Improvements of blood safety using NAT testing for donor screening

13th Střešovice Blood Transfusion day
2019-11-21

Ralf Himmelreich, GFE Blut

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Agenda

- Blood donor screening: trends, changes, numbers
- World wide numbers
- NAT Testing
- Emerging viruses (HEV & WNV)
- Outlook

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Blood donor screening: trends, changes, numbers

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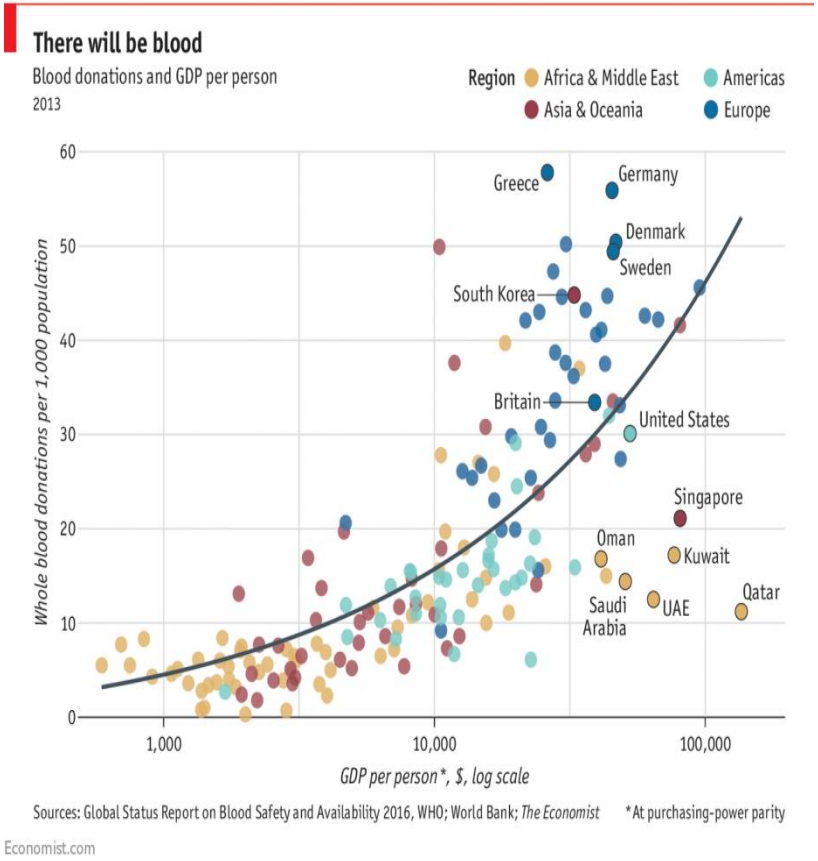
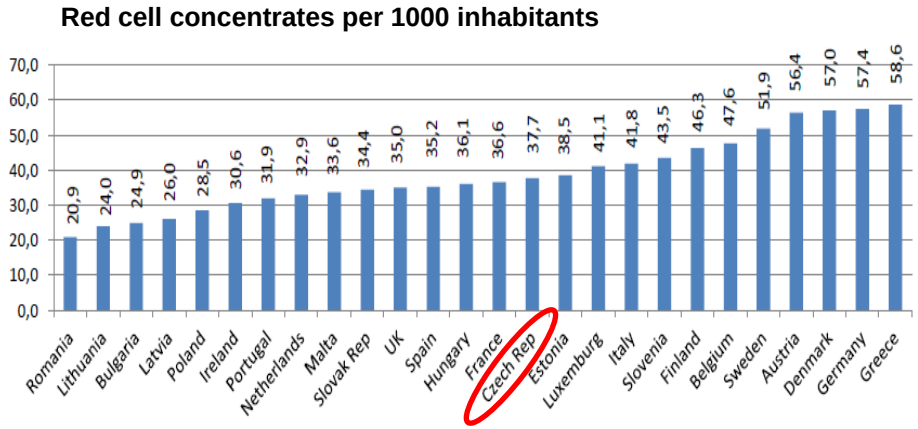
Blood donation in different countries



- Donation rate is significantly higher in high developed countries



- Also the need and consumption of blood products is higher in these countries

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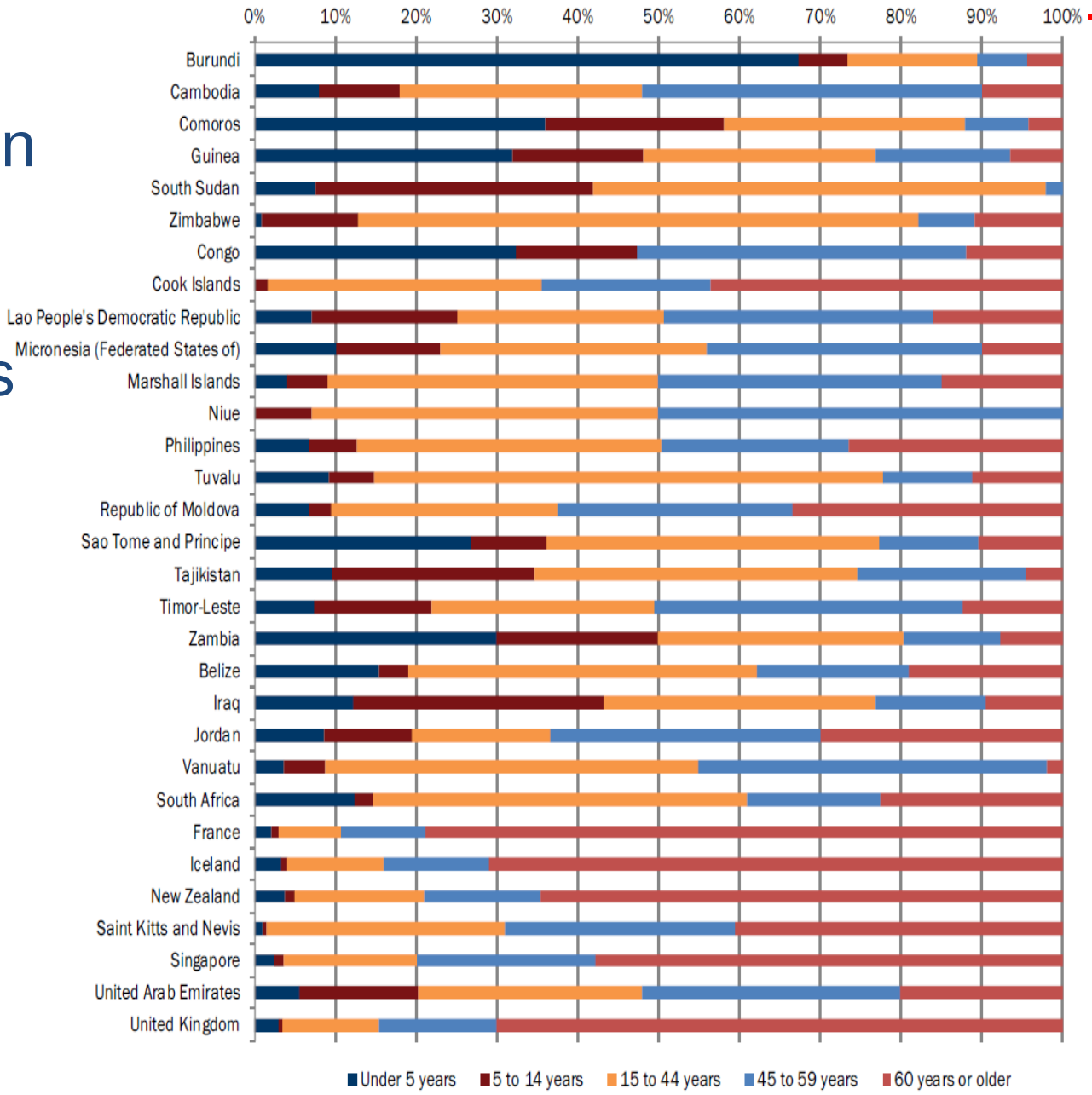
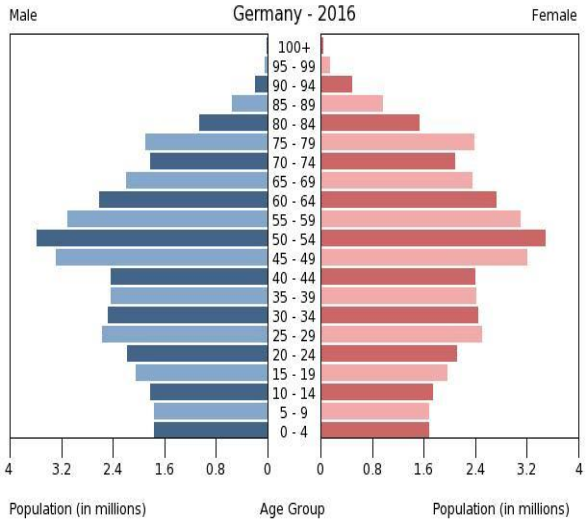
Age distribution of patients receiving blood products

A prosperous society leads to older recipients



Blood donation – covering the demand

- The Demographic change leads to a yearly loss of approx 100.000 donors due to age exclusion (73y)
- In Germany only 3% of the inhabitants are regularly blood donors
- The future problem is, how to cope with the demand on blood products



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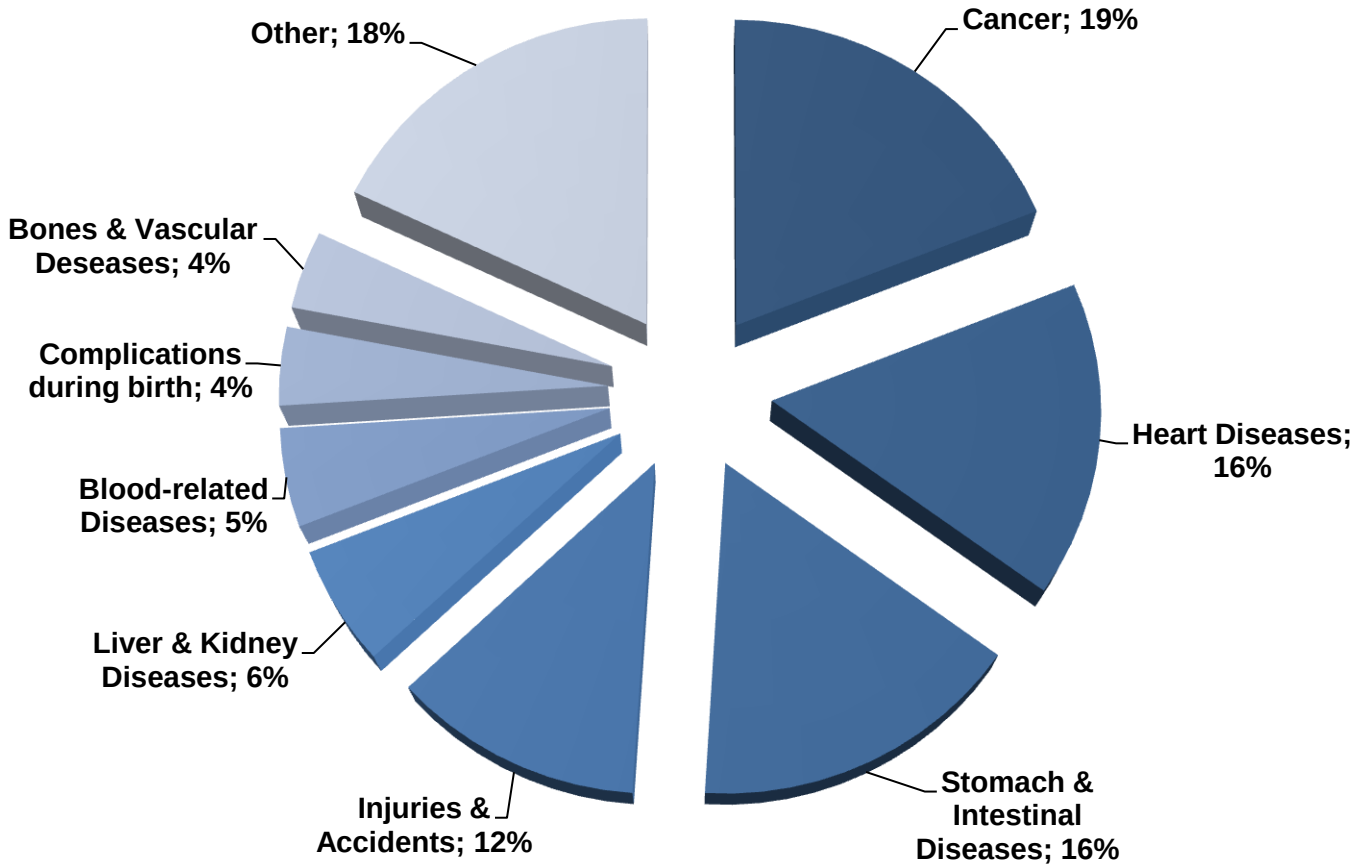
Application areas for blood donations



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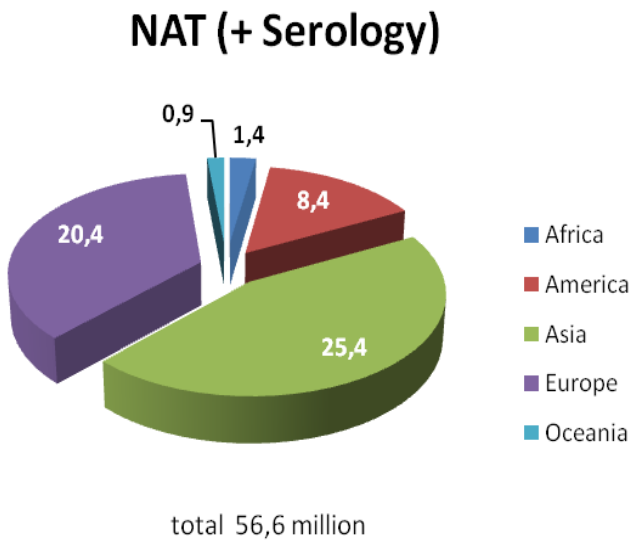
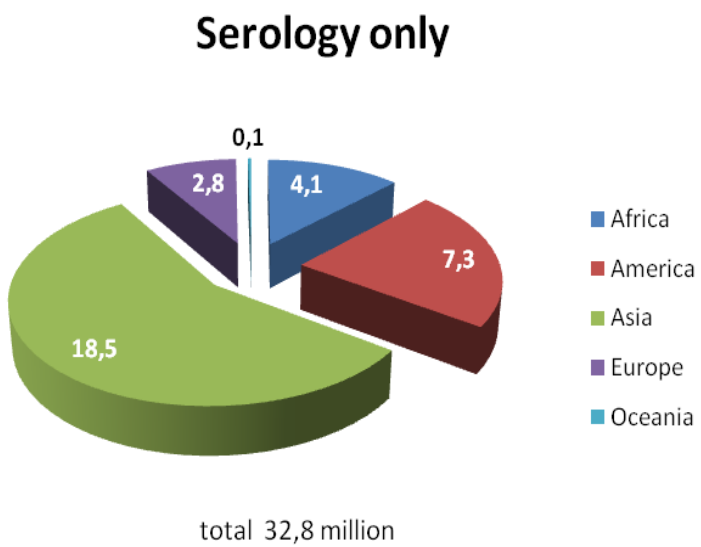
World wide numbers of Testing

Global blood donations

Total 89.4 million whole blood donations





China = 50 % of the Asian NAT market

125 countries; 7'800+ laboratories

Please note: the numbers are related to whole blood; apheresis samples not included!

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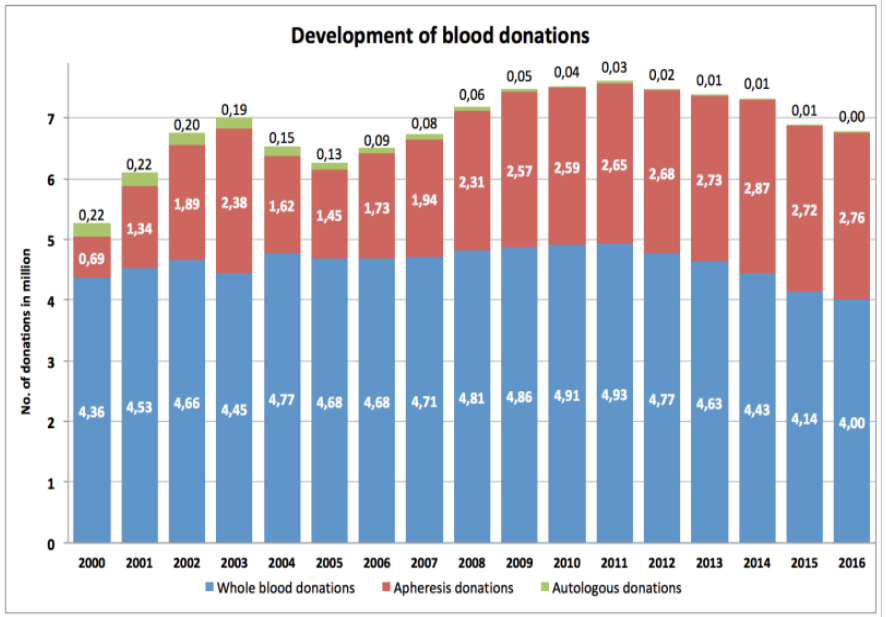
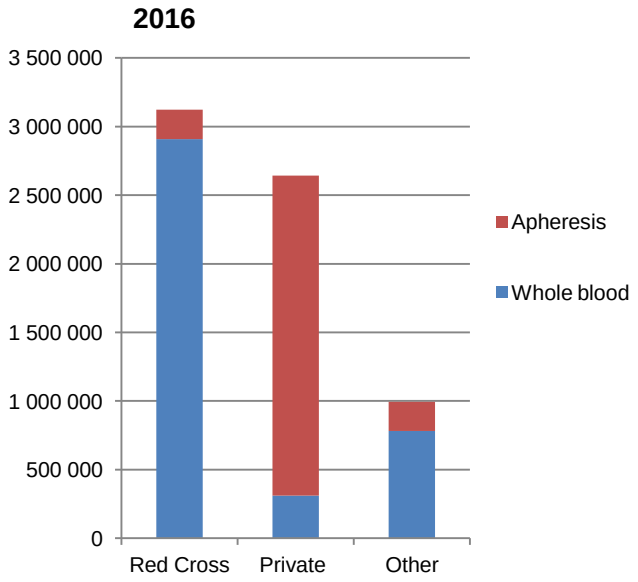
Screening in Germany

- 4 Blood-Screening-Services and the plasma-industry are testing ~80% of the donations
  (BSD West, NSTOB, BRK, BaWüHe; CSL Plasma Labor, Octapharma, Biotest, Heama)
- Remaining part is done by small laboratories





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NAT Testing

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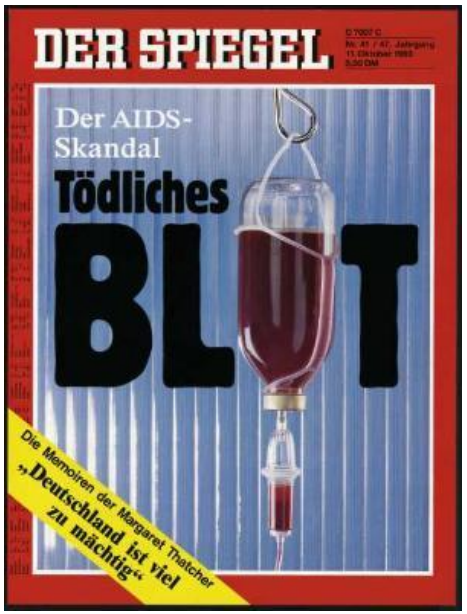
NAT Testing was triggered by scandals

DER SPIEGEL 41/1993



The „AIDS Scandal“

The authors mention that they reported already 10 years ago on the risk of transmitting HIV by blood products and that there had been more than 200 critical articles on that issue and nothing happened.

Next scandal:

Detection of HCV RNA in Clotting Factor Concentrates

Blood. 1993 Apr 1;81(7):1898-902.

Hepatitis C viral RNA in clotting factor concentrates and the development of hepatitis in recipients. Makris M, et al.

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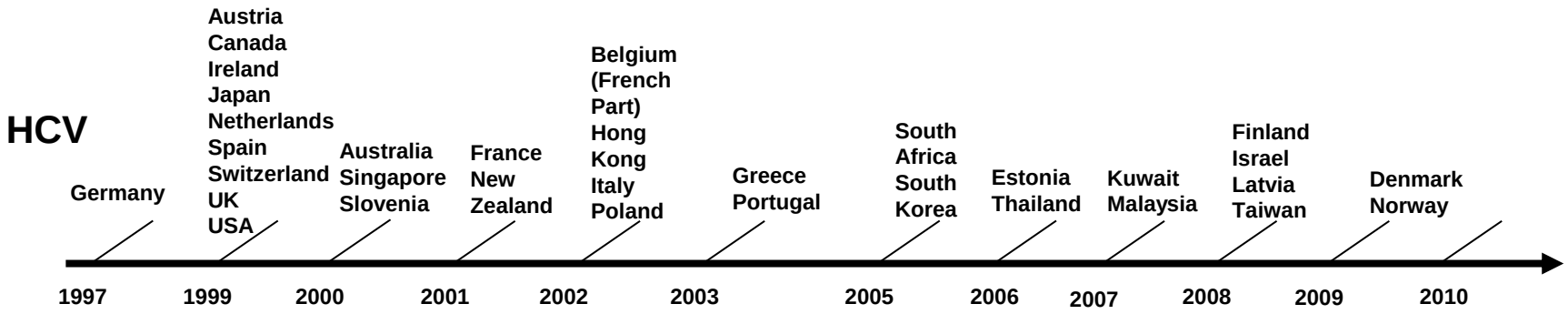
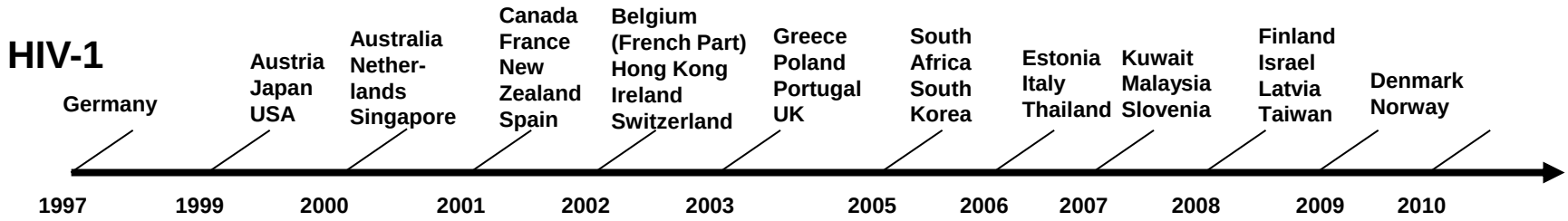
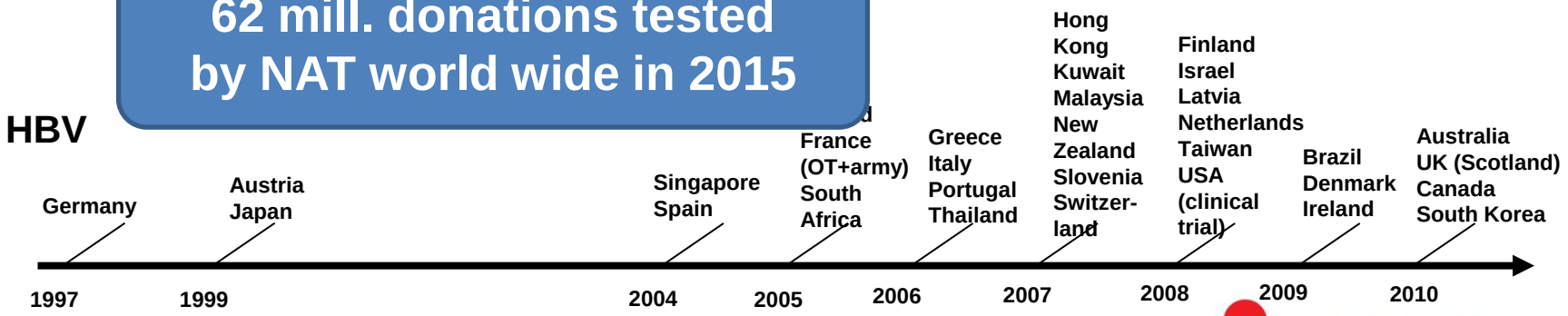
Introduction of NAT Testing World Wide

International Survey on NAT testing (2008) population covered: 1.15 billion in 33 countries





62 mill. donations tested by NAT world wide in 2015



Vox Sang. 2012; 102(1): 82-90

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Systems on the market

- Roche cobas 6800/8800

Systems on the market

- Grifols Procleix – Tigris system

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Systems on the market

- Grifols Procleix – Panther System

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Systems on the market

- Altona Diagnostics – AltoStar

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Systems on the market

- Siemens – VERSANT kPCR Molecular System

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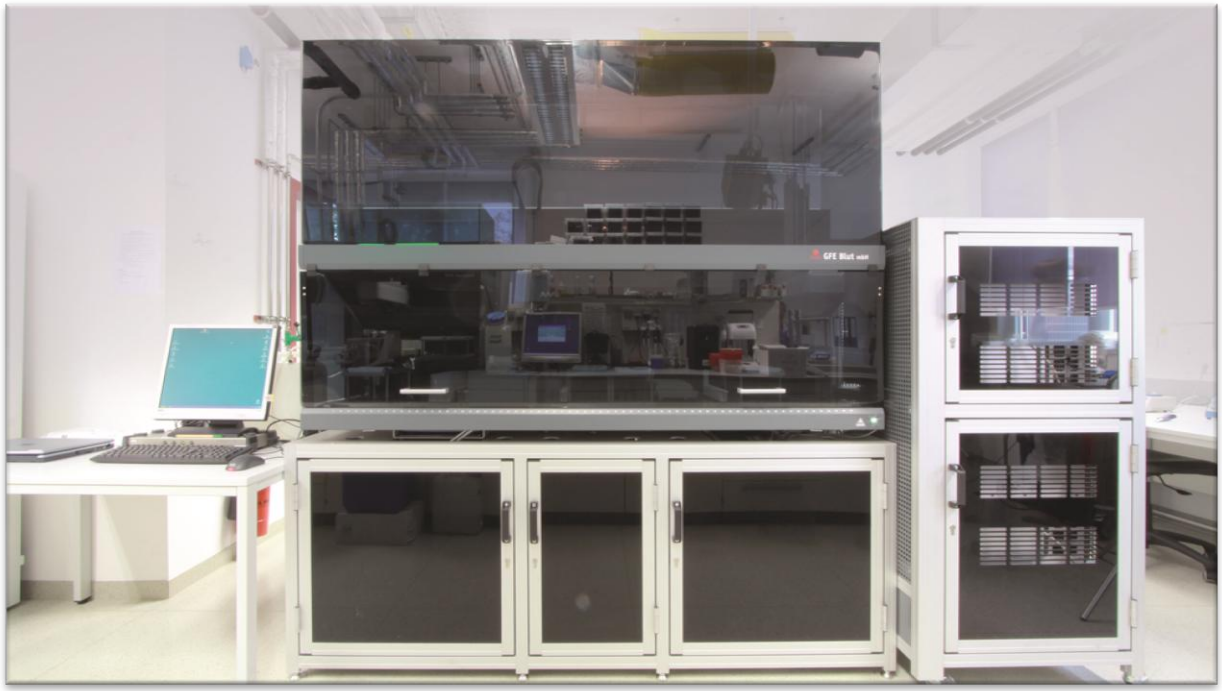
Systems on the market

- GFE Blut - autoX System



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GFE Blut: latest development

- GFE PoET System

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System requirements and specifications

- Medium to high throughput laboratories
- Fully automated workflow
- Pooling options
- Efficient extraction protocol
- State of the art RT qPCR Assay
- Intuitive multilingual software with LIMS compatibility
- Highest safety standards
- Latest liquid handling and robotics technology
- Cost efficient, versatile and extendable

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Emerging Viruses

HEV and WNV

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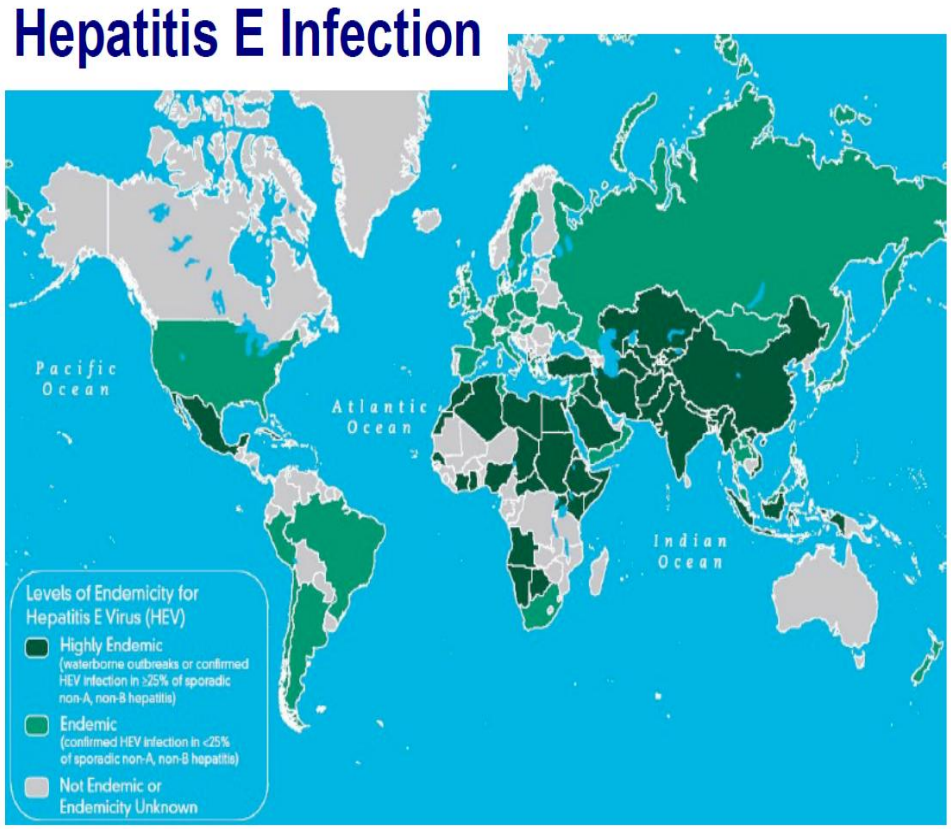
Hepatitis E Virus - world wide distribution

- Source for infection mainly contaminated drinking water and food
- Yearly 6 Mio symptomatic patients in South-East Asia



Endemic and epidemic in Southeast and Central Asia plus Japan, Middle East, North and West Africa, Mexico, Brazil

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Testing strategy - international

- There is no uniform testing strategy
- Non-defined detection limits
  - As sensitiv as possible (Grifols ID-NAT ~2 IU/ml, Roche 6 IU/ml until 2.000 IU/ml)
- Infectious dose is not exactly known
  (10^3 – 10^4 IU/ml; Dreier et al.)

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HEV Guideline in Germany

- As of January 2020 all Blood Donation Samples have to be screened for HEV
- 96er Pool testing is applicable
- Test sensitivity at least 2.000 IU/ml
- Transitional period for frozen products
- Transfusion risk shall be decreased by 80%

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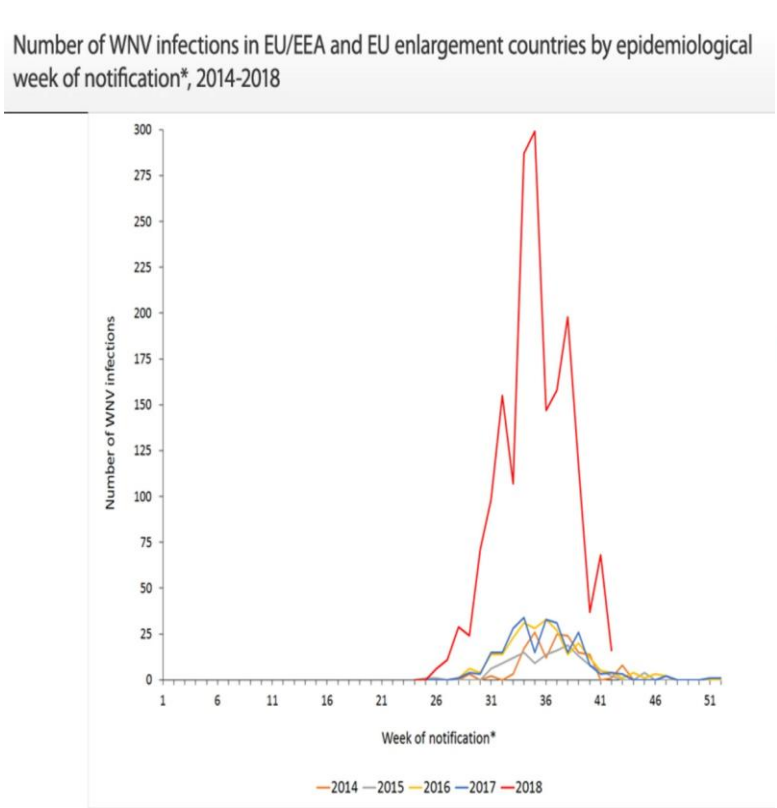
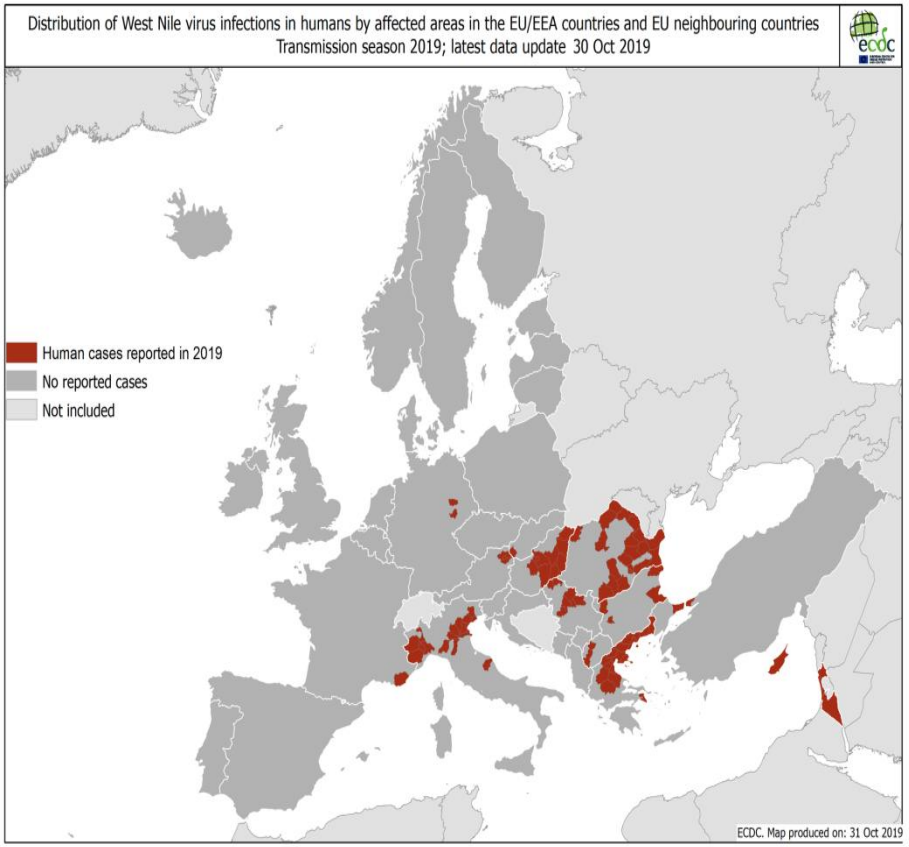
West Nile Virus WNV

- Significant increase in European distribution





Increase of the WNV distribution

- Climate changes trigger the distribution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SINGLE VIEW

PRESSEMITTEILUNG | 26.09.2019 <- Back to: Communications

ERSTE DURCH MÜCKEN ÜBERTRAGENE WEST-NIL-VIRUS-ERKRANKUNG BEIM MENSCHEN IN DEUTSCHLAND

+++ Gemeinsame Pressemitteilung von RKI, FLI und BNITM +++


THE INDEPENDENT

News > World > Europe

West Nile virus reaches Germany in 'sign of climate change'

Unusually warm summers mean mosquitos carrying deadly infection moving further north

Tim Wyatt | @tswyatt | Friday 27 September 2019 17:08 |


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GESUNDHEIT 24.10.2019 Schlagzeilen | DAX 13.162,41 | Abo

Nachrichten > Gesundheit > Diagnose & Therapie > Viren > West-Nil-Fieber: Weitere Fälle in Deutschland - Gefahr durch Mücken

Durch Mücken angesteckt

Wahrscheinlich Hunderte Infektionen mit West-Nil-Fieber in Deutschland

Erst vor Kurzem wurde bekannt, dass sich erstmals in Deutschland ein Mensch durch eine Mücke mit dem West-Nil-Fieber infiziert hat. Jetzt ist klar: Es gibt viele weitere Betroffene. Auch das Zika-Virus hat Europa erreicht.

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Implications for WNV Testing in Germany

- Considerations for routine WNV testing is still ongoing. Paul-Ehrlich Institute has recently launched a phased plan approach
  - Assay has to cover linage 1 #2 with at least 250 IU/ml (single donor)
- In summer – *the holiday season* - there is a resource limitation in Blood donation centres
- Important issues are:
  - Costs, Sensitivity, Pool-Size (96 vs 8), organization and scheduling of extra testing work …
- Common practice (according to ECD 2014/110/EU) so far:
  - Blood donation are set on hold for 28 days if donor has visited a WNV vulnerable zone. Exception: Donation is negative in an NAT single test

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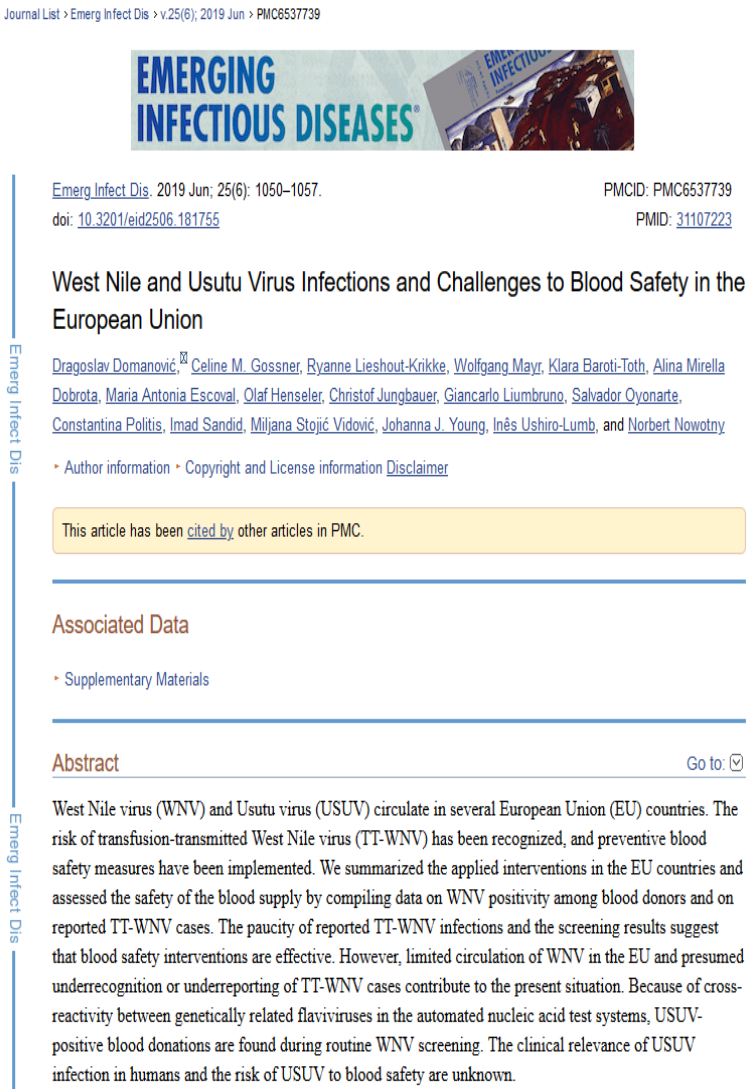
More Implications for WNV Testing

- Differentiation of Usutu Virus?
  - WNV and USUV are genetically closely related
  - Many NAT Tests cannot differentiate between Usutu and WNV infection
  - For patient cases it has been shown by sequencing that WNV infections turned out to be Usutu



Journal List > Emerg Infect Dis > v.25(6); 2019 Jun > PMC6537739

EMERGING INFECTIOUS DISEASES

Emerg Infect Dis. 2019 Jun; 25(6): 1050–1057. PMCID: PMC6537739
doi: 10.3201/eid2506.181755 PMID: 31107223

West Nile and Usutu Virus Infections and Challenges to Blood Safety in the European Union

Dragoslav Domanović, Celine M. Gossner, Ryanne Lieshout-Krikke, Wolfgang Mayr, Klara Baroti-Toth, Alina Mirella Dobrota, Maria Antonia Escoval, Olaf Henseler, Christof Jungbauer, Giancarlo Liumbruno, Salvador Oyonarte, Constantina Politis, Imad Sandid, Miljana Stojić Vidović, Johanna J. Young, Inês Ushiro-Lumb, and Norbert Nowotny

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Associated Data

Supplementary Materials

Abstract Go to:

West Nile virus (WNV) and Usutu virus (USUV) circulate in several European Union (EU) countries. The risk of transfusion-transmitted West Nile virus (TT-WNV) has been recognized, and preventive blood safety measures have been implemented. We summarized the applied interventions in the EU countries and assessed the safety of the blood supply by compiling data on WNV positivity among blood donors and on reported TT-WNV cases. The paucity of reported TT-WNV infections and the screening results suggest that blood safety interventions are effective. However, limited circulation of WNV in the EU and presumed underrecognition or underreporting of TT-WNV cases contribute to the present situation. Because of cross-reactivity between genetically related flaviviruses in the automated nucleic acid test systems, USUV-positive blood donations are found during routine WNV screening. The clinical relevance of USUV infection in humans and the risk of USUV to blood safety are unknown.

Emerg Infect Dis

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Emerging / Re-Emerging Viruses

- Cytomegalovirus
- Zika Virus
- Chikungunya Virus
- Dengue Virus

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Outlook

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Future challenges: Blood Donor NAT Screening

- Pathogens
  - Emerging and re-emerging viruses
  - New pathogen variants (e.h. HIV-1 Subtype L)
  - Bacteria
  - Parasites (Malaria, Chagas, Babesiosis, etc.)
- Product requirements
  - High through-put walk away automation and reagent management
  - High sensitivity and short time to result
  - Low costs, work load, complexity
- Implementation of new technologies
  - Fast, cost efficient and sensitive

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Thank you very much for your attention

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