



Bacterial Screening of NHSBT Platelet Components

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Overview

- **Impact of bacterial transmission**
 - **Why PCs are the greatest risk**
 - **NHSBT Strategy**
 - **Impact diversion and improved donor arm disinfection**
 - **NHSBT protocol Bacterial Screening**
 - **NHSBT results Bacterial Screening**
 - **Added value Bacterial Screening**
 - **Future development**
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Bacterial Mortality Worldwide

USA	2005-2015	38 deaths	(FDA)
France	1994-2015	36 deaths	(Haemovigilance)
Germany	1997-2014	14 deaths	(Haemovigilance)
U.K.	1994	3 deaths	(Pre-SHOT)
U.K.	1996-2016	11 deaths	(SHOT)


Platelet Components Are The Greatest Risk!

- **USA: (FDA) 2005 – 2015 platelet components comprised 87% (33/38) bacterial fatalities**
 - **UK: (SHOT) 1996 – 2016 platelet components comprised 84% (37/44) cases**
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Klebsiella oxytoca



NHSBT Strategy

- **Improved donor arm disinfection**
 - **Diversion**
 - **Bacterial Screening**
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Interventions Introduced


- **Improved Donor Arm Disinfection – implemented nationally 2007**
- **Diversion – implemented nationally 2003**
- **In combination 77% reduction in contamination**

McDonald, C.P. *et al.*, Relative Values of the Interventions of Diversion and Improved Donor-Arm

Disinfection to Reduce the Bacterial Risk from Blood Transfusion: *Vox Sanguinis* (2004), 86:178-182




Post Implementation Improved Donor Arm Disinfection and Diversion (2006 – 2010)

- 7 contamination incidents in PC
 - 10 patients affected
 - 3 deaths
 - 5 near misses
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NHSBT Bacterial Screening

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Bacterial Screening of Platelet Components in NHSBT

- **NHSBT Board Meeting in January 2010**
 - **Decision was made to implement bacterial screening within 12 months**
 - **February 2011 rolled out**
 - **July 2011 all components screened**
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BacT/ALERT System



Bacterial Screening Laboratory



Bacterial Screening Laboratory




Bacterial Screening Laboratory



NHSBT Test Protocol

(1 test, Extension Shelf Life to 7 Days)

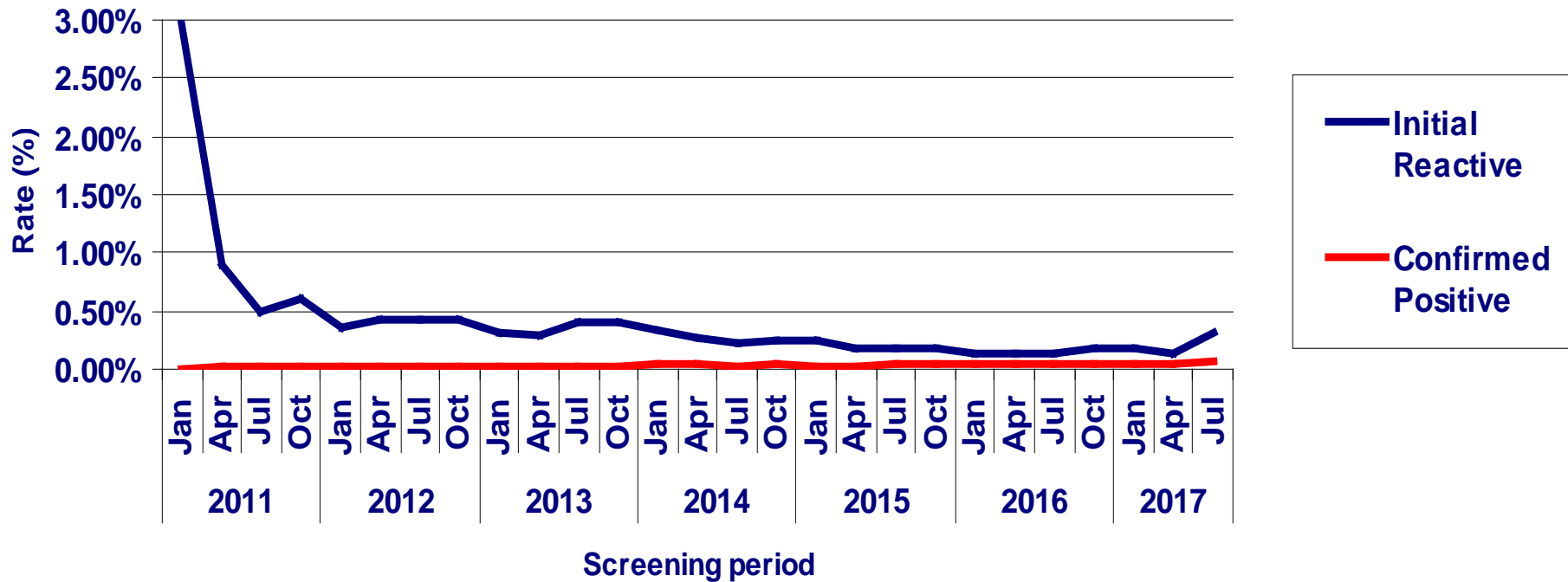
- 1. Platelet components held for \geq 36hrs – 48hrs after collection**
 - 2. Platelet components sampled and tested**
 - 3. Held for 6hrs**
 - 4. Released with a 7 day shelf life**
 - 5. Monitored for the component shelf life**
 - 6. Positives recalled**
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What Happened?

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Quarterly Bacterial Screening Rates (February 2011 - Sept 2017)



Initial Reactive and Confirmed Positive Rates (Cumulative Feb 2011 – Sept 2017)

	Number	Initial Reactive Rate	Confirmed Positive Rate
Apheresis*	1,285,959	0.33%	0.02%
Pooled*	530,804	0.25%	0.07%
Total	1,816,763	0.31%	0.04%

*Apheresis platelets screened from Feb 2011

*Pooled platelets screened from May 2011

Initial Screen: Bottle Reactivity


(February 2011 – Sept 2017)

Bottle Type	Initial Reactive	False Positive
Anaerobic	73.8%	77.9%
Aerobic	21.3%	21.7%
Both	4.8%	0.4%

Confirmed Positives - Bottle Type (February 2011 – Sept 2017)

- Anaerobic bottle 65%
 - Aerobic bottle 7%
 - Both bottles 28%
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Confirmed Positives (February 2011 – Sept 2017)

- 666 confirmed
 - 640 Gram positives
 - 26 Gram negatives
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Confirmed Organisms (February 2011 – Sept 2017)

Gram Positives (n=640):

Propionibacterium spp. = 346
Staphylococcus spp. = 163
Streptococcus spp. = 105
Gemella spp. = 6
Listeria monocytogenes = 4
Corynebacterium spp. = 3
Enterococcus spp = 3
Lactobacillus casei = 2
Bacillus cereus = 2
Granulicatella adaciens = 2
Lactococcus lactis = 1
Peptostreptococcus micros = 1
Finnegoldia magna = 1
Misc. Gram Positive bacilli = 1

Gram Negatives (n=26):

Escherichia coli = 9
Serratia marcescens = 5
Klebsiella spp. = 5
Enterobacter spp = 2
Pseudomonas aeruginosa = 1
Haemophilus aphrophilus = 1
Bacteroides vulgatus = 1
Proteus mirabilis = 1
Campylobacter lari = 1

Confirmed Positive Gram Positive 'Pathogenic' Organisms (Feb 2011 – Sept 2017)

Organisms	n	Detection Time Range (hours)	Total Contaminated Components
<i>Streptococcus dysgalactiae</i> (Group G/C)	24	2-19	32
<i>Staphylococcus aureus</i>	17	2-21	21
<i>Streptococcus pneumoniae</i>	12	10-13	16
<i>Streptococcus agalactiae</i> (Group B)	6	6-16	5
<i>Listeria monocytogenes</i>	4	14-20	5
<i>Bacillus cereus</i>	2	11-14	2

Total cases with pathogenic organisms: 65
Total number of contaminated components: 81

Confirmed Positive Gram Negative 'Pathogenic' Organisms (Feb 2011- Sept 2017)

Organisms	n	Detection Time Range (hours)	Total Contaminated Components
<i>Escherichia coli</i>	9	3-14	19
<i>Serratia marcescens</i>	5	3-13	8
<i>Klebsiella oxytoca</i>	3	3-10	4
<i>Klebsiella pneumoniae</i>	2	4-11	3
<i>Proteus mirabilis</i>	1	14	1
<i>Pseudomonas aeruginosa</i>	1	15	1
<i>Campylobacter lari</i>	1	32	1

Total cases with pathogenic organisms: 22
Total number of contaminated components: 37

Number of Splits Contaminated in Confirmed Positive Apheresis Donations (Feb 2011 – Sept 2017)


		Total number of splits positive per investigation		
Splits per donation	1	2	3	
2	47.9% (69)	52.1% (75)	N/A	
3	50% (16)	18.8% (6)	31.2% (10)	

NB: when all components returned for confirmatory/reference testing


Near Misses and Transmissions

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Transmissions and Near Misses

- 1 transmission: 1 x *Staphylococcus aureus*
 - 4 near misses: 3 x *S. aureus*
1 x *Serratia marcescens*
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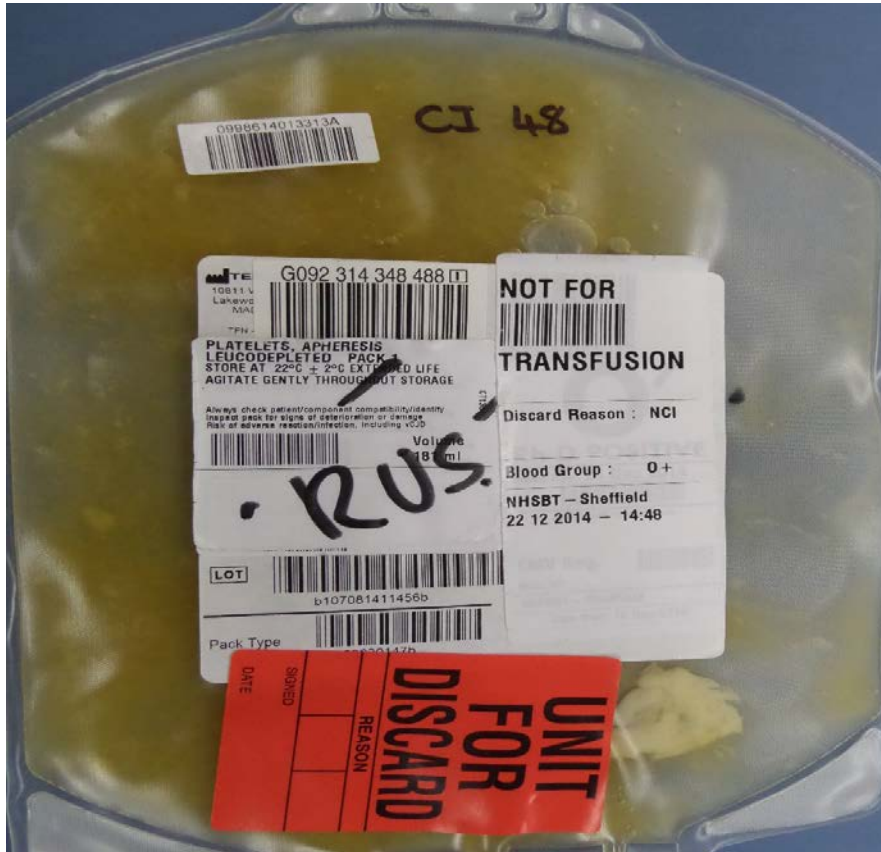
Near Miss 1: 2013

- Apheresis platelet donation (2 splits)
 - Large clumps reported in pack 2 by Hospital A
 - Pack 1 issued to Hospital B but not transfused. No clumps present
 - Both units received by NBL
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Near Miss 1: 2013 (cont'd)

- No clumps visible in pack 2, but were present in pack 1
 - BacT/ALERT cultures for both units positive in 3.8hr
 - *Staphylococcus aureus* isolated
 - Investigation of donor found *S. aureus* colonisation
 - Strain typing of PC and donor isolates were indistinguishable
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Near Miss 3



BacT/ALERT Culture Bottles



Near Miss 4: 2015

- **Apheresis unit – 2 splits**
 - **Clumps observed in split 1 by SHU**
 - **Packs and BacT/ALERT screening bottles sent to NBL**
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Near Miss4: 2015


Pack 1



Pack 2



Near Miss 4: 2015 (cont'd)

- Gram from pack 1 – Gram negative rods
 - Gram from pack 2 – negative
 - Clotted pack 1 – positive on BacT/ALERT 3.7h
 - Unclogged pack 2 – negative on BacT/ALERT
 - *S. marcescens* identified from pack 1
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Near Miss 4: 2015




Inoculated

Uninoculated

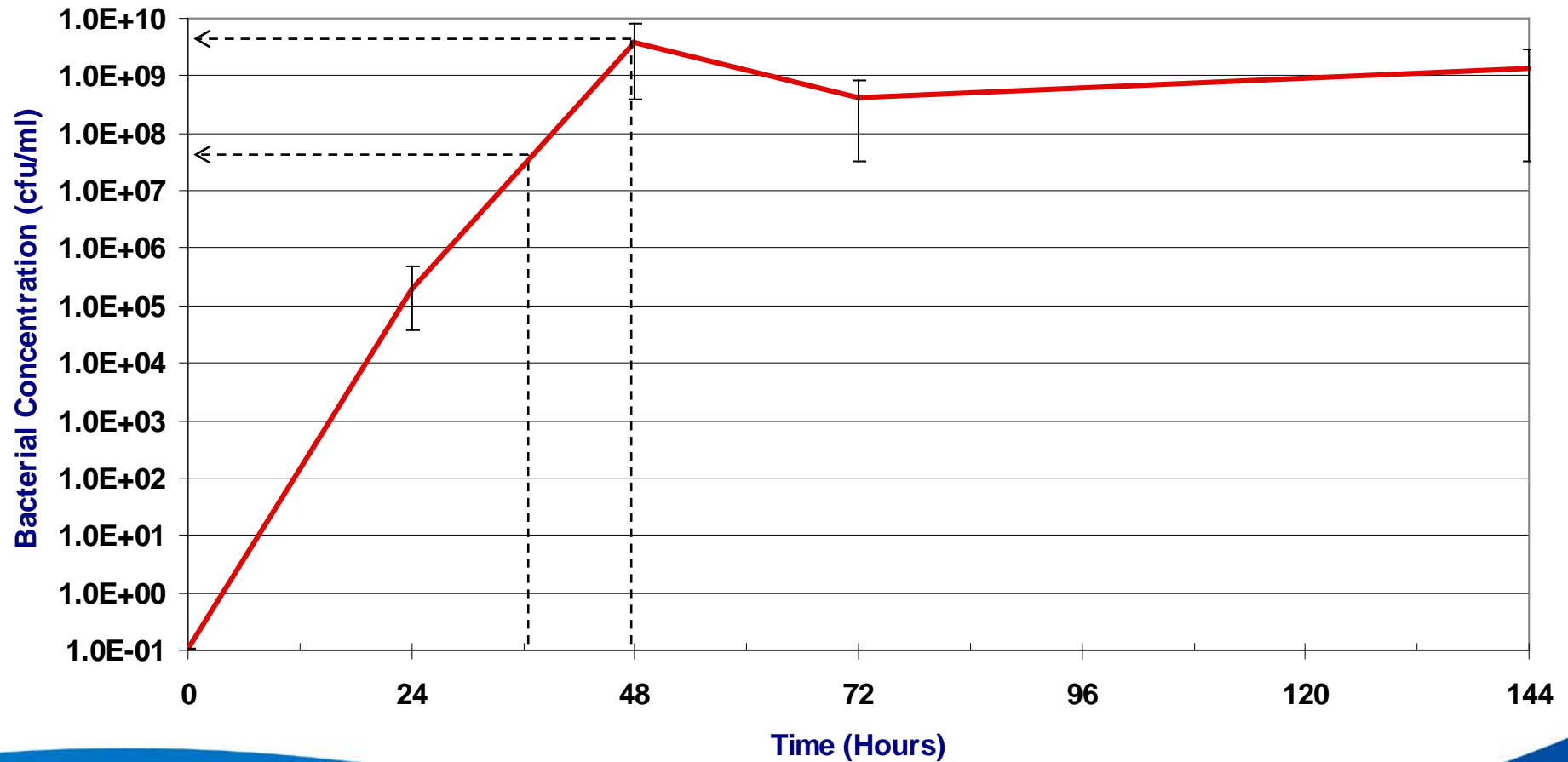
Near Miss 4: 2015 (cont'd)

- **BacT/ALERT bottles – Gram stain negative (both packs)**
 - **BacT/ALERT bottles subcultured into new bottles – negative**
 - **Screening bottles inoculated *S. marcescens* – positive**
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Near Miss 4: Conclusion

- **Not a BacT/ALERT failure**
 - **Insufficient bacteria at sampling time?**
 - **Contamination post screening?**
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Growth Kinetics of *S. marcescens* in Platelets Suspended in Plasma



Confirmed Transfusion-Transmitted Infection (TTI) 2015


- Pooled platelet unit transfused into AML patient
- After 15 mins, the patient became agitated and suffered rigors, tachycardia and pyrexia
 - Temperature rose to 38.7°C, then 40°C overnight
- Patient cultures grew *Staphylococcus aureus*

Confirmed TTI: 2015 (cont'd)

- Platelet unit received by NBL
- Unit was leaking through open port, sealed with a capped needle
- Remaining contents (~3ml) appeared 'cloudy'
- Gram stain showed heavy contamination with GPC
- BacT/ALERT cultures positive in 3.8h



Confirmed TTI: 2015 (cont'd)

- *S. aureus* isolated, strain type matched the patient isolate
 - All 4 associated red cells units were cultured by NBL and remained negative after 7 days incubation
 - 2/4 Donors investigated – both had *S. aureus* in multiple sites
 - Strain typing of 1st donor isolates showed a distinct strain (no match)
 - Strain typing of 2nd donor showed closely-related Spa type and matching DNA fingerprint
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Bacterial Screening: Added Value



Donor Healthcare Benefits

Bacterial Screening


- ***Streptococcus bovis* (n=4):** donor's colonic polyps
- ***Streptococcus constellatus* (n=3) and *P. micros*:** dental

McDonald, C. *et.al.*, *Transfusion*, 2013,53:2117-2119

Lee, CK. *et.al.*, *Transfusion*, 2013,53:2205-2208



Bacterial Screening Provides Insight into Possible Source of Contamination

- **Pseudomonas spp. – poor hygiene facilities**
 - **Staphylococcus spp. – inadequate donor arm disinfection**
- 


Future




BacT/ALERT Virtu




Virtuo Advantages

- **Superior performance to BacT/Alert 3D**
 - **Faster detection times**
 - **Potentially lower false positive rates**
 - **Automated loading and unloading**
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NHSBT Screening (February 2011 to March 2017)


- 1 transmission in >1.8million PC screened (*S.aureus*)
 - 4 near misses (3 *S. aureus* and *S. marcescens*)
 - False negative rate 1 in 360,000 (0.0003%)
 - 1 CP in 6015 TE platelets screened (*S. pneumoniae*)
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Success NHSBT Bacterial Screening

- **Delayed sampling**
 - **High volume tested (5-7%)**
 - **Screening of apheresis splits**
 - **Use of a two bottle system**
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Conclusion

**Bacterial Screening
within NHSBT has
proven to be extremely
successful risk
reduction intervention!**



Bacterial Screening of Platelet Components by National Health Service Blood and Transplant, an Effective Risk Reduction Measure

C. McDonald, J. Allen, *et al.*,

Transfusion 2017;57;1122-1131



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THANK YOU

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