

Snapshot audit of minimal volume blood sampling to prevent iatrogenic anaemia 2017

Blood Matters Program



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Background

Iatrogenic anaemia occurs due to blood loss from repeated blood sampling to obtain specimens for laboratory testing. It may also be called hospital-acquired anaemia.

The association between the volume of blood taken for sampling and iatrogenic anaemia is being increasingly documented in peer-reviewed journals. Vincent et al. (2002) find that patients in European intensive care units have substantial blood loss through blood sampling: on average, 41 ml a day. They recommend strategies to reduce these losses, and suggest that education and the development of guidelines may help reduce blood loss.

Tinmouth et al. (2008) review strategies to reduce blood loss and prevent anaemia. They note the impact of blood loss in critically ill patients due to diagnostic testing, and that there is a consequent increased risk of anaemia and potential for blood transfusion, with its associated risks.

In a recent Australian study, Ullman et al. (2015) find that adult patients in intensive care units had a blood loss of 38 ml a day, with significantly lower volumes in paediatric intensive care units (nine ml) and neonatal intensive care units (0.2 ml). They find that adult patients in intensive care units are sampled more frequently and have greater blood loss per sample than paediatric and neonatal patients. This difference cannot be explained by severity of illness; however, paediatric and neonatal intensive care units more often used small-volume phlebotomy tubes.

Ullman et al. postulate that neonatal intensive care unit practitioners may be more conscious of maintaining fluid balance and blood volume, and that the risk of iatrogenic anaemia is under-estimated in older children and adult patients.

Neonatal volumes may also be lower due to adherence to Australian and New Zealand Society of Blood Transfusion (ANZSBT) guidelines (ANZSBT 2016), which state that further testing for pretransfusion antibody screen and direct antiglobulin test are not required if initial results are negative until the infant reaches four months of age (Section 4.4.1.2).

The National Blood Authority (NBA) Patient Blood Management (PBM) Guidelines target iatrogenic anaemia as an important element to support pillar two, 'Minimise blood loss', in order to reduce the need for transfusion.

The *Patient Blood Management guidelines: Companion's* document (2014) supports the NBA guidelines and PBM guidelines. Companion 17 addresses reducing iatrogenic blood loss, and recognises that diagnostic testing contributes to blood loss in critically ill patients. It also outlines potential strategies to minimise such blood losses by:

- using microsampling
- introducing point-of-care testing
- having a process and device to reinfuse initial blood taken from indwelling devices
- ordering only essential blood tests.

Companion 17 acknowledges that implementing these strategies requires planning and communication with stakeholders such as medical staff, laboratory scientists and nursing staff.

Currently in Victoria there is no data on practices to reduce iatrogenic blood loss. To determine how Blood Matters can support health services to reduce this type of blood loss, we designed a snapshot audit to measure the practices that are currently in place.

Objectives

- To determine if health services have policies in place to minimise blood sample collection volume and frequency to reduce iatrogenic anaemia
- To explore what practices are currently in place that may support minimal blood sampling and what the perceived barriers are to implement these practices.

Method

We invited public and private health services in rural and metropolitan areas (n = 149) in four jurisdictions (Victoria, Northern Territory, Australian Capital Territory and Tasmania) to respond to an online audit of policies and strategies that support reduction of iatrogenic blood loss.

Strategies included in the audit were those recommended in recent peer-reviewed literature, namely:

- small-volume phlebotomy tubes
- closed-system sampling
- frequent evaluation of routine blood sampling orders
- bundled scheduling of blood sampling
- point-of-care testing
- non-invasive monitoring
- charting of cumulative daily phlebotomy loss.

Health services were also asked about perceived barriers, if any, to introducing such strategies. The audit was open from 19 January to 28 February 2017.

Results

Seventy-eight health services completed the online audit (response rate 52 per cent).

Only six health services report having a policy to minimise the volume and frequency of blood sample collection to reduce iatrogenic anaemia (Table 1).

Table 1: Clinical areas and strategies covered by the policy to minimise the volume and frequency of blood sample collection to reduce iatrogenic anaemia

Health service	ICU	Paediatric	General wards	Emergency	Strategies included in policy
1	✓	✓	✓	✓	No strategies; only noted in PBM policy
2		✓			Bundled scheduling Reinfusing initial draw
3		✓	✓	✓	Small-volume tubes Closed system sampling
4	✓	✓	✓	✓	None stated
5			✓		Small-volume tubes Frequent evaluation of routine blood orders
6			✓		States to collect exact amount (4 mls) for screening

Although most health services did not have a specific iatrogenic anaemia policy, 86 per cent (n = 67) report that minimal blood sampling (either through practice at a clinical area or as strategies in place) occurs to some degree. It is most common in paediatrics, followed by general wards and intensive care units (Table 2). Not all health services that reported minimal volume strategies included a clinical area.

Table 2: Clinical areas* within a health service practicing minimal blood sampling, whether a formal guideline exists or not

ICU	Paediatric	General wards	Emergency	Other
12	20	13	4	Renal unit (n = 1)
15%	26%	17%	5%	Oncology (n = 4) Neonate (n = 6) High risk patients (n = 2)

*A health service could select more than one clinical area.

Strategies most frequently reported (Table 3) are point-of-care testing (n = 45), small-volume phlebotomy tubes (n = 36), frequent evaluation of routine sampling orders (n = 27) and closed-system sampling (n = 19). However, these health services report that these strategies predominantly occur for purposes other than to minimise iatrogenic anaemia, most frequently for convenience, time efficiencies or improved patient comfort. Only two health services report charting of cumulative daily phlebotomy loss specifically in neonatal special care units.

Table 3: Minimal blood sampling strategies used within a health service* (in at least one clinical area), whether a formal guideline exists or not

Strategy	Number of health services reporting minimal sampling to minimise iatrogenic anaemia	Number of health services reporting minimal sampling for other reasons
Small-volume phlebotomy tubes	13 (17%)	23 (29%)
Closed-system sampling	10 (13%)	9 (12%)
Frequent evaluation of routine blood sampling orders	9 (12%)	18 (23%)
Bundled scheduling of blood sampling	10 (13%)	23 (29%)
Point-of-care testing	4 (5%)	41 (53%)
Non-invasive monitoring	6 (8%)	18 (23%)
Charting of cumulative daily phlebotomy loss	1 (1%)	1 (1%)

*A health service could select more than one practice.

Only 32 per cent of health services (n = 25) report using minimal blood sampling practices for the purpose of minimising iatrogenic anaemia, in at least one clinical area or patient group. In addition, some health services report practices that may potentially promote unnecessary blood tests, such as ordering specified test sets (n = 30) and routine blood sampling orders (n = 18), without adequately evaluating the clinical condition of the individual patient.

The most frequent (n = 39) explanation for a lack of policy or practice of minimal sampling is, 'Practice has not been considered'. In addition, a number of health services state that small tubes require increased manual handling, which limits their use.

Table 4: Perceived barriers to implementing minimal blood sampling

Barriers*	Number (percentage)
Small-volume tubes are not available	6 (8%)
Small-volume tubes are not suitable for our pathology	8 (10%)
Practice is not supported by pathology/laboratory	8 (10%)
Practice is not supported by management	1 (1%)
Practice of returning blood from central lines	13 (17%)
Resources to instigate and sustain change are not available	5 (6%)
Practice has not been considered	39 (50%)
No known barriers	26 (33%)

*Reliance on auditor knowledge/clarification with the laboratory staff.

A number of the smaller rural health services also note that they do not need minimal blood sampling strategies due to the (low) level of acuity of their patients.

Another issue relates to challenges for laboratories. Handling and processing small-sample volume tubes for paediatric and ‘difficult to bleed’ patients can pose issues. Ideally, automated analysers would be designed to easily and readily handle small sample volumes collected in paediatric tubes. However, many automated analysers are only designed to handle standard adult tubes.

Paediatric samples may use an adaptor on the loading rack or require the sera to be aliquoted into sample cups. These processes can be time consuming and may lead to specimen errors.

We asked health services to report on the make of analysers they use in their laboratories, but unfortunately we did not ask for the model. This makes it difficult to report on current limitations due to equipment type within the health services. Table 5 includes the list of analysers used for different blood tests.

Table 5: Makes of analysers used within the health services*

Maker	FBE	Group and save	Coagulation testing	Biochemistry
Abbott	11	2		9
Roche	44		8	14
Beckman-Coulter	7	1		23
Siemens	2		29	17
Grifols		29		
DiaMed/BioRad		14		
Ortho (incl. AutoVue)		14		1
Saxo	1	1	2	2
Stago			22	
Werfen			5	
Manual		4		
Testing done off site	4	4	3	3
Unknown	9	9	9	10

*Reliance on auditor knowledge/clarification with the laboratory staff.

Summary and conclusions

Currently most health services do not have policies to support minimal blood sampling as a PBM approach. It appears this has not been considered, although minimal blood sampling strategies are used widely for reasons other than prevention of iatrogenic anaemia.

Audit recommendations

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- Develop a guideline addressing iatrogenic anaemia that could be used by health services for policy development
- Develop and promote educational strategies to increase awareness of iatrogenic anaemia and potential benefits of strategies to reduce this
- Develop an audit tool to determine the cumulative daily phlebotomy loss per patient to highlight the need for practice change
- Promote or develop (if not currently available) pictorial tables including test and sample tube required and volume.
- Re-audit policy and practice in 2018

At the health service level

- Health services should develop and implement policies to promote minimal sampling strategies that address patient blood management issues (iatrogenic anaemia)
- Health services should consider including audit of cumulative daily phlebotomy loss per patient as a Blood Management/Hospital Transfusion Committee agenda item to review and make recommendations around practice to address potential iatrogenic anaemia
- Health services should explore the potential to use small volume tubes compatible with current laboratory analysers

References

- ANZSBT 2016, *Guidelines for transfusion and immunohaematology laboratory practice* https://www.anzsb.org.au/data/documents/guidlines/GuidelinesforTransfusionandImmunohaematologyLaboratoryPractice_1ed_Nov20_.pdf accessed 1 April 2017.
- National Blood Authority 2014, *Patient Blood Management Guidelines – Companions* <www.blood.gov.au/system/files/documents/patient_blood_management_guidelines_companions.pdf> accessed 1 April 2017.
- Tinmouth AT, McIntyre LA and Fowler RA 2008, 'Blood conservation strategies to reduce the need for red blood cell transfusion in critically ill patients', *Canadian Medical Association Journal*, vol. 178, no. 1, pp. 49–57, <doi.org/10.1503/cmaj.071298> accessed 1 April 2017.
- Ullman AJ et al. 2015, "“True blood”: The critical care story: an audit of blood sampling practice across three adult, paediatric and neonatal intensive care settings', *Australian Critical Care*, vol. 29, no. 2, pp. 90–95.
- Vincent et al. 2002, 'Anemia and blood transfusion in critically ill patients', *Journal of the American Medical Association*, vol. 288, no. 12, pp. 1499–506.

Appendix 1: Audit tool

Minimal volume blood sampling to prevent iatrogenic anaemia

Snapshot audit

Iatrogenic anaemia is a term applied to the anaemia that results from blood loss due to repeated blood sampling to obtain specimens for laboratory testing. Strategies to reduce iatrogenic blood loss include altering of test ordering behaviour (limiting the number of tests ordered), micro-sampling, reinfusion of blood drawn from indwelling devices and point of care microanalysis (NBA 2014). The use of micro-sampling has been shown to significantly reduce the volume of blood loss and has been associated with a significant reduction in blood transfusion (Tinmouth 2008). Implementing strategies to reduce iatrogenic blood loss in an organisation requires strategic planning, communication and implementation with relevant stakeholders such as medical staff, laboratory scientist and nursing staff.

References

Tinmouth, A, McIntyre, L, Fowler, R. Blood conservation strategies to reduce the need for red cell transfusion in critically ill patients, CMAJ 2008;178:49-57.
National Blood Authority Patient Blood Management Guidelines Companions No 17 Reduce iatrogenic blood loss (2014)
<https://www.blood.gov.au/patient-blood-management-guidelines-companions>
'True Blood' The Critical Care Story: An audit of blood sampling practice across three adult, paediatric and neonatal intensive care settings, Australian Critical Care 29 (2016) 90-95.

Name of health service: _____

Email address of the person completing the survey: _____

Please complete survey by **28/02/2017** online at:

<http://122.252.13.117/bloodaudit/TakeSurvey.asp?PageNumber=1&SurveyID=5LJI74ML972KG>

1. Does your health service have a policy/guideline to minimise the volume and frequency of blood sample collection to prevent iatrogenic anaemia?
 - Yes
 - No
 - Unsure
- a. If yes, which clinical areas within your health service does the policy cover?
 - ICU
 - Paediatric
 - General wards
 - Emergency
 - None of the above
 - Other, please specify: _____

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- b. If yes, which strategies are stipulated in the policy/guideline to support minimal blood sampling:
- small volume phlebotomy tubes (e.g., using paediatric sample tubes or sample tubes with thick walls)
 - closed system sampling (where samples are taken from central lines (Hickman's) reinfusing initial blood taken or using the initial draw for blood cultures)
 - frequent evaluation of routine blood sampling orders (Reducing the number of samples taken from the patient, such as not doing a daily cross match specimen)
 - bundled scheduling of blood sampling
 - point of care testing
 - non-invasive monitoring
 - charting of cumulative daily phlebotomy loss
 - None of the above
 - Other, please **specify**: -----

2. Whether a formal guideline exists or not, do any of the below areas within your health service practice minimal blood sampling?
- ICU
 - Paediatric
 - General wards
 - Emergency
 - None of the above
 - Other, please specify: -----

3. Whether a formal guideline exists or not, are any of the following strategies (which support minimal sampling) currently in place:

	Yes- to minimise iatrogenic anaemia	Yes- other reasons	No
Small volume phlebotomy tubes (e.g., using paediatric sample tubes or sample tubes with thick walls)	<i>r</i>	<i>r</i>	<i>r</i>
Closed system sampling (where samples are taken from central lines (Hickman's) reinfusing initial blood taken or using the Initial draw for blood cultures)	<i>r</i>	<i>r</i>	<i>r</i>
Frequent evaluation of routine blood sampling orders (Reducing the number of samples taken from the patient, such as not collecting a cross match specimen daily)	<i>r</i>		<i>r</i>
Bundled scheduling of blood sampling	<i>r</i>	<i>r</i>	<i>r</i>
Point of care testing	<i>r</i>	<i>r</i>	<i>r</i>
Non-invasive monitoring	<i>r</i>	<i>r</i>	<i>r</i>
Charting of cumulative daily phlebotomy loss	<i>r</i>	<i>r</i>	<i>r</i>

4. If any of the above answers include "yes-for other reasons", please comment on what the reasons may be, e.g., Point of care testing is used in some areas for convenience rather than for the purpose of minimal sampling.

5. Whether a formal guideline exists or not, do you include specific education regarding iatrogenic anaemia?

- Yes
- No
- Unsure

6. Do any of the following practices occur within your health service that may potentially increase the number of samples taken?

- Specified test set- (i.e. where a specific patient group have specified tests taken at stipulated time points regardless)
- Routine blood sampling orders (i.e. daily FBE regardless of clinical condition of the patient)
- None of the above

7. If no policy is in place or where minimal sampling is not practiced, could you please indicate what may be an obstacle to this practice?

- Small volume tubes are not available
- Small volume tubes are not suitable for our pathology provider's analysers
- Practice is not supported by pathology/laboratory-
- Practice not supported by management
- Practice of returning blood from central lines not supported
- Resources to instigate and sustain change not available
- Practice has not been considered
- No known barriers
- Other, please specify: -----

8. What make of analyser is used by your pathology provider for: (where multiple laboratories provide services please list all)

a. Full Blood Examination (FBE)

- Abbott
- Roche
- Beckman-Coulter
- Other, please specify: -----

b. Group and save

- DiaMed/BioRad
- Grifols
- Immucor
- Abbott
- Other, please specify: -----

c. Biochemistry

- Ortho
- Abbott
- Roche
- Diasys
- Other, please specify: -----



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d. Routine Coagulation testing

- Stage
- Grifols
- Roche
- Other, please **specify**:-----

9. Other comments:

Thank you for taking the time to participate in this survey



Appendix 2: Summary results

Totals

Total number of invitations to participate	149	100%
Number returned	78	52%

Questions

Question 1

Does your health service have a policy/guideline to minimise the volume and frequency of blood sample collection to prevent iatrogenic anaemia? (n = 78)

Response	Number	Percentage
Yes	6	8%
No	67	86%
Unsure	5	6%

Question 1a

If yes, which clinical areas within your health service does the policy cover? (n = 6)

Clinical area	Number	Percentage
ICU	2	33%
Paediatric	4	67%
General wards	5	83%
Emergency	3	50%
None of the above	–	–
Other	–	–

Question 1b

If yes, which strategies are stipulated in the policy/guideline to support minimal blood sampling (n=6)

Strategy	Number	Percentage
Small volume tubes	2	33%
Closed system	2	33%
Frequent evaluation	1	17%
Bundled scheduling	1	17%
Point of care testing	–	–
Non-invasive monitoring	–	–
Charting of blood loss	–	–
None of the above	2	33%
Other	1	17%

Question 2

Whether a formal guideline exists or not, do any of the below areas within your health service practice minimal blood sampling? (n = 78)

Clinical area	Number	Percentage
ICU	12	15%
Paediatric	20	26%
General wards	13	17%
Emergency	4	5%
Other: Neonate	6	8%
Other: Oncology	4	5%
Other: Renal	1	1%

Question 3

Whether a formal guideline exists or not, are any of the following strategies (which support minimal sampling) currently in place: (n = 78)

Strategy	Yes – to minimise iatrogenic anaemia: Number	Yes – to minimise iatrogenic anaemia: Percentage	Yes – other reasons: Number	Yes – other reasons: Percentage
Small volume tubes	13	17%	23	29%
Closed system	10	13%	9	12%
Frequent evaluation	9	12%	18	23%
Bundled scheduling	10	13%	23	29%
Point of care testing	4	5%	41	53%
Non-invasive monitoring	6	8%	18	23%
Charting of blood loss	1	1%	1	1%

Question 4

If any of the above answers include 'yes – for other reasons', please comment on what the reasons may be, for example, point of care testing is used in some areas for convenience rather than for the purpose of minimal sampling.

Reason	Number
Small volume tubes – neonates/paediatric only	9
Small volume tubes – difficult to bleed patients	17
Small volume tubes – Jehovah's Witness patients	2
Frequent evaluation – reduce level of intervention	3
Frequent evaluation – cost saving	4
Bundled scheduling – reduce level of intervention	6
Bundled scheduling – efficiency	8
Point of care – no or limited pathology onsite	9
Point of care – timeliness of results/urgent care	24
Non-invasive monitoring – reducing level of intervention	3

Question 5

Whether a formal guideline exists or not, do you include specific education regarding iatrogenic anaemia? (n = 78)

Response	Number	Percentage
Yes	6	8%
No	64	82%
Unsure	8	10%

Question 6

Do any of the following practices occur within your health service that may potentially increase the number of samples taken? (n = 78)

Practice	Number	Percentage
Specified test set	30	38%
Routine blood sampling orders	18	23%

Question 7

If no policy is in place or where minimal sampling is not practiced, could you please indicate what may be an obstacle to this practice? (n = 78)

Obstacle	Number	Percentage
Small volume tubes are not available	6	8%
Small volume tubes are not suitable	8	10%
Practice is not supported by pathology	8	10%
Practice not supported by management	1	1%
Practice of returning blood from central lines	13	17%
Resources to instigate and sustain change not available	5	6%
Practice has not been considered	39	50%
No known barriers	26	33%
Other	–	–

Question 8

What make of analyser is used by your pathology provider for: (n = 78)

(Multiple responses allowed per question)

Full blood examination

Make of analyser	Number	Percentage
Abbott	11	14%
Roche	44	56%
Beckman-Coulter	7	9%
Other	16	18%

Group and save

Make of analyser	Number	Percentage
DiaMed/BioRad	14	18%
Grifols	29	37%
Immucor	0	0%
Abbott	2	3%
Ortho	14	18%
Other	19	24%

Biochemistry

Make of analyser	Number	Percentage
Ortho	1	1%
Abbott	9	12%
Roche	14	18%
Diasys	0	0%
Beckman-Coulter	23	29%
Siemens	17	22%
Other	15	19%

Routine coagulation testing

Make of analyser	Number	Percentage
Stago	22	28%
Grifols	0	0%
Roche	8	10%
Siemens	29	37%
Other	19	24%

