Targeted literature review:

What are the key infection prevention and control recommendations to inform a prevention of contamination of blood culture quality improvement tool?

Part of HAI Delivery Plan 2011-2012:
Task 6.1: Review of existing infection prevention and control care bundles to ensure ongoing need and fitness for purpose

Version 1.0: April 2012
Targeted literature review: What are the key infection preventions and control recommendations to inform a prevention of contamination of blood culture quality improvement tool?

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Targeted literature review: What are the key infection preventions and control recommendations to inform a prevention of contamination of blood culture quality improvement tool?

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1. Executive summary

Taking a patient's blood for 'culture' is a vital test in healthcare to establish whether a patient has bacteraemia and to guide appropriate therapy. It is vital that the test is as accurate as possible.

Contamination of the blood sample can occur during the process from; the hands of the healthcare workers, the patient's skin, the environment or the equipment used including the sample bottle itself. Contamination of the blood culture sample is a widespread problem, with rates of approximately 10% being reported.\(^1,2\) Blood culture contamination can lead to unintended consequences which can impact on patient safety and result in avoidable increased costs.\(^2\) Some have therefore recommended that the incidence of blood culture contamination should be lower than 3%.\(^2\)

In Scotland, the concern over blood culture contamination is mainly anecdotal. It subsequently relates to a broader piece of work focused on sepsis management as well as forming part of the support for the HEAT target \textit{Staphylococcus aureus} bacteraemias reduction.

The recommendations result from the review of scientific evidence and the process of assessing these within a health impact and expert opinion framework. The key recommendations and their scientific grade of evidence for the prevention of blood culture contamination quality improvement tool are now presented:

If taking a sample for blood culture is clinically indicated then:

- Ensure that blood culture bottle tops are decontaminated by rubbing with an antiseptic containing 70% isopropyl alcohol and left to dry (Category 1B)*
- Ensure that hand hygiene is performed immediately before the process of taking a blood culture sample (WHO Moment 2) (Category 1A)
- Ensure that a skin antiseptic containing 70% isopropyl alcohol is used to cleanse the skin site and left to dry (Category 1B)
- Ensure that aseptic technique is maintained including use of gloves; don't touch critical parts, including the skin following disinfection (Category 1B)
- Ensure that the blood culture bottle is inoculated first (if taking blood for other samples) (Category II)

* to find out more information on the categories of these recommendations see \textit{Appendix 3}

Note: this review identifies the resulting key evidence based recommendations and does not aim to identify all the elements of a checklist or standard operating procedure covering taking a blood culture. Other locally available procedures and tools should address all steps related to taking samples for blood culture.

\textbf{In conclusion:} It is now advised that the key recommendations listed as a result of this review here and summarised in \textit{Appendix 5} are considered for application into practice as supported by quality improvement tools including care bundles. These activities can also be supported by national patient safety /quality improvement work (as directed by Healthcare Improvement Scotland).
2. Aim of the review

To review the evidence base as well as expert opinion to ensure that the key recommendations included within a quality improvement tool are the most critical for improving and streamlining practices related to preventing contamination occurring when taking samples for blood culture. HPS Infection Control Team undertook a review of the Blood Culture portfolio recommendations developed by Healthcare Improvement Scotland/SPSP.

3. Background

3.1 The problem

The Chief Nursing Officer (CNO) requested that NHS Quality Improvement Scotland, through the Scottish Patient Safety Programme(SPSP) in partnership with Health Protection Scotland (HPS) and NHS Education for Scotland (NES), drive a 90 Day Staphylococcus aureus bacteraemias (SAB) Rapid Improvement Cycle in a small number of NHS boards (2010/11). This was due to exceedances in the SAB HEAT targets being noted within a number of NHS boards. One of the aims of this programme was to reduce blood culture (BC) contamination rates to <5% by testing and implementing a blood culture portfolio.

A definition of blood culture contamination is ‘a false positive defined as the growth of bacteria in the blood culture bottle which were not present in the patient’s bloodstream and were introduced during sample collection’. There are a number of organisms which are commonly associated with contamination of blood cultures. These include: coagulase-negative staphylococci, nonhaemolytic streptococci, Lactococcus and Lactobacillus as well as commonly known causes of HAI such as Staphylococcus aureus. Contamination can arise from a number of different sources, including the hands of the healthcare worker, the patient’s skin, the environment and the equipment used to transfer the sample to the culture bottles e.g. needle and syringe. Contamination of blood culture samples is considered a widespread problem with contamination rates of approximately 10% being reported. Unintended consequences can result from false positive results including administration of antibiotics which are not required or are inappropriate. This can result in an increased risk to patients by failure to quickly and accurately diagnose a bacterial infection and also therefore add to the antimicrobial resistance (AMR) burden. It can also result in artificially raised Staphylococcus aureus bacteraemia rates which can affect perceptions of how a hospital or NHS board is performing against the HEAT targets as well as public concern. In addition, it can have cost implications for example, due to increased length of stay. In order to support activities stemming from the SAB 90 day programme, recommendations for safe blood culture sampling are deemed helpful in enhancing clinical practice.

3.2 Why taking samples for blood culture is needed

Blood culture is a vital test in healthcare to establish whether a patient has a bacteraemia and to guide appropriate therapy e.g. antibiotics. It is vital that the test is able to accurately identify whether there is bloodstream infection present and the causative microorganism as soon as possible, particularly as the patients requiring this test are often critically ill.
3.3 How contamination of blood culture samples can be prevented

Critical for this review is to present the evidence describing the key times when aseptic techniques should be applied and maintained. Other aspects are care of the equipment and products used as well as the standard practice of hand hygiene at the right time.

Key recommendations should therefore ensure that blood cultures are taken when clinically required, are taken using techniques designed to minimise contamination and therefore ensure the valid and reliable outcomes of this clinical test for each individual patient.

3.4 Out of scope for this review

This literature review does not address any issues specific to:

- Paediatric patients
- Definition of sepsis
- Any other aspect related to blood culture or bacteraemia/sepsis management
- The whole blood culture procedure
- Use of blood sampling packs and cost analysis associated with this

3.5 Assumptions – to ensure successful application of recommendations into practice

There are a number of aspects related to healthcare delivery that were not within the remit of this review as it is clear that they are the responsibility of other professionals. These include that:

- Staff are appropriately trained and competent in all aspects of the management of taking blood cultures preferably using an approved educational package
- The overall approach to the delivery of healthcare is supported by patient safety and improvement approaches and organisational readiness.
4. Results

The recommendations presented are based on review of the current evidence using the previous criteria seen in Appendix 1 as a basis for the question set. To further aid the process of deciding what final key recommendations were to be included, all the recommendations resulting from the review of the evidence were assessed using the ‘health impact and expert opinion framework’ seen in Appendix 2. The final key recommendations were identified as a result of this evaluation as well as being informed by the process of wider consultation.

The methodology for the review is described within Appendix 3; the specific search strategy in Appendix 4 and finally a summary of the resulting recommendations can be found in Appendix 5.

4.1 Review of evidence base

4.1.1 Final recommendation - Ensure that blood culture bottle tops are decontaminated by rubbing with an antiseptic containing 70% isopropyl alcohol and left to dry (Category 1B)

Preparation of the equipment used is a vital step in commencing the aseptic technique required to minimise the risk of contamination while collecting a blood sample. Ensuring that all the equipment is available close to hand and that it is sterile, so as to minimise the risk of contamination occurring during the process is critical. Blood culture bottles are clean but not sterile and therefore the rubber septum is a potential source of microbial contamination. The risk of contamination may be minimised by rubbing the septum with an antiseptic containing 70% isopropyl alcohol and allowing it to dry prior to inoculation. The microbiocidal activity of alcohol is well described and 70% isopropyl alcohol is effective against a range of pathogens which are associated with healthcare associated infection (HAI) or are common blood culture contaminants. Therefore, despite the lack of strong evidence to specifically support this practice, it is included in many descriptions of methods in use within peer reviewed scientific publications and is considered good practice based on accepted principles of ensuring sterility and an aseptic technique. In summary, it is recommended that the rubber septum of the blood culture bottle tops should be rubbed with an antiseptic containing 70% isopropyl alcohol and left to dry, to minimise the risk of contamination, although exact detail of this procedure including the rubbing time is not evident. The recommendation given results from all evidence considerations and after applying the framework described in Appendix 2.

4.1.2 Final recommendation - Ensure that hand hygiene is performed immediately before taking a blood culture sample (WHO Moment 2) (Category 1A)

This recommendation, and the importance of hand hygiene performance, is consistent with all current evidence, guidelines and the Department of Health (DH) High Impact Intervention. The World Health Organization (WHO) Guidelines on Hand Hygiene in Health Care (2009) clearly describe the indications for hand hygiene and present these within the WHO ‘My 5 Moments for Hand Hygiene’ approach, including...
emphasising the importance of performing hand hygiene before clean/aseptic procedures to prevent healthcare associated infection (HAI). These 5 Moments have been widely promoted within NHSScotland for a number of years and hand hygiene performance is measured against compliance with these Moments. This tool aims to provide an opportunity to identify the hand hygiene occasion when risk is highest in relation to blood culture contamination. The recommendation given results from all evidence considerations and after applying the framework described in Appendix 2.

(Note: this should not detract from the steps in the full procedure which include hand hygiene before decontaminating blood culture bottles as best practice).

4.1.3 Final recommendation - Ensure that a skin antiseptic containing 70% isopropyl alcohol is used to cleanse the skin and left to dry (Category 1B)

Effective skin decontamination prior to venous access for obtaining a blood culture sample is crucial to avoid contamination from microorganisms present on the patient’s skin. The Department of Health (DH) high impact intervention recommends that ‘2% chlorhexidine gluconate in 70% alcohol is used and allowed to dry for at least 30 seconds’ however the supporting evidence for this recommendation is not clear. Within NHSScotland, anecdotal evidence reveals that a common way of skin being prepared prior to obtaining a blood culture within the majority of clinical areas is by a single use alcohol impregnated swab. Therefore due to the ambivalent nature of the evidence, a more detailed review was conducted to further examine the evidence on skin antisepsis.

There have been a number of studies evaluating the use of different skin antiseptics and potential effect on blood culture contamination. There are some difficulties in comparing across these studies due to differences in the definition of blood culture contamination, the myriad different antiseptics studied and the lack of high quality studies e.g. randomised control trials (RCTs). There is generally a lack of studies specifically comparing the use of 2% chlorhexidine in 70% isopropyl alcohol to the use of 70% isopropyl alcohol alone.

A controlled trial which compared the effect of four different antiseptics on the rate of blood culture contamination found no difference between povidone iodine, tincture of iodine, isopropyl alcohol and povidone iodine with alcohol and concluded that the use of isopropyl alcohol may be indicated due to reasons of cost and tolerability. However chlorhexidine was not evaluated within this study. One study compared the use of Chloroprep® to tincture of iodine for skin preparation and found that the use of Chloroprep® combined with a vigorous scrubbing action resulted in a reduction in the rate of blood culture contamination. However it is not clear from the results whether it is the scrubbing action or the effect of the 2% chlorhexidine in 70% isopropyl alcohol solution which is effective. Again, this study did not compare the effects of the two skin antiseptics commonly used within NHSScotland.

Taking a sample for blood culture requires a rapid effective method of disinfection, which makes 70% isopropyl alcohol suitable given its efficacy as a disinfectant combined with its rapid drying action.
Therefore considering the lack of specific evidence to suggest that 2% chlorhexidine in 70% isopropyl alcohol should be used preferentially over 70% isopropyl alcohol alone for skin preparation prior to venepuncture for a blood culture sample, a skin antiseptic containing 70% isopropyl alcohol is recommended. This review identified no specific studies or evidence with respect to technique for application or specific recommendation on drying time; therefore it is recommended that manufacturers’ instructions are referred to for any product used. The recommendation given results from all evidence considerations and after applying the framework described in Appendix 2.

Note: This does not preclude the use of 2% chlorhexidine in 70% isopropyl alcohol, where local settings choose to do so.

4.1.4 Final recommendation - Ensure that aseptic technique is maintained including use of gloves; don’t touch critical parts, including the skin following disinfection (Category 1B)

Aseptic technique is a broad term for a number of actions which prevent cross transmission of microorganisms. This includes factors such as sterility of equipment combined with a non touch technique. This is also the basis of the aseptic non-touch technique (ANTT®) which is advocated for use in some parts of the UK. Indeed this method is promoted for use in the EPIC2 guidelines on which many of the Department of Health (DH) high impact interventions are based. However there are a number of activities which should be considered as part of aseptic technique. These include preparation of a surface area which prevents ‘touch’ contamination of equipment being used, use of sterile equipment or effective decontamination of equipment prior to use, use of personal protective equipment (PPE) e.g. gloves, in addition to not touching critical parts that must remain sterile throughout the procedure and appropriate hand hygiene performed at the right times. It may be reasonable to assume therefore that this recommendation reflects the widest context of ‘aseptic technique’ to ensure that it is giving clear direction to all the critical actions that will result in a reduction/prevention in contamination of blood culture samples. Therefore this recommendation is based on accepted practice as described in clinical procedures and policies. The recommendation given results from all evidence considerations and after applying the framework described in Appendix 2.

4.1.5 Final recommendation - Ensure that the blood culture bottle is inoculated first (if taking blood for other samples) (Category II)

This is a good practice point designed to avoid cross contamination of additives between tubes during the procedure. The World Health Organization (WHO) guidelines provide a table which details the order in which blood samples should be drawn, which is based on national standards from the USA. The Department of Health (DH) high impact intervention also includes this key action and also it forms part of good aseptic practice to minimise the number of manipulations as far as possible to reduce potential for contamination. It is concluded therefore that although this is not a strong evidence based recommendation, it is strongly embedded in good practice and should be included as one of the key recommendations. The
recommendation given results from all evidence considerations and after applying the framework described in Appendix 2.

4.2 Review of additional evidence based on initial search findings

4.2.1 Ensure that date, time and rationale for taking blood culture are documented (Category II)

The Department of Health (DH) high impact intervention and the World Health Organization (WHO) guidelines include recommendations to document the date, reason for sample being taken, site of venepuncture along with person undertaking the procedure and whether it is considered high risk.\(^2,15\) This is firmly based on good practice; and is also required to enable some evidence based actions to be carried out i.e. to check that the blood culture has been clinically indicated. This step may be important for patient safety however it is not solely an infection prevention precaution; therefore it is not within the remit of this review. However the importance of accurate documentation will be included within the summary of recommendations as standard in Appendix 5.

4.2.2 Additional consideration

Some acute settings regularly use specially designed ‘blood culture’ packs as part of a quality improvement/patient safety approach and this has also been reported within some studies\(^1,7\) However since the equipment needed to take a blood culture sample safely is already available within clinical practice a review of the evidence underpinning the use of these packs has not been undertaken. The cost implications of their use may have to be considered at a local level.

In conclusion: It is now advised that the key recommendations listed as a result of this review here and summarised in Appendix 5 are considered for application into practice as supported by quality improvement tools including care bundles. These activities can also be supported by national patient safety /quality improvement work (as directed by Healthcare Improvement Scotland).

5. Implications for research

A number of gaps in current evidence have been identified as a result of this review, which may have implications for future research priorities. These are summarised below:

- Further work to identify acceptable rates of blood culture contamination in NHSScotland
- Further research is required to identify the importance of inoculation of the blood culture sample bottle first and potential impact on blood culture contamination
- Further research is required on the most effective antiseptic for skin decontamination prior to taking a sample for blood culture
• The optimum order for the procedure/aseptic technique to prevent blood culture contamination.
• Further work on the exact method and time for rubbing rubber blood culture bottle tops.
6. References


(6) CDC. Guideline for Disinfection and Sterilization in Healthcare Facilites. 2008


Note: A number of references listed above are cited within the literature review methodology which has been placed in **Appendix 3** for ease of reading of this document.
Appendix 1: Previous criteria under review

A Blood Culture portfolio was developed by Healthcare Improvement Scotland in conjunction with SPSP. The criteria below were used as the question set to frame this review of the evidence base

- Decontaminate blood culture bottle tops with 70% alcohol and leave to dry
- Carry out hand hygiene before touching the patient
- Apply a skin antiseptic containing 70% alcohol to cleanse the skin and leave to dry
- Don’t touch critical parts
- Inoculate blood culture bottles first
- Document rationale for taking blood culture as well as document date and time of blood culture.
## Appendix 2: Framework – tool to evaluate evidence based recommendations alongside the health impact contribution & expert opinion (based on target group covered by this review)

<table>
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<th>Recommendation for review</th>
<th>Ensure that blood culture bottle tops are decontaminated by rubbing with an antiseptic containing 70% isopropyl alcohol and left to dry.</th>
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<td>Grade of recommendation (based on review of evidence)</td>
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<th>Safe: Not implementing this recommendation may increase the chance of blood culture contamination which may impact on patient care/treatment</th>
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<tr>
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<td>Effective: This recommendation forms an essential part of the aseptic procedure required to prevent contamination of the blood culture sample</td>
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<td></td>
<td>Efficient: This recommendation fits with the practices that should be acceptable to clinicians and allows for correct use of equipment.</td>
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<tr>
<td></td>
<td>Equitable: This recommendation promotes equitable care for all patients requiring a blood culture sample and may result in reduction in avoidable NHS costs and be beneficial to all</td>
</tr>
<tr>
<td></td>
<td>Timely: This recommendation fits with other aspects of taking a blood culture sample aseptically</td>
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<td></td>
<td>Person Centred: This is a person centred action to reduce blood culture contamination which could lead to delays in treatment or inappropriate treatment and allows for communication with patients undergoing the procedure</td>
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<th>Feasibility and sustainability (Y/N/?))</th>
<th>Applicability and reach (Y/N/?))</th>
<th>Training and informing (Y/N/?))</th>
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<td>Potential for measurement through e.g. observation</td>
<td>Easily implemented within current culture and will improve the quality of care now</td>
<td>Potentially implemented based on reliably available resources/products/prompts</td>
<td>Stealth integration into natural workflow/logical clarity of concept (also see Cause &amp; Effect Chart)</td>
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<td>Y</td>
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| Is this a key recommendation? | Yes |

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Targeted literature review: What are the key infection preventions and control recommendations to inform a prevention of contamination of blood culture quality improvement tool?
**Recommendation for review**

Ensure that hand hygiene is performed immediately before the process of taking a blood sample (WHO Moment 2).

**Grade of recommendation**

Category 1A

**Health impact contribution**

**Safe:** Not implementing this recommendation could put the patient at risk of harm and increase the risk of contamination of a blood culture.

**Effective:** This recommendation will minimise the risk of contamination of the blood sample from healthcare workers' hands during the procedure.

**Efficient:** This recommendation reduces the risk of blood culture contamination occurring and therefore may result in a reduction in associated NHS costs.

**Equitable:** This recommendation promotes a standard of care for all patients that may result in reduction in avoidable NHS costs and be beneficial to all.

**Timely:** This recommendation should be an integral part of healthcare worker activity and patient/individual care and fits.

**Person Centred:** This is a person centred action to reduce the chance of contamination occurring at the point of access and allows for engaging the patient in knowing that safe care is being practiced.

**Expert opinion/consultation and practical considerations**

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<th>Applicability and reach (Y/N/?</th>
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**Is this a key recommendation?**

Yes
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<th>Recommendation for review</th>
<th>Ensure that a skin antiseptic containing 70% isopropyl alcohol is used to cleanse the skin and left to dry</th>
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<tbody>
<tr>
<td>Grade of recommendation (based on review of evidence)</td>
<td>Category 1B</td>
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| Health impact contribution (based on Healthcare Quality Strategy for NHSScotland) | **Safe:** Not implementing this recommendation may put the patient at risk of harm and result in contamination of the sample  
**Effective:** This recommendation reduces the risk of contamination of the blood sample from the patient’s skin during the procedure as well as patient harm  
**Efficient:** This recommendation will fit with accepted clinical practice and helps prevent contamination of the sample and which could result in a reduction in the NHS cost associated with blood culture contamination  
**Equitable:** This recommendation supports equitable care for all patients and may result in reduction in avoidable NHS costs, beneficial to all  
**Timely:** This recommendation fits with all the other actions required to take a blood sample while minimising the risk of contamination contributing to streamlining of care  
**Person Centred:** This is a person centred action aimed at reducing the potential for contamination occurring during the procedure |
| Expert opinion/consultation and practical considerations | Measurement and feedback (Y/N/?):  
Potential for measurement through e.g. observation | Feasibility and sustainability (Y/N/?):  
Easily implemented within current culture and will improve the quality of care now | Applicability and reach (Y/N/?):  
Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart) | Training and informing (Y/N/?):  
Potential for congruency in design and meaning, with HCW, trainer and observer training and education |  
| | Y | Y | Y | ? | Y |
| Is this a key recommendation? | Yes |
**Recommendation for review**

Ensure that aseptic technique is maintained including use of gloves; don’t touch critical parts, including the skin following disinfection.

**Grade of recommendation (based on review of evidence)**

Category 1B

**Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)**

- **Safe**: Not implementing this recommendation may put the patient at risk of harm and result in contamination of the sample
- **Effective**: This recommendation should minimise the risk of contamination occurring during the procedure
- **Efficient**: This recommendation will help prevent contamination of the sample and result in a reduction in the NHS cost associated with blood culture contamination
- **Equitable**: This recommendation will help prevent contamination of the sample and result in a reduction in avoidable personal and NHS cost associated with blood culture contamination, beneficial to all
- **Timely**: This recommendation fits with all the other actions required to take a blood sample while minimising the risk of contamination, contributing to streamlining of care

**Person Centred**: This is a person centred action to ensure safe care in all patients requiring a sample taken for blood culture and allows for communication with patients undergoing the procedure

**Expert opinion/consultation and practical considerations**

<table>
<thead>
<tr>
<th>Measurement and feedback (Y/N/?</th>
<th>Feasibility and sustainability (Y/N/?</th>
<th>Applicability and reach (Y/N/?</th>
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Is this a key recommendation? Yes
<table>
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<tr>
<th>Recommendation for review</th>
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<tbody>
<tr>
<td>Grade of recommendation (based on review of evidence)</td>
<td>Category II</td>
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| **Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)** | **Safe**: This recommendation forms part of recognised best practice which helps avoid contamination of the blood culture sample occurring during the procedure.  
**Effective**: This recommendation should contribute to preventing contamination occurring during sampling and avoid further complications.  
**Efficient**: This recommendation forms part of the procedure set out to prevent contamination occurring during sampling but may not be viewed as not efficient by staff in the first instance  
**Equitable**: This recommendation supports equitable care for all patients and result in reduction of avoidable NHS costs and be beneficial to all  
**Timely**: This recommendation fits with all the other actions required to take a blood sample while minimising the risk of contamination, although education may be required to support the order of actions to achieve this standard |
| **Person Centred**: | N/A |
| **Expert opinion/consultation and practical considerations** | **Measurement and feedback (Y/N/?)** | Feasibility and sustainability (Y/N/?) | Applicability and reach (Y/N/?) | Training and informing (Y/N/?) |
| Potential for measurement through e.g. observation | Easily implemented within current culture and will improve the quality of care now | Potential for consistent delivery | Easily implemented based on reliably available resources/products/prompts | Stealth integration into natural workflow/logical clarity of concept (also see Cause & Effect Chart) | Unambiguous | Potential for applicability to a wide range of settings | Avoids unintended consequences/perverse behaviour | Potential for congruency in design and meaning, with HCW, trainer and observer training and education |
| Y | Y | Y | Y | ? | Y | Y | ? | Y |
| **Is this a key recommendation?** | YES (Agreed following additional consultation) |
Targeted literature review: What are the key infection preventions and control recommendations to inform a prevention of contamination of blood culture quality improvement tool?

Appendix 3: Literature review methodology

The evidence underpinning the criteria for a quality improvement tool was reviewed using a targeted systematic approach to enable input and resource to be concentrated where needed. This methodology is fully described within a separate paper ‘Rapid method for development of evidence based/expert opinion key recommendations, based on health protection network guidelines’

Initial rapid search and review

The initial search rapid literature search was carried out to identify mandatory guidance, or recent national or international evidence based guidance which either agrees or refutes that the current key recommendations are the most important to ensure optimal PVC care:

- The main public health websites were searched to source any existing quality improvement tools
- Relevant guidance and quality improvement tools e.g. Department of Health (DH), Centers for Disease Control and Prevention (CDC) etc were reviewed
- Additional literature identified and sourced e.g. from the relevant Cochrane reviews.

The quality of evidence based guidance was assessed using the AGREE instrument\(^{16}\) and only guidance which achieved either a strongly recommend or recommend rating was included.

Targeted systematic review

As a result of initial rapid search and review, recommendations requiring a more in depth review were identified. This involved searching of relevant databases including OVID Medline, CINAHL, EMBASE. All literature pertaining to recommendations where evidence was either conflicting or where new evidence was available were critically appraised using SIGN checklists and a ‘considered judgement’ process used to formulate recommendations based on the current evidence for presentation and discussion with the National HAI Quality Improvement Tools Group in Scotland.

Grading of recommendations

Grading of the evidence is using the Healthcare Infection Control Practices Advisory Committee (HICPAC) method.\(^{17}\) In addition to the overall assessment of the evidence underpinning the recommendation, other factors are considered which affect the overall strength of the recommendation such as the health impact and expert opinion on the potential critical outcomes.

The HICPAC categories are as follows:

| Category 1A – strong recommendation based on high to moderate quality evidence |
| Category 1B – strong recommendation based on low quality of evidence which suggest net clinical benefits |
or harms or an accepted practice (e.g. aseptic technique)

<table>
<thead>
<tr>
<th>Category 1C – a mandatory recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category II – a weak recommendation which shows evidence of clinical benefit over harm</td>
</tr>
<tr>
<td>No recommendation – not sufficient evidence to recommend one way or another</td>
</tr>
</tbody>
</table>

**Framework for identifying final key recommendations**

One way of improving implementation of evidence based guidance is by the identification of key recommendations which if applied will improve practice and outcome.\textsuperscript{18-24} This is the foundation of ‘care bundles’ and other quality improvement tools which rely on the identification of key evidence based recommendations to ensure application in practice.\textsuperscript{25}

A method has been developed which aims to reflect graded recommendations in line with ensuring healthcare quality, attention to cost and practical application. It combines approaches used by the Institute of Healthcare Improvement (IHI) and World Health Organization, among others, in identifying the critical factors from the evidence to ensure patient safety in a range of fields.\textsuperscript{24,26} The method considers the current NHSScotland Quality Strategy dimensions and finally expert opinion applied within a formal framework. This framework includes a range of practical considerations under the headings measurement and feedback, feasibility and sustainability, applicability and reach, training and informing.

Ultimately, HPS key recommendations are presented taking all of these factors into account, with the aim of improving practice and outcome.

The search strategy used is described in **Appendix 4**.
Appendix 4: Search Strategy

Database: Ovid MEDLINE(R) <1948 to August Week 3 2011>

Search Strategy:

1. exp Blood Specimen Collection/ (11630)
2. exp Antisepsis/ (3976)
3. exp Anti-Infective Agents/ (1129606)
4. exp Alcohols/ (511106)
5. exp Disinfectants/ (47546)
6. exp Chlorhexidine/ (5286)
7. contamination.mp. (92838)
8. exp Bacteria/ (949536)
9. 2 or 3 or 4 or 5 or 6 (1528212)
10. 7 or 8 (1022780)
11. 1 and 9 and 10 (82)
12. limit 11 to (english language and humans) (72)

Key literature from e.g. the relevant Cochrane reviews were also sourced and critically appraised using SIGN methodology
Appendix 5: Summary of key recommendations for preventing contaminations of a blood culture

Preventing contamination when taking a sample for blood culture

Patient who needs a sample for blood culture

If taking a sample for blood culture is clinically indicated then

Ensure that:
- blood culture bottle tops are decontaminated by rubbing with an antiseptic containing 70% isopropyl alcohol and left to dry
- hand hygiene is performed immediately before the process of taking a blood culture sample (WHO Moment 2)
- a skin antiseptic containing 70% isopropyl alcohol is used to cleanse the skin site and left to dry
- aseptic technique is maintained including use of gloves; don’t touch critical parts, including the skin following disinfection
- the blood culture bottle is inoculated first (if taking blood for other samples)

Practice points
Documenting date and time of taking a sample for blood culture is an important step.
The use of personal protective equipment (PPE) including gloves is important in all procedures where blood and body fluid risk exists.
The featured recommendation on hand hygiene does not detract from other times when hand hygiene is recommended and will be monitored against (namely the 5 Moments for Hand Hygiene).
The featured recommendations do not aim to cover emergency situations, which require clinical judgement for patient care actions.

Further information (Click on highlighted text in the box(es) above to link to evidence underpinning each recommendation)
For further information on the background to these recommendations and the literature reviews that informed these please visit http://www.hps.scot.nhs.uk as well as referring to your local teams and policies.