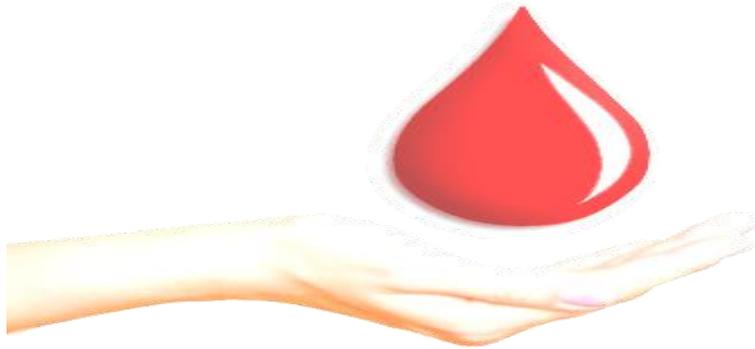


Reducing Phlebotomy Blood Loss In ICU

Less **i**s More



Aine McCartney
Manager of the Haemovigilance Team

My Objectives today

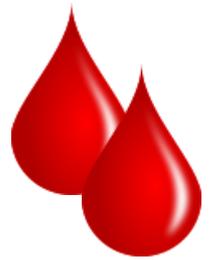
1. Share my thoughts on 'Haemovigilance – its different dimensions' regarding PBM

2. Show you the BHSCT Phlebotomy volume reduction in ICU project

If not being done in your hospital already -

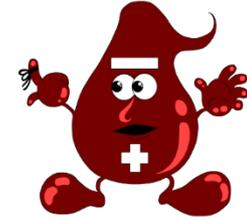
3. Get you interested in doing this or encouraging those in your hospital to do -

Background ...



- ***Phlebotomy-related blood loss may lead to iatrogenic anemia, slower recovery, increased length of stay and blood transfusion in ICU patients*** (Corwin et al. 2004; McEvoy et al. 2013).
- NATA 2016 Dublin: included as points in many presentations
- Personal family experience

Background...



- Samples taken on average per patient in ICU/day



Patrick Meybohm, Frankfurt, BBTS 2016

Phlebotomy on ICU (1 day)



Phlebotomy-related blood loss may lead to iatrogenic anemia, slower recovery, increased length of stay and blood transfusion in ICU patients(Corwin et al. 2004; McEvoy et al. 2013).

Current Opinion in Anaesthesiology 2008, 21:657-663

EDITORIAL COMMENT

Our own blood is still the best thing to have in our veins

Tim Frenzel, Hugo Van Aken and Martin Westphal

Patient Blood is more Important Than Donor Blood

James Isbister, Clinical Hematologist, 2014

Patient Blood Management (PBM)

Is it part of the current NI Haemovigilance Practitioner role?

YES

- Appropriate use of blood
- Single unit transfusion
- Patient information and consent
- Cell Salvage
- Promote alternatives to transfusion

NO

- Near patient testing for anaemia and coagulation
- Pre-op anaemia
- Anaemia in medicine and obstetrics
- Oral iron review
- IV iron strategies
- Tranexamic Acid Use
- New technologies to support PBM
- Reducing phlebotomy loss

NI Haemovigilance Co-Ordinator Role

- Within Job Description 2014

“Contribute to the development and implementation of a regional patient blood management plan.”

SQB: Safety Quality Belfast

Trust Quality Improvement Strategy

Institute for Healthcare Improvement (IHI)

- Cohort 2 2016 – 150 multi-discipline staff
- Start September
- E-learning and monthly sessions
- **Project/poster required for completion in June 2017**
- 3 in our group - not nursing or medical
- QI Mentor

Initially our project goal was to reduce volume of sampling by introducing smaller sample bottles in ICU.

Regional ICU in Royal Victoria Hospital

27 beds (19 Main ICU, 8 HDU)

1300 admissions a year

17 Consultants

220 nursing staff





We approached clinical team in RICU to ask if they would support our '*less is more – reduced blood sampling*' improvement project.

Multi - Disciplinary Project team established



Nurse Development Lead, Nurse Educator, Critical Care Technicians, Nurses including managers, Consultant in charge along with SQB project team



PDSA 1:

Develop Staff Questionnaire of current phlebotomy practices.

Questionnaire circulated over 2week period. (N=44)

The image shows two versions of a questionnaire form. The left form is titled "Improvement in Blood Sampling Volume's (BSV) Project - HCU Staff Pre-Engagement Questionnaire" and includes sections for "Please indicate your clinical role", "How do you know what blood tests to take?", and "What blood tests (including ABG and Blood Culture) do you take for?". The right form is titled "Staff Questionnaire" and includes sections for "How much flush volume do you usually use off the blood line including ABG?", "What and how often do you use ABG samples?", "How much blood would you take from ABG samples (not including flush volume)", "What tests do you take additional bloods for?", and "Do you feel the flush blood is generally taken for the sample wasted?".

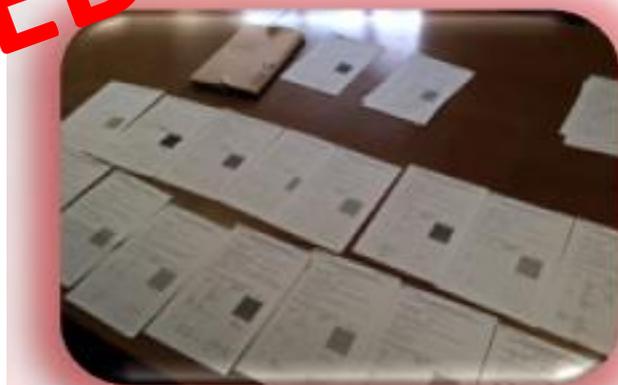
PDSA 2:

Observation of :
Flush Volume & ABGA Volume
(N=8)

Analysis of data highlighted:

- ABGA was the most frequent blood test.
- Variation in pre-sample waste Volume & ABGA Sample Volume.

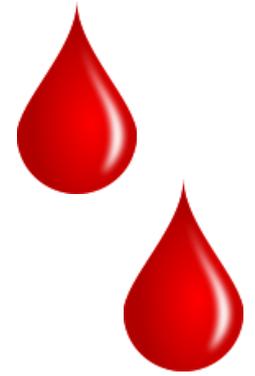
AIM OF PROJECT REDEFINED:



New Aim for SQB project

To reduce volume of Arterial Blood Gas Analysis (ABGA) by 30% in RICU & remove variation by June 2017.

What We Found in ABGA Sampling:



Variation:

- In practice across BHSCT ICU Sites
- In pre-sample waste Volume
- In ABGA Sample Volume

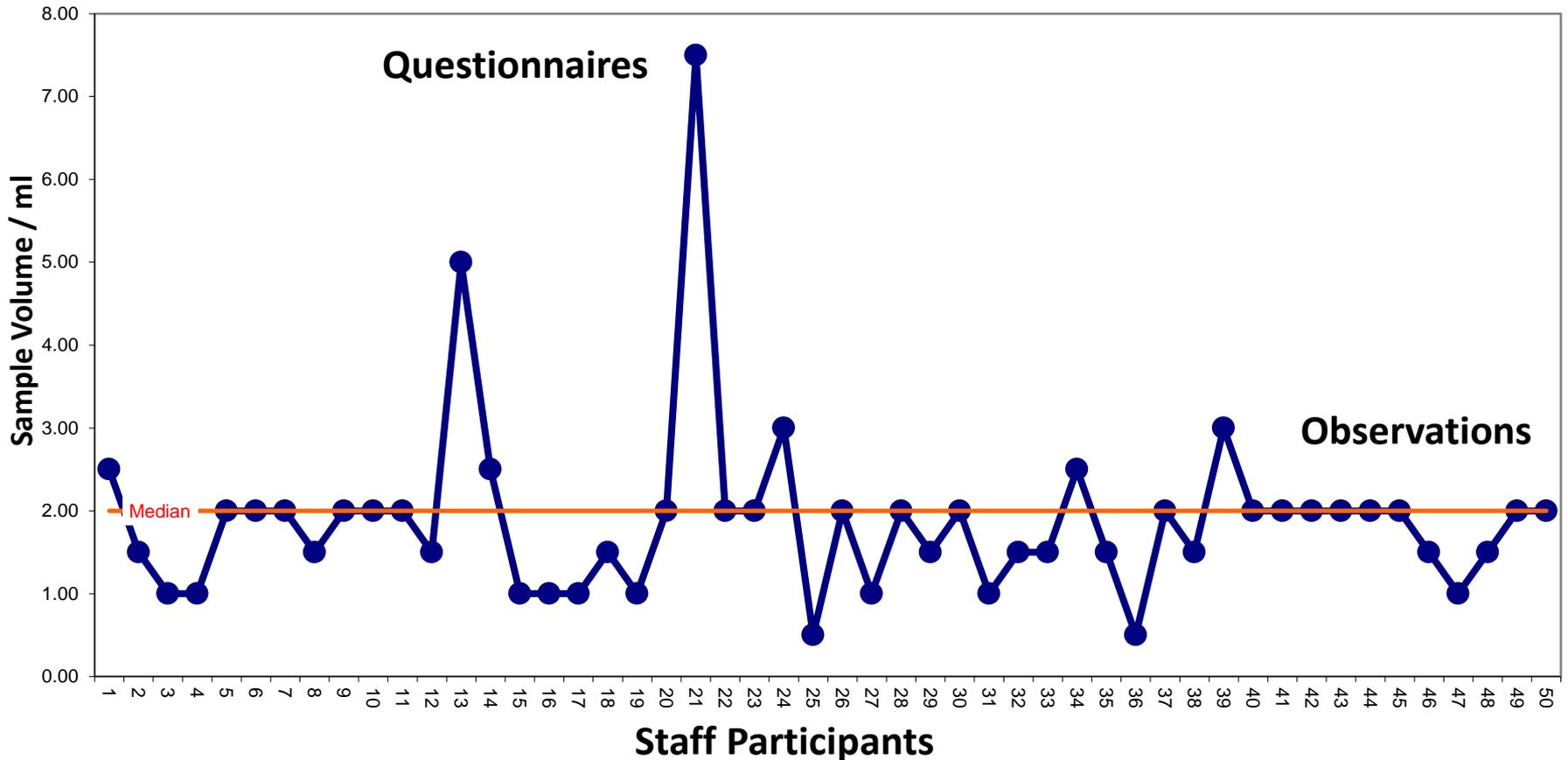
Waste:

- Staff Time
- Unnecessary use of Heparin
- Repeat Samples

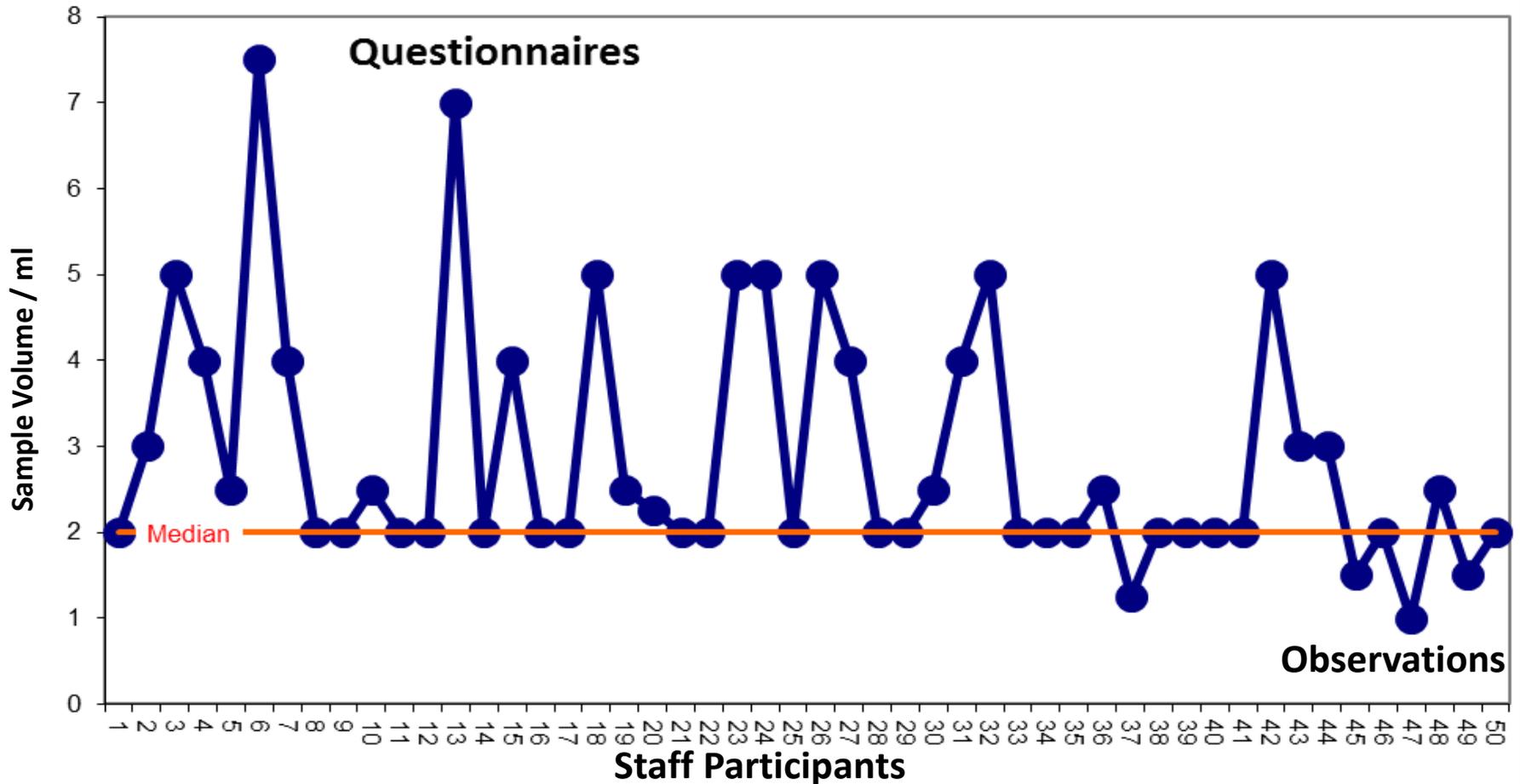
Risk:

- No Standardised ABGA Protocol in RICU
- Potential Infection Control (needle stick injury)
- Unreliable Results

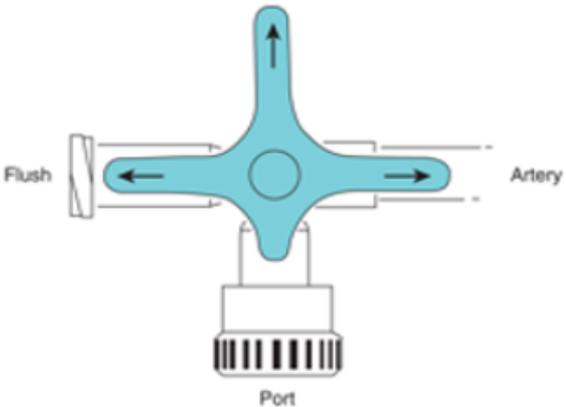
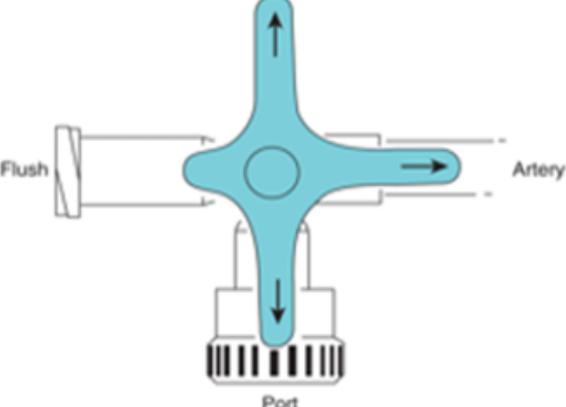
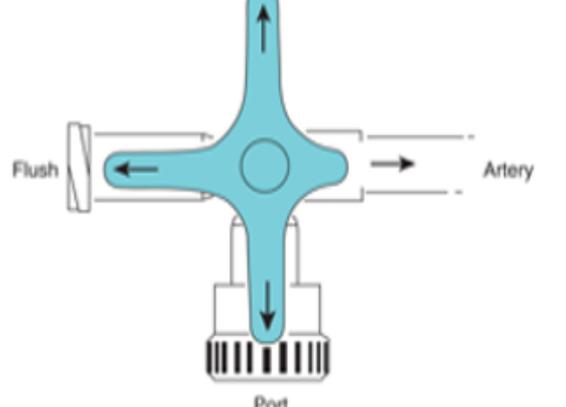
Average Volume of ABGA Blood Sample



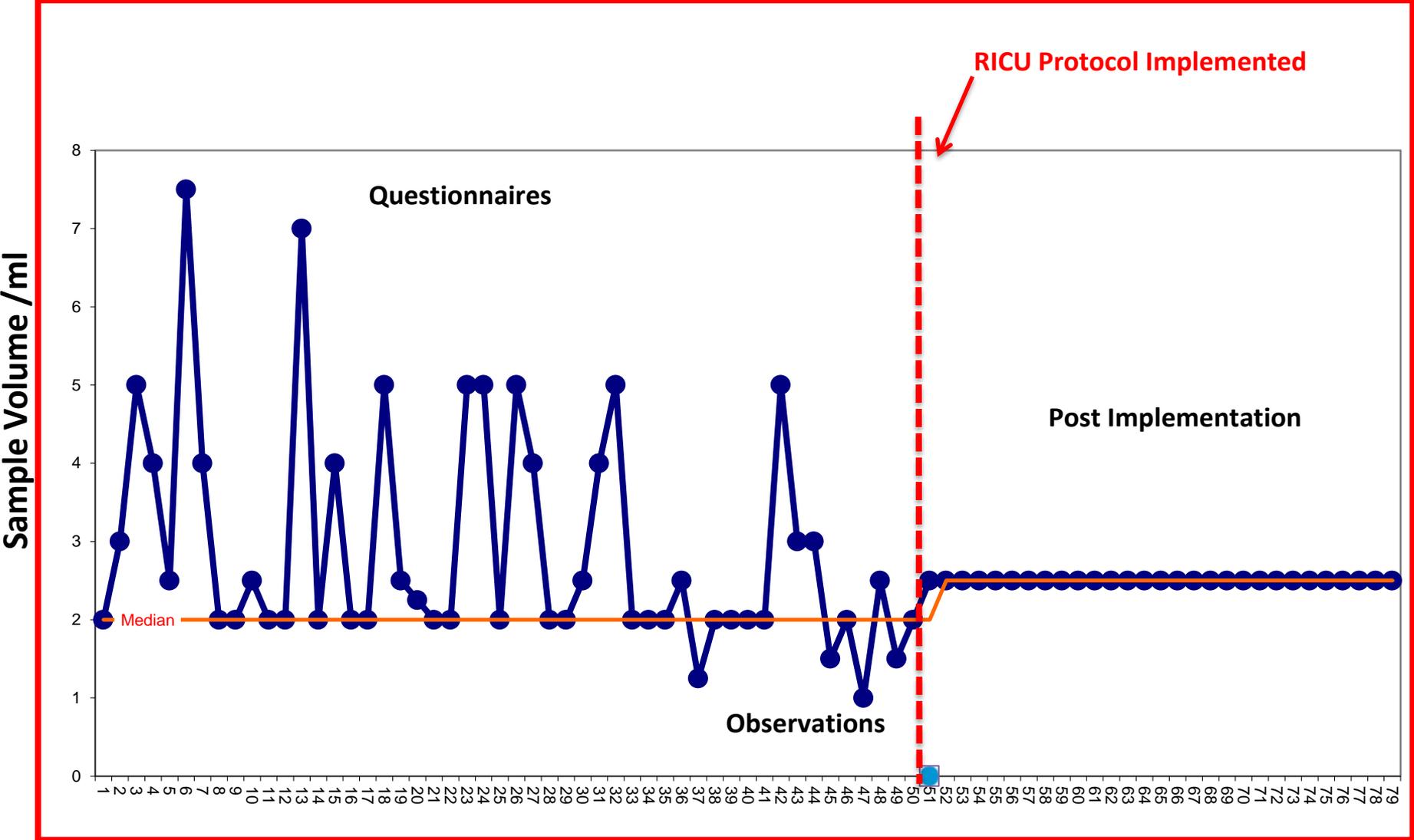
Average Volume of Pre-Sample Waste Solution



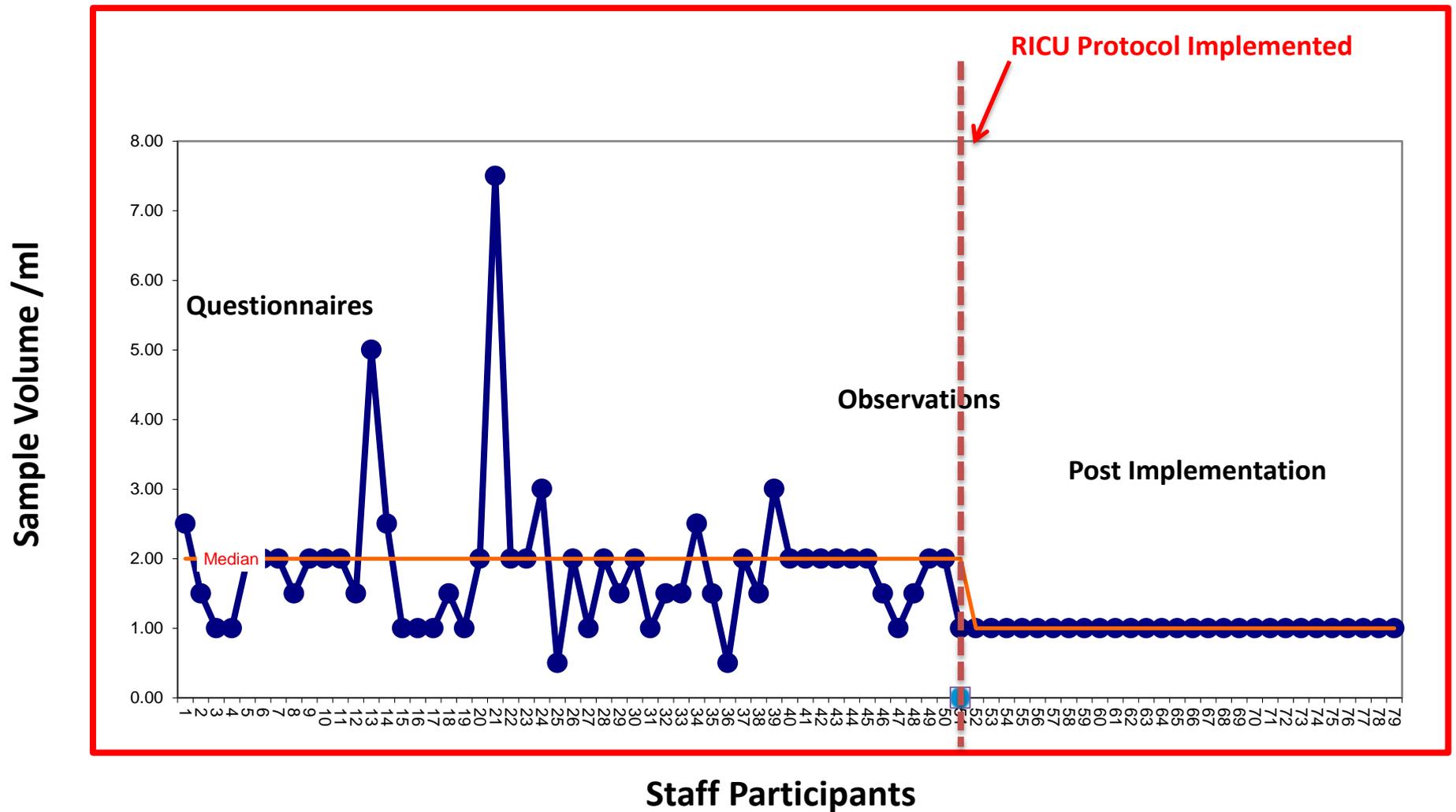
Standard Operating Procedure - Sampling blood from arterial line

Fig.1	Fig.2	Fig.3
		
<ol style="list-style-type: none"> 1. Explain procedure to patient Prepare blue tray to ensure all equipment available. 2. Press silence button on monitor for duration of sampling. Check that three-way tap (Fig. 1) is closed to port. 3. Decontaminate hands with bactericidal alcohol hand rub and apply gloves. 4. Remove cap from three-way tap and clean open port with chlorhexidine 2% in 70% isopropyl swab (Fig 1). 5. Allow to dry. 	<ol style="list-style-type: none"> 6. Connect 2ml syringe to open port. 7. Turn three-way tap to artery and port thus off to infusion. 8. Slowly withdraw 2.5ml of pre-sample dead space fluid (Fig. 2) to achieve a whole blood sample. 9. Close port. 10. Expel air before taking sample (to prevent air in sample) 11. Connect blood gas 1ml Dry Heparin syringe. 12. Turn three-way tap to artery and port (Fig. 2) i.e. thus off to infusion. Slowly remove approximately 0.5mls of blood. 13. Remove syringe and replace cap. 	<ol style="list-style-type: none"> 14. Turn three-way tap to infusion and port (Fig. 3). Flush onto sterile gauze by pulling actuator (see instructions with set). 15. Turn three-way tap to infusion and artery (Fig. 1). 16. Flush cannula gently by pulling actuator. As cannula is flushed observe digits for signs of blanching, discoloration or complaints of pain from the patient. 17. Clean port with chlorhexidine 2% in 70% isopropyl alcohol swab and apply new sterile Luer-Lock non injectable cap and check it is secure. 18. Check pressure cuff inflated to 300 mmHg. 19. Analyse sample as soon as practicable 20. Transport sample in blue tray

Average Volume of Pre-sample Waste Solution

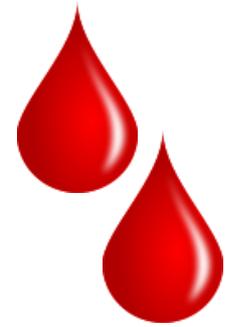


Average Volume of ABGA Blood Sample



Results

The amount of blood loss due to ABGA in 44 patients was reduced by 48% in May 2017.



Total Volume (44) Pre Implementation	Total Volume (44) Post Implementation
84.5mls Mean 1.92ml	44mls Mean 1.0ml
Reduction ABGA sample volume 47.92%	

SQB Submission Poster



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caring supporting improving together

Reduce Blood Loss

Less is More





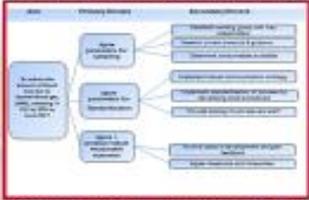
safety & quality

Background:
Studies highlighted prebatory blood loss in intensive care patients leads to diagnostic anaemia resulting in slower recovery, increased length of stay and more transfusions. We wanted to investigate if and how we could address this in intensive Care RCU.

What we did:

- Established a multi disciplinary team October 2016
- Investigated blood test data and analysed the findings which showed gaps to be made with Arterial Blood Gas Analysis (ABGA) sampling
- Examined ABGA protocol within BHCT
- Designed & circulated a questionnaire. The target set was aim on blood gas sampling

Aim:
To reduce the amount of blood loss due to Arterial-Blood Gas Analysis (ABGA), sampling in RCU by 35% by June 2017.





Questionnaire

What we found in blood gas sampling:

Variation:

- In practice across BHCT sites
- In flush volume
- In ABGA sample volume

Waste:

- Staff time
- Unnecessary use of heparin
- Repeat samples

Risk:

- No standardised ABGA protocol in RCU
- Potential infection control



Analyzing the questionnaire data

Outcomes:

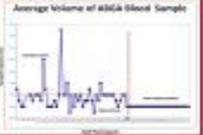
- Sourced suitable 1ml pre-heparinised syringes suitable for ABGA sampling
- Determined minimum flush volume required
- Identified a draft CCaNI protocol with fixed maximum volume for ABGA sampling
- Developed RCU protocol in line with the CCaNI draft
- Standardisation across BHCT ICU Sites

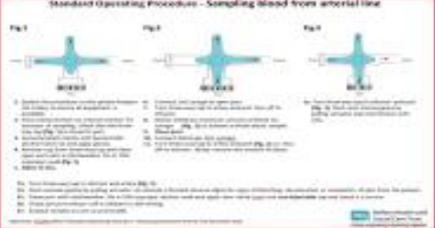
Results:
The amount of blood loss due to Arterial-Blood-gas (ABGA), sampling in RCU was reduced by 48% May 2017.

Mean total volume (ml) Pre implementation	Mean total volume (ml) Post implementation
84.0mls	44mls

Reduction ABGA sample volume 47.62%

Feedback:
Positive feedback from users throughout – Supportive of the new process.



Standard Operating Procedure – Sampling blood from arterial line

Conclusion & The Future:
Standardisation of other blood testing protocols regarding specific volume and frequency. Use of small volume sample bottles or alternative methodologies (Haemoglobinometers). Reduction of any unnecessary sampling. Use of Order Commas could result in a marked further reduction in intensive care blood loss, which can be extended to all clinical areas within the Belfast Trust.



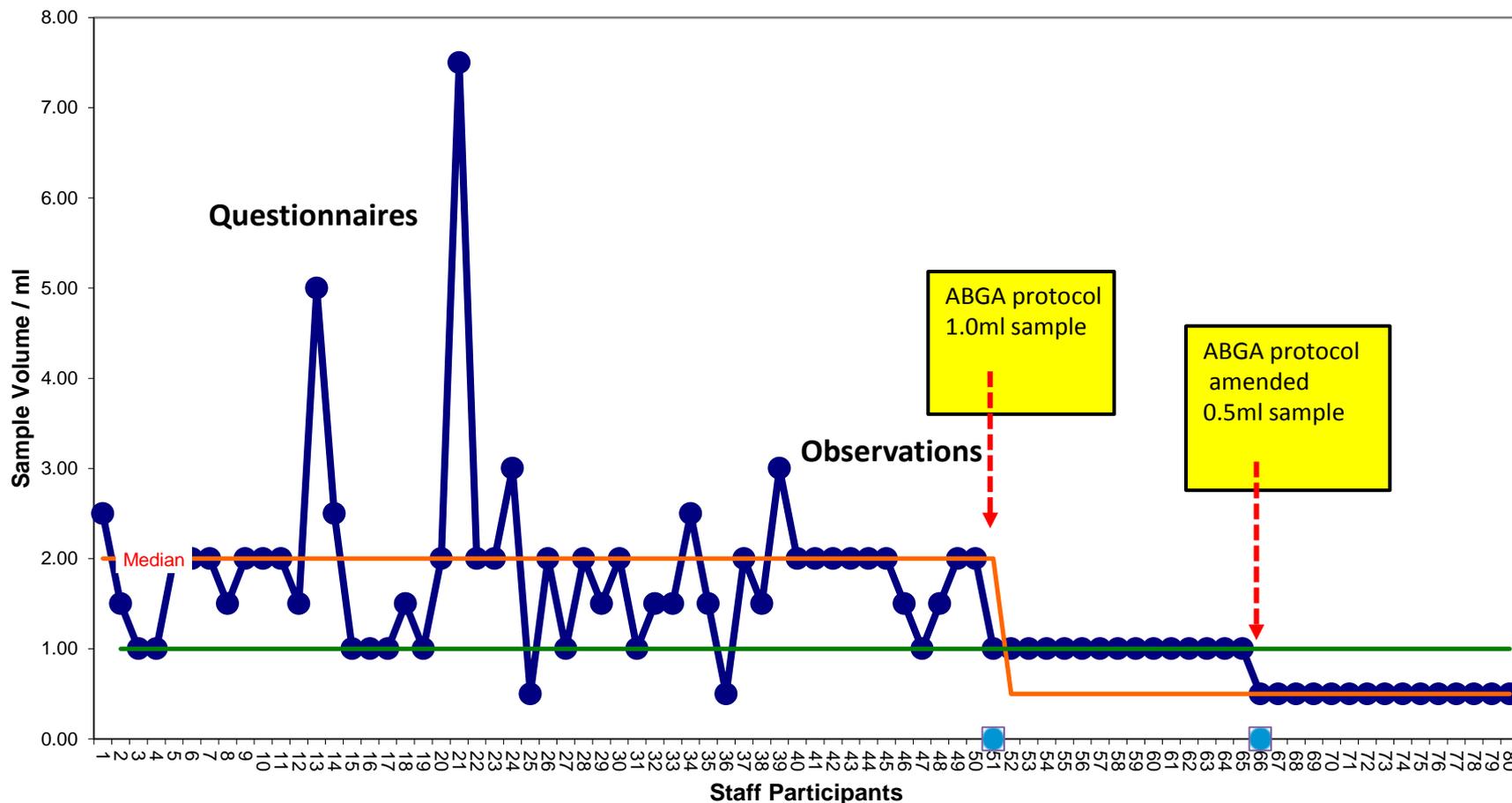
Belfast Health and Social Care Trust
caring supporting improving together

The SQB Team:
Aine McCartney, Deirdre Donaghy, Geraldine Turner, Digs O'Neill (SQB Blanton)

Extended Project Team:
Una Bludger, Gemma Craven, Victoria Widdie, Terry Coogan and Paul Caddell

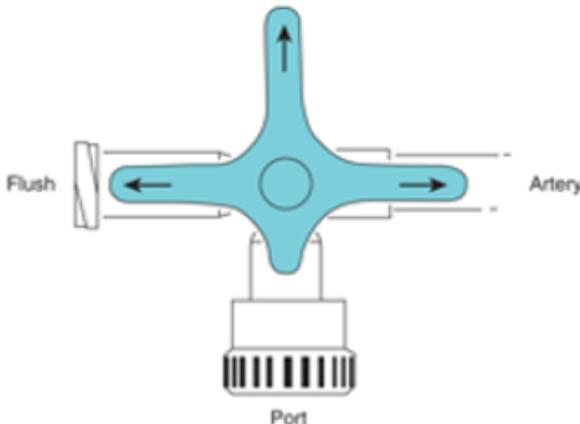
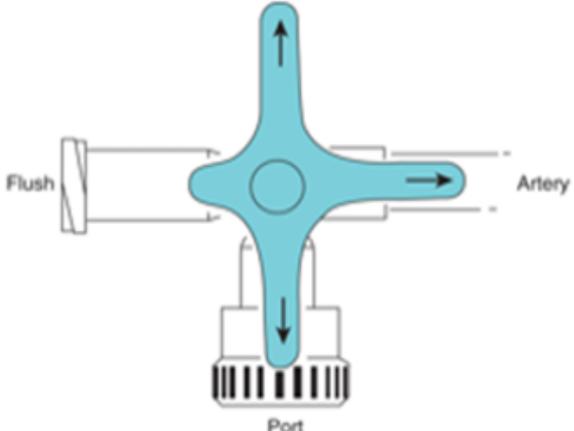
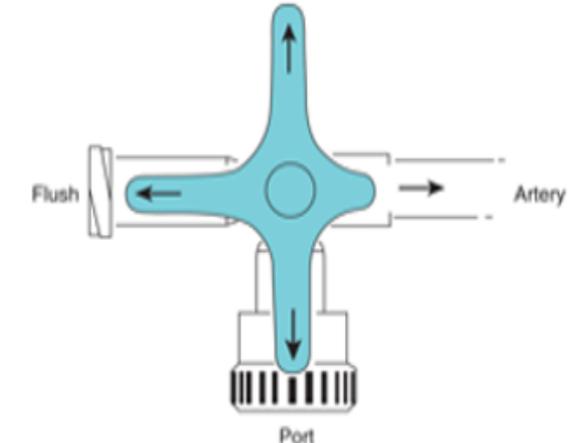


After SQB submission



Average 6.1 ABG samples/ patient/ day in RICU

Standard Operating Procedure - Sampling blood from arterial line

Fig.1	Fig.2	Fig.3
		
<ol style="list-style-type: none"> 1. Explain procedure to patient. Prepare blue tray to ensure all equipment available. 2. Press silence button on monitor for duration of sampling. Check that three-way tap (Fig. 1) is closed to port. 3. Decontaminate hands with bactericidal alcohol hand rub and apply gloves. 4. Remove cap from three-way tap and clean open port with chlorhexidine 2% in 70% isopropyl swab (Fig 1). 5. Allow to dry. <div style="border: 2px solid red; padding: 5px; margin-top: 10px;"> <p>*In event of uncertainty over sample accuracy:</p> <ul style="list-style-type: none"> • Repeat sample • If ongoing query – immediately check repeat sample on second analyser (if available) • If ongoing query - send specimen to lab <p>** Consider impact of line position/patency</p> </div>	<ol style="list-style-type: none"> 6. Connect standard 2ml syringe to open port. 7. Turn three-way tap to artery and port; thus off to infusion. 8. Withdraw 2.5ml of pre-sample dead space fluid (Fig. 2) to achieve whole blood sample. 9. Close port. 10. Expel air from 1ml Dry Heparin syringe before taking blood gas sample 11. Connect 1ml Dry Heparin syringe. 12. Turn three-way tap to artery and port (Fig. 2); thus off to infusion. 13. *Pull plunger gently- to prevent excess pressure/shearing of cell wall/haemolysis 14. Draw-off approximately 0.5ml of blood. 15. Remove syringe. Cover with bung from pack. 16. Replace cap on three-way tap port. 	<ol style="list-style-type: none"> 17. Turn three-way tap to infusion and port (Fig.3) 18. Flush onto sterile gauze by pulling actuator 19. Turn three-way tap to infusion and artery (Fig. 1) 20. Flush cannula gently by pulling actuator. As cannula is flushed observe digits for signs of blanching, discoloration or complaints of pain. 21. Clean port with chlorhexidine 2% in 70% isopropyl alcohol swab. 22. Apply new sterile Luer-Lock non-injectable cap. Check cap is secure. 23. Check pressure cuff inflated to 300 mmHg. 24. *To ensure thorough mix of blood/heparin - hold syringe in hand and rotate wrist back and forth for 20-30 seconds. 25. Analyse sample as soon as practicable 26. Transport sample to analyser in blue tray

Reduce Blood Loss

Less *i* More



*The BHSCT Phlebotomy blood loss
project continued....*

Back to our original aim

Sourcing smaller volume tubes

- ? Paediatric sample bottles
- ? Narrow bore sample bottles
- ? False bottom sample bottles

Spoke to one of suppliers

Feedback from own Haemovigilance staff

Looked under my nose!

How much blood is actually needed

SAMPLE TUBES AVAILABILITY NORTHERN IRELAND						
13 x 75 mm	Current use adult samples	BD sample	Sarstedt	Griener	Lab comment	Additional info
		13 x 75 mm	13 x 75 mm	13 x 75 mm		Sarsted tubes can be used for vacuette and/or draw
EDTA	4ml	2 4	2.7	1 2 3 4	Can use 2 easily for FBC but not if ESR included	
COAG	2.7 ml	1.8 2.7	1.8 3 4.3	1 2 4	1.8 may not be enough for automatic additional tests	
Li Hep	4 ml	2 4	2.7	2 3 4 4.5		
Li Hep gel		3	2.7 4.0	2 2.5 3 4		
serum	4 ml	4	2.7 4	1 2 3 4		
Serum gel		3.5	2.7 2.4	2.5 4 3.5		

RICU currently using

4 ml EDTA/FBC: 2 ml EDTA/RBC

4 ml Lithium Hep without gel: 3 ml Lithium Heparin with gel

Biochemistry manager says quality of Li Hep is much better as keeps RBCs separate after spinning from plasma

HAEMOVIGILANCE AMC 30/05/17

Pilot

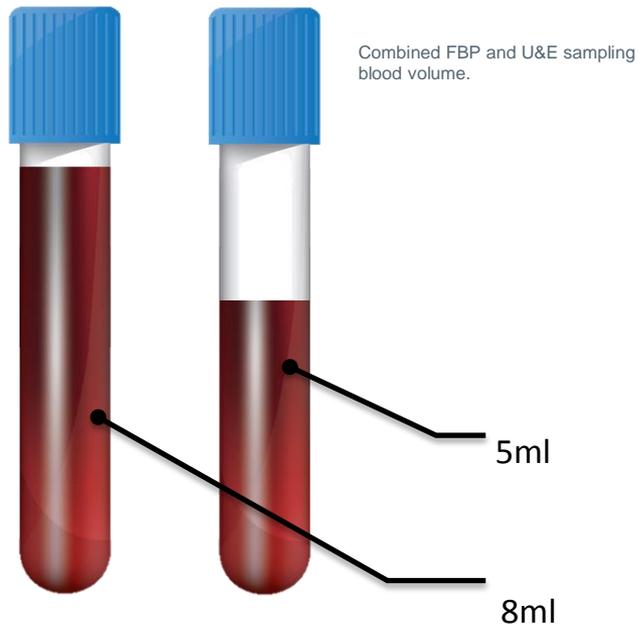
HDU (8 beds) for a 2 week period

- Removed 4mls EDTA and 4mls Bio bottles
- Replaced with 2mls and 3mls bottles
- Haematology and Biochemistry assessing rejected samples (haemolysis, insufficient volume)
- Left comment sheet for HDU staff



RICU Smaller Sample Bottles

*Full Blood Count (FBC), Urea & Electrolyte (U&E)



Smaller volume bottles have same external dimensions as larger volume & their introduction was are cost neutral

* FBC: 4ml → 2mls

**U&E: 4ml → 3mls

RICU average RBC/ patient/ day = 1.33

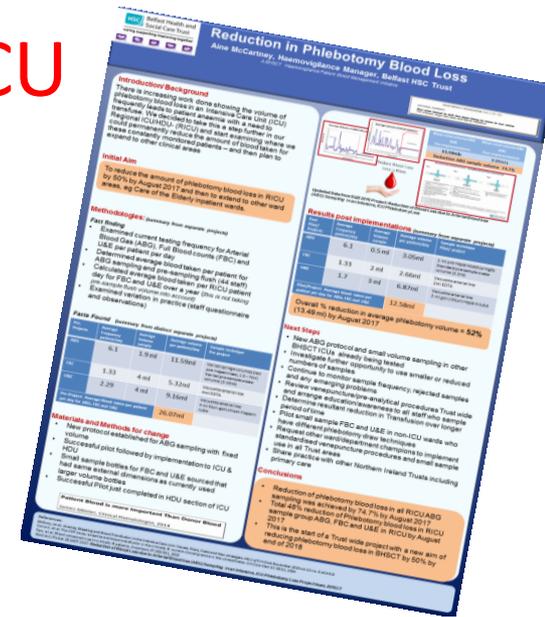
RICU average U&E/ patient/ day = 2.29

Sample rejection rate and clinical sampling practice were not adversely affected

Combined Phlebotomy Blood Loss RICU

Results pre- project

Pre-Projects	Average Frequency patient/day	Average Volume sample	Average volume per patient/day	Sample technique Pre project
ABG	6.1	1.9 ml	11.59ml	Varied syringe volume pre-heparinised, 1.5ml Varied pre-sample volume (2-10ml)
FBC	1.33	4 ml	5.32ml	Vacurette arterial line 4ml EDTA
U&E	2.29	4 ml	9.16ml	Vacurette arterial line 4ml EDTA
Pre-Project: Average Blood taken per patient per day for ABG, FBC and U&E			26.07ml	

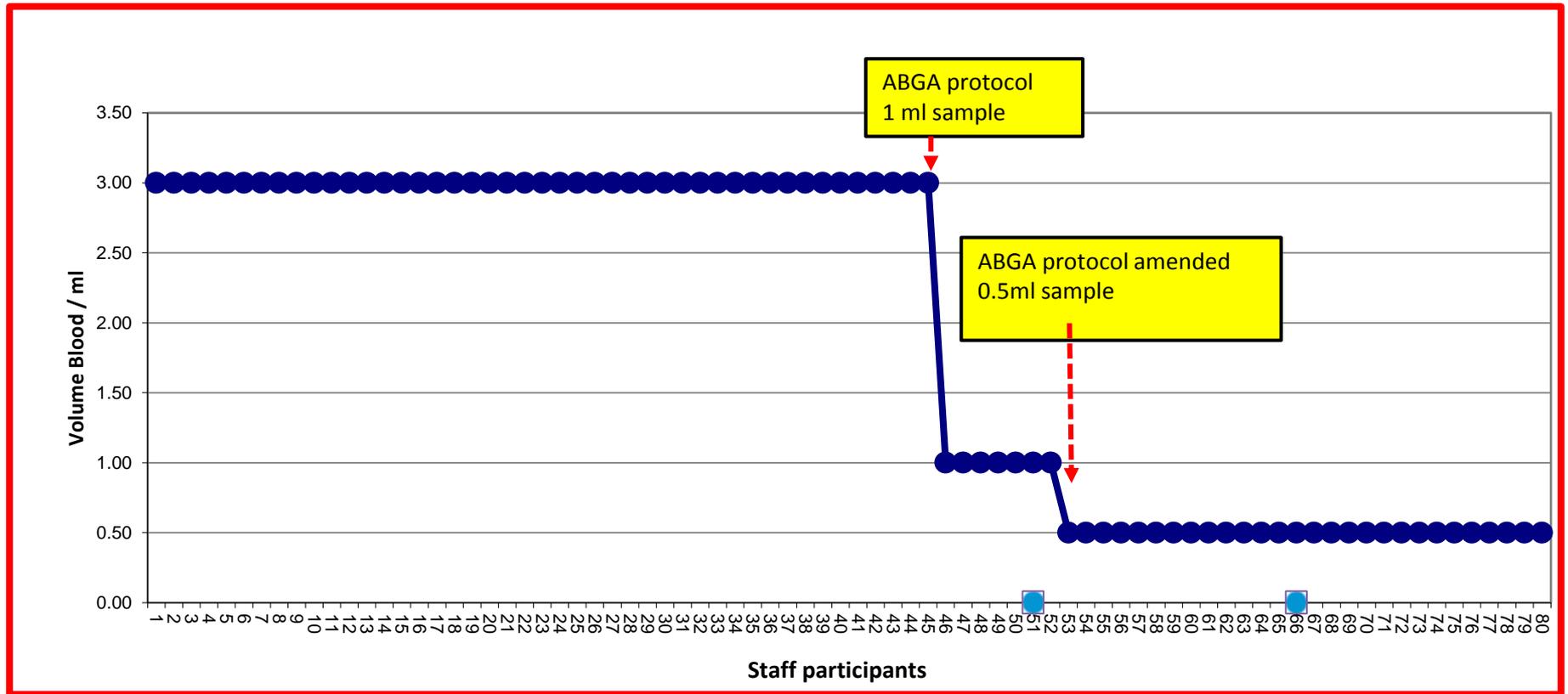


Results post project implementation

Post Pilot/Projects	Average Frequency patient/day	Average Volume sample	Average volume per patient/day	Sample technique Pilot/ project
ABG	6.1	0.5 ml	3.05ml	1 ml pre-heparinised syringe Standard pre-sample volume (2.2ml)
FBC	1.33	2 ml	2.66ml	Vacurette arterial line 2ml EDTA
U&E	2.29	3 ml	6.87ml	Vacurette arterial line 3 ml gel Lithium Heparin
Pilot/Project: Average blood taken per			12.58ml	

Overall % reduction in average phlebotomy volume = **52% (13.49 ml)** per patient per day

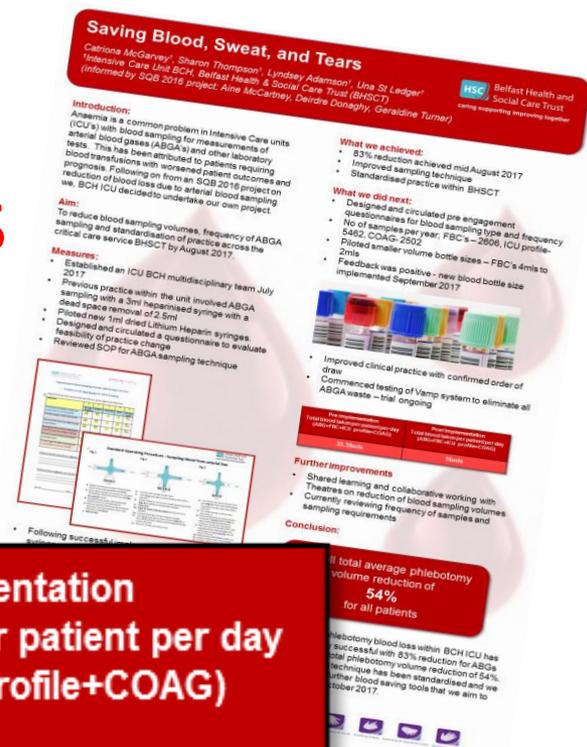
ABGA sample volume BCH ICU



Point to note: Price of 1ml pre-heparinised syringe = 50% less than 3ml syringe



BCH and Mater ICU Phlebotomy Blood Loss



Pre implementation Total blood taken per patient per day (ABG+FBC+ICU profile+COAG)	Post Implementation Total blood taken per patient per day (ABG+FBC+ICU profile+COAG)
35.39mls	16mls

Overall total average phlebotomy
volume reduction of
54%
for all patients



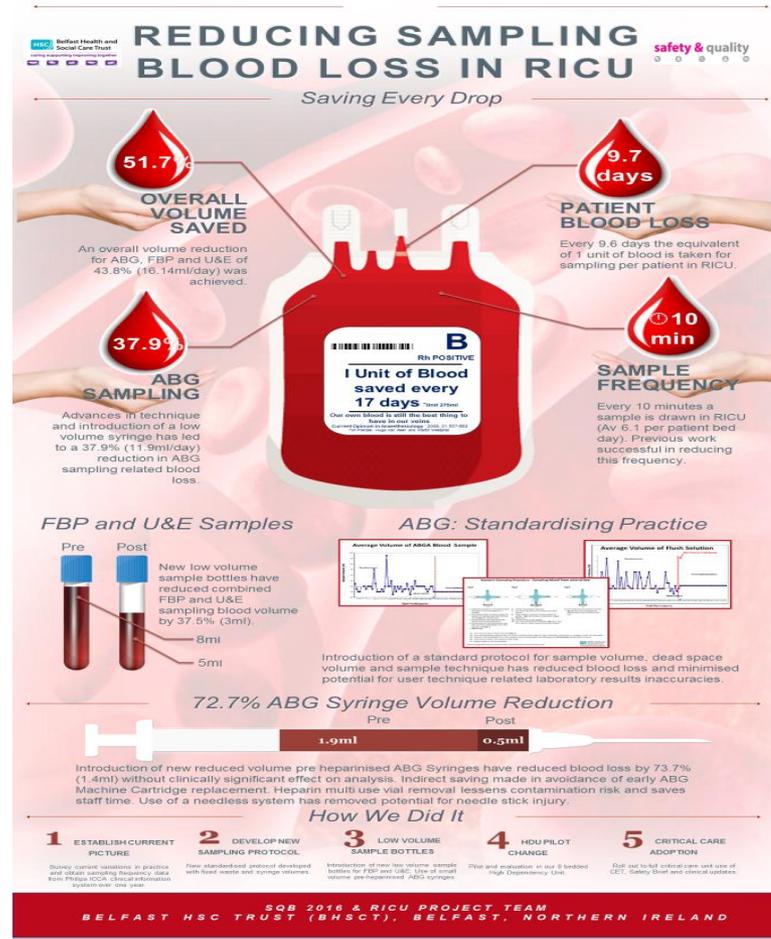
Sample Volume Reduction from three most frequent blood tests

- % reduction of volume for three most frequent blood test was **52%**
- Or reduction = **13.5mls per patient per day**

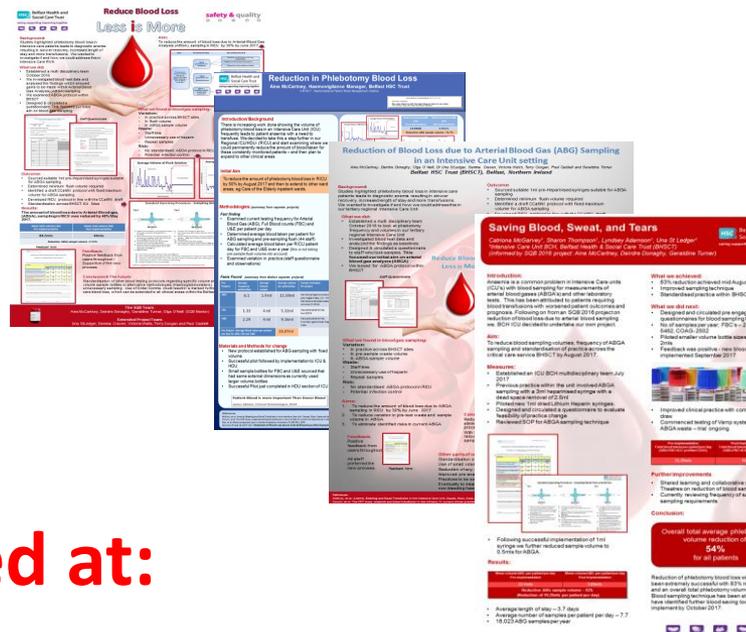
This is 94.5mls a week – for these 3 tests only

Note: a seriously ill patients may need more frequent sampling of these tests and may be in ICU for longer periods

RICU staff poster for Intensive Care Society State of the Art conference 2017.



Showcasing



Reducing Phlebotomy Loss in Belfast Trust's Intensive Care Units

Aine McCartney, Hemovigilance Manager
for: Safety Quality Belfast 2018, Less is More & RICU, BCH and MIH Project teams
Belfast Health & Social Care Trust, Belfast, Northern Ireland

Arterial Blood Gas (ABG) sampling volume within and between three main Trust ICUs (RICU, BCH ICU & MIH ICU) was noted to be variable and excessive to need. The ABG test was the most frequent blood test at an average 6.5 per day. Next most frequent tests were the Full Blood Count (FBC) and the Urea & Electrolyte (U&E). The project was carried out in RICU and spread to the other two main Trust ICUs

A Trust-wide standardised protocol for ABG sampling was developed and introduced. (0.5ml sample and minimum waste draw)
Result: Average test frequency x volume = reductions of 72.7% (RICU), 83% (BCH ICU) and 83% MIH ICU in ABG blood volume

Smaller sample volume FBC and U&E bottles were introduced with same external dimensions as larger volume bottles (cost neutral).
Sample rejection rate and clinical sampling practice were not adversely affected.
Result: Average reductions in 37.5% in combined FBP and U&E sample volume

Overall Results
Pre project average blood taken/ patient/ day for 3 most frequent blood tests = 27ml
Post Project average blood taken/ patient/ day for the 3 most frequent blood tests = 13ml
Blood volume reduction in the 3 most frequent tests = 54%
This reduction has been sustained to date in all three ICUs for over the last 8 months

Other advantages

- Staff took ownership of patient's sampling volume- sustainability
- Quicker draw time of smaller samples
- Awareness to ICU staff of order of taking different samples
- Reducing wastage of ABG machine cartridge
- Heparin multi use vial removal lessens contamination risk and saves staff time.
- Use of a needless system has removed potential for needle stick injury

Next Steps

- Testing Vamp system to eliminate arterial line sampling waste
- Monitor transfusion requirements in ICU over longer term
- Review pre-analytical sample procedures Trust-wide to ensure quality sampling
- Rollout of smaller volume sample tubes to other clinical areas
- Share practice with other Northern Ireland Trusts including primary care

Belfast Health and Social Care Trust
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Posters presented at:

- SQB 2016/7
- *SHOT UK Annual Symposium: **July 2017**
- BHSCT Safetember: **September 2017**
- British Blood Transfusion Society: **Sept 2017**
- NI Red Cells in Perspective Conference: **Feb 2018**
- NATA- Patient Blood Management, Haemostasis & Thrombosis: **April 2018**

*Serious Hazards of Transfusion



What we learnt..

- Getting the right people is essential (MDT)
- Start small – grow – and spread
- Adaptable as project develops
- Leave ownership in the clinical area - sustainability
- Co-ordination / project lead / timeframe
- Keep up Momentum
- DO IT! Explore viability of ideas



Next Steps

- Testing system to eliminate arterial line sampling waste, eg VAMP
- Monitor transfusion requirements in ICU over longer term
- Review pre-analytical sample procedures Trust-wide to ensure quality sampling
- Rollout of smaller volume sample tubes to other clinical areas
- Share practice with other Northern Ireland Trusts including primary care
- **Explore Implementation of Patient Blood Management Strategy in Northern Ireland, starting with BHSCT**



ACKNOWLEDGEMENTS

- **Rest of SQB Team:** Geraldine Turner, Deirdre Donaghy
- **Olga O’Neill:** SQB mentor
- **Clinical teams and managers**
 - **RICU:** Paul Caddell, Tori Watt, Terry Coogan, Gemma Craven, Amanda Scappattici, Elaine Bradley, Jacqueline Crowe, Sr Rhoda McFarland, Dr Amit Bedi
 - **BCH ICU:** Catriona McGarvey, Sharon Thompson, Sr Lyndsey Adamson
 - **MIH ICU:** Eddie Kearney, Sr Tracie Young, Dr Martin Duffy
- **Una StLedger:** Nurse Development Lead, Critical Care
- **Steve Coward & Joy Gallagher:** Biochemistry and Haematology operational managers



Email: Aine.mccartney@belfasttrust.hscni.net