NAVZKRŽNI PREIZKUS, GEL:NUJNO: NEG. z enimom NEG. s Coombsovim testom |
| 19/10/2013 12:00 | IZV | D5005156 | TKTM | JEINTODD | 20042 | KRVNA SKUPINA, NUJNO: A, RDO POZITIVNA |
| 19/10/2013 12:00 | GRA | 000000000 | TKTM | JEINTODD | 21592 | AVTOKONTROLA, GEL NUJNO: NT |
| 19/10/2013 12:00 | IZV | D5005157 | TKTM | JEINTODD | 21550 | INDIREKTNI COOMBSOV TEST, GEL: NEGATIVEN |
| 19/09/2013 11:48 | OBR | 25023501 | TKAH | JEINTODD | 23040 | NAVZKRŽNI PREIZKUS, GEL TEST: NEG. z enimom NEG. s Coombsovim testom |
| Izvid nadomešča izvid št. 25023491 (popravljeni matični podatki) | | | | | | |
| 19/09/2013 10:53 | OBR | 25023499 | TKAH | JEINTODD | 20001 | KRVNA SKUPINA, GEL: A, RDO POZITIVNA |
| 19/09/2013 11:48 | OBR | 25023501 | TKAH | JEINTODD | 20040 | KRVNA SKUPINA, GEL: A, RDO POZITIVNA |
| Izvid nadomešča izvid št. 25023491 (popravljeni matični podatki) | | | | | | |
| 19/09/2013 11:48 | OBR | 25023501 | TKAH | JEINTODD | 21591 | AVTOKONTROLA, GEL: POZITIVNA |
| Izvid nadomešča izvid št. 25023491 (popravljeni matični podatki) | | | | | | |
| 19/09/2013 10:53 | OBR | 25023499 | TKAH | JEINTODD | 21012 | ERITROCITNI ANTIGENI KELL: K- |
| 19/09/2013 10:53 | OBR | 25023500 | TKAH | JEINTODD | 21535 | DIREKTNI COOMBSOV TEST, GEL: anti-IgG pozitiven |
| 19/09/2013 10:53 | OBR | 25023500 | TKAH | JEINTODD | 21535 | DIREKTNI COOMBSOV TEST, GEL: anti-IgA negativ |
| 19/09/2013 10:53 | OBR | 25023500 | TKAH | JEINTODD | 21535 | DIREKTNI COOMBSOV TEST, GEL: anti-IgM negativ |
| 19/09/2013 10:53 | OBR | 25023500 | TKAH | JEINTODD | 21535 | DIREKTNI COOMBSOV TEST, GEL: anti-C3c negativ |
| 19/09/2013 10:53 | OBR | 25023500 | TKAH | JEINTODD | 21535 | DIREKTNI COOMBSOV TEST, GEL: anti-C3d negativ |
| 19/09/2013 11:52 | OBR | 25023502 | TKAH | JEINTODD | 21530 | DIREKTNI COOMBSOV TEST, GEL: POZITIVEN |
| 19/09/2013 11:53 | OBR | 25023503 | TKAH | JEINTODD | 21550 | INDIREKTNI COOMBSOV TEST, GEL: NEGATIVEN |
| 03/10/2013 10:40 | OBR | 25023651 | TKMT | JEINTODD | 23040 | NAVZKRŽNI PREIZKUS, GEL TEST: NEG. z enimom NEG. s Coombsovim testom |
| 03/10/2013 10:40 | OBR | 25023651 | TKMT | JEINTODD | 20040 | KRVNA SKUPINA, GEL: A, RDO POZITIVNA |
| 03/10/2013 10:40 | OBR | 25023651 | TKMT | JEINTODD | 21591 | AVTOKONTROLA, GEL: POZITIVNA |
| 03/10/2013 10:40 | OBR | 25023652 | TKMT | JEINTODD | 21550 | INDIREKTNI COOMBSOV TEST, GEL: NEGATIVEN |

Issued units

| DATUM IZDAJE | IME | ŠT.KRVI | VOL. | ABORHO | IZVID | KLINIKA | NAROČILNICA |
|--------------|-----|---------|------|--------|---------|----------|-------------|
| 19/09/2013 | KEF | 2222744 | 305 | A-POZ | 5023501 | JEINTODD | 12775 |
| 19/09/2013 | KEF | 2228574 | 300 | A-POZ | 5023501 | JEINTODD | 12775 |
| 03/10/2013 | KEF | 2231102 | 260 | A-POZ | 5023651 | JEINTODD | 12826 |
| 19/10/2013 | KEF | 2227117 | 260 | A-POZ | 5005156 | JEINTODD | 12893 |

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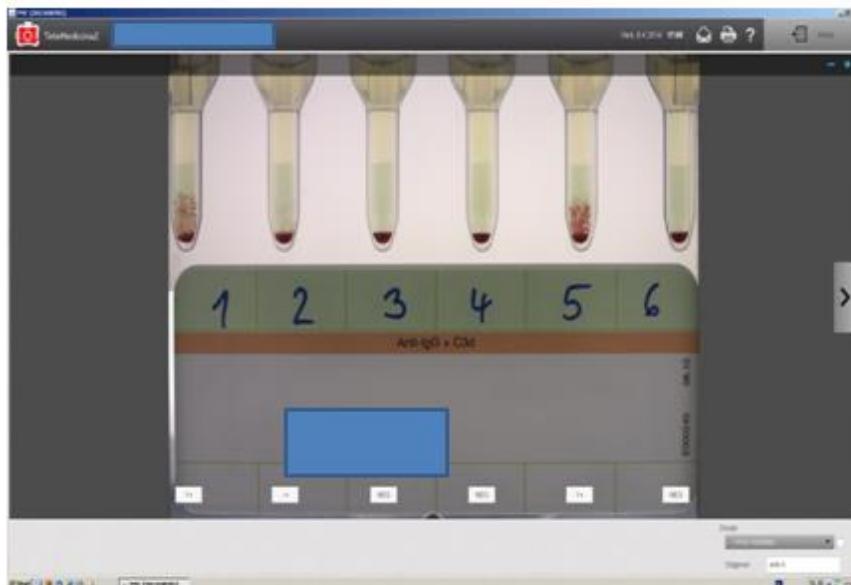
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Magnified image of gel card and columns



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Digital signature

The screenshot shows a computer window titled 'JasperViewer' displaying a medical test result. The result includes a photograph of four test tubes labeled 'DVS', 'Euv.', 'AHG', and 'AHO'. The test tube labels are also repeated in the text area. The text area contains the following information:

Tip preiskave: NP 2231239 (D-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 entrocytina protitelesa nerazvidne specifičnosti, najverjetnejno avitoprotitelesa. Priporočamo nadaljnje testiranje na ZTM.
mag. Marjeta Maček Kvanka, dr.med. [21.10.2013 ob 06:50]
Positivni navzkrižni rezulsi z encimom so posledica nespecifične encimskih 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:
SvLAVLjyqBZCDmz+el2ta8f8MGxQjDNPhn7ju+el1aLG5ekoytqg21MeK27fUDOp3dIwUOpx7sp/n55d8lfr/S2c2p8j09h+42zny0,9
V+5rHEkZj92eeyXAl6TQ9LwUk28sk4+r1LzudnY4EDOnF4j325v/p1DukP9q=

Stran 6 / 6

The screenshot shows a digital document with the following details:

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

KRVNA SKUPINA, NUJNO: A, RhD POZITIVNA
AVTOKONTROLA, GEL NUJNO: NEGATIVNA

NAVZKRIZNI PREIZKUS, GEL TEST - NUJNO:
NEG. z encimom NEG. s Coombsovim testom
ST.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)

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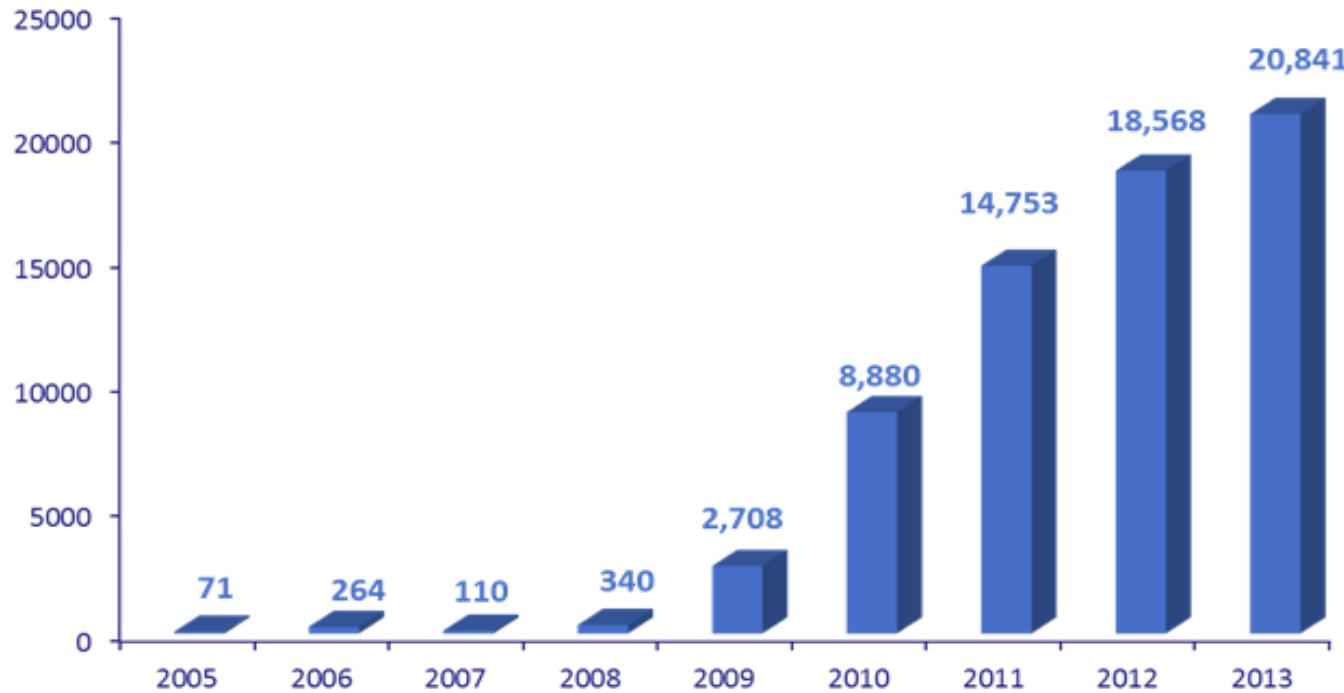
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Number of TM sessions 2005-2013

Number of TM sessions



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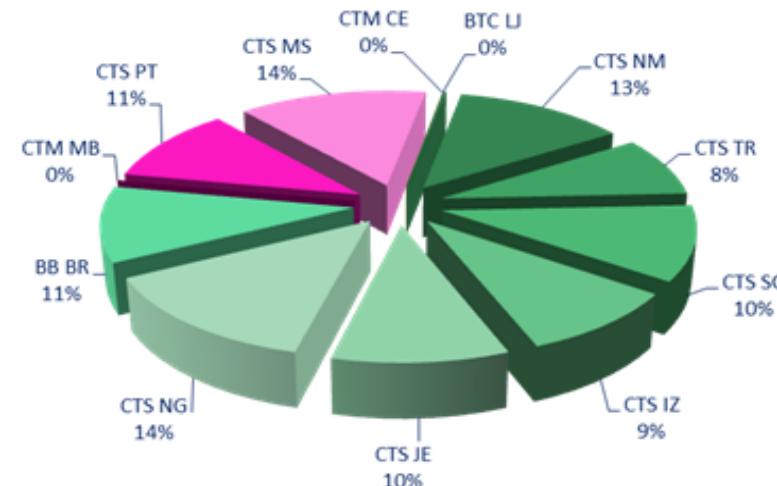


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TM2 sessions in 2013

| LOCATION | Teleconsultations in 2013 |
|--------------------|---------------------------|
| BTC of Ljubljana | 52 |
| CTS Novo mesto | 2,670 |
| CTS Trbovlje | 1,758 |
| CTS Slovenj Gradec | 2,189 |
| CTS Izola | 1,944 |
| CTS Jesenice | 2,032 |
| CTS Nova Gorica | 2,824 |
| BB Brežice | 2,213 |
| CTM Maribor | 5 |
| CTS Ptuj | 2,227 |
| CTS Murska Sobota | 2,927 |
| CTM Celje | 0 |
| SLOVENIA | 20,841 |

Teleconsultations in 2013



Number of tests: XM=16.600; Ab screening=13.746; Ab specification=360

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Outcomes from TM

- Improved patient safety
- Improved organisation of work at remote CTSs
- Rationalisation of activities in Slovenian BTS
- Better transfusion service to clinicians without their involvement in PTT
- Prompt resolution of the majority of reactive IH results without unnecessary delay in the supply of patient with blood components

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TM and patient safety

- PTT supervised by TMSs 24/7/356 nation-wide
- Continuous workflow in IH laboratories
- Improved availability of typed RBC units

**Safer pretransfusion practice for sensitized patients:
from issuing XM-negative units to Ag-negative XM-negative units**

- Quicker response, especially in patients with unexpected antibodies
- More cases solved on site
- Fewer samples transported to the Reference laboratory

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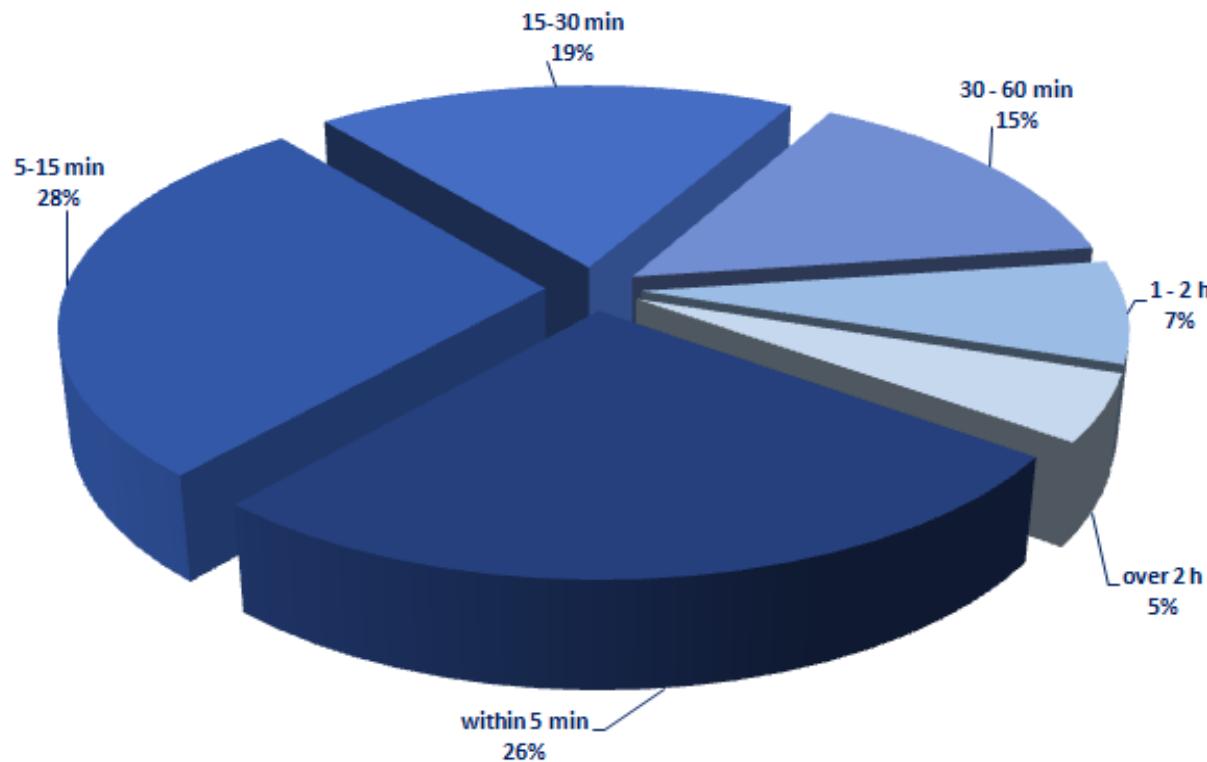
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Responding time to TM sessions: **88% in < 1h**



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Haemovigilance reports 2002-2013

Number of haemolysis cases

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Haemolysis | 5 | 2 | 2 | 5 | 3 | 3 | 3 | 0 | 4 | 3 | 7 | 1 |
| - | | | | | | | | | | | | |
| - | | | | | | | | | | | | |
| Total | 86 | 107 | 146 | 149 | 191 | 192 | 204 | 174 | 170 | 142 | 162 | 113 |

Number of Serious Adverse Reactions

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------|------|------|------|------|------|------|------|------|------|------|------|
| Haemolysis | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - | | | | | | | | | | | |
| - | | | | | | | | | | | |
| Total | 9 | 16 | 11 | 10 | 14 | 16 | 15 | 13 | 17 | 15 | 13 |

⁴Potocnik M: Hemovigilanca v Sloveniji v letu 2012. Isis 2013; 10: 59-65.

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Rationalisation of activities

- Four TMSs responsible 24/7 for all CTs in Slovenia:
 - TM consultant for Ljubljana region, responsible for 6 CTSS and 1BB,
 - TM consultant for Maribor region, responsible for CTM MB and 2 CTSS
 - TMS responsible for BTCS
 - TMS responsible for CTM Celje
- TM consultant can work from any location
- Reduction in number of TMSs in CTSS
- Allocation of some TMSs to the BTCS LJ and CTM MB



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Discussion

- A unique experience of using a national TM system for remote interpretation of PTT, connecting BTS and hospitals nation-wide
- Comparable experiences from other countries: limited^{5,6}
- Patient safety improvement: likely, although Haemovigilance data are too small to show significant decrease of SARs
- Satisfaction survey with clinicians: desirable to assess impact on BTS-Hospitals relationships more accurately

⁵Staves J, Davies A, Kay J, Pearson O, Johnson T, Murphy MF: Electronic remote blood issue: a combination of remote blood issue with a system for end-to-end electronic control of transfusion to provide a "total solution" for a safe and timely hospital blood transfusion service. Transfusion 2008; 48: 415-24.

⁶Berti 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.

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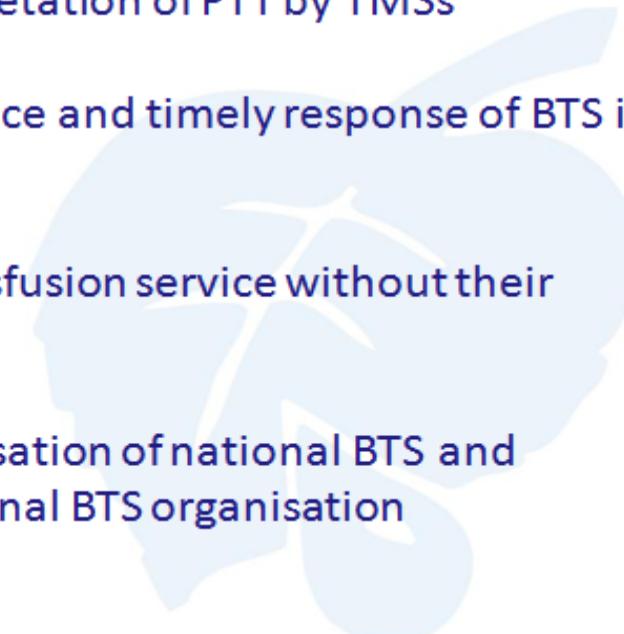
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Conclusions

- Effective use of national TM system connecting BTS and hospitals for remote interpretation of PTT nation-wide, expanding in the last 5 years
- TM enables continuous remote interpretation of PTT by TMSs
- 24/7 availability of TMS: safer PTT service and timely response of BTS in every distant location
- Clinicians provided with improved transfusion service without their involvement in PTT
- TM was a key element in the re-organisation of national BTS and enables further rationalisation of national BTS organisation



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TELEMEDICINA - IZZIVI V URGENCI IN NA ČEZMEJNEM OBMOČJU

TELEMEDICINA - SFIDE NELLA MEDICINA D'URGENZA E NELL'AREA TRANSFRONTALIERA

Portorož - Portorose, 20.6.2014

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Slovenska bolnišnica Izola
Ospedale Generale Isola



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