Targeted literature review:

What are the key infection prevention and control recommendations to inform a peripheral vascular catheter (PVC) maintenance care quality improvement tool?
### HPS ICT Document Information Grid

| **Purpose:** | To present a review of the evidence to inform the content of HAI related quality improvement tools for NHSScotland. This supports the functions of HPS in developing effective guidance, good practice and a competent workforce and translating knowledge to improve health outcomes. |
| **Target audience:** | All NHSScotland staff involved in patient care activities where interventions can lead to HAI, particularly those interventions that can cause bloodstream infections such as line insertion. Infection prevention and control teams in NHS boards and other settings. Partner organisations particularly Healthcare Improvement Scotland and National Education for Scotland to ensure consistent information across similar improvement documentation. |
| **Description:** | Literature critique summary and presentation of key recommendations to inform HAI quality improvement tools, based around a framework that evaluates these against the health impact contribution and expert opinion/practical application. |
| **Update/review schedule:** | Every three years; however if significant new evidence or other implications for practice are published updates will be undertaken. |
| **Cross reference:** | Standard Infection Control Precautions Policies in the National Infection Prevention and Control Manual. Data on HAI incidence and prevalence and process compliance data. Implementation support from Healthcare Improvement Scotland and/or others, education and training support from National Education Scotland. |
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1. Executive summary

Peripheral Vascular Catheters (PVCs) are the most commonly used invasive medical devices within all acute care settings. The use of PVCs is necessary to provide vascular access for the administration of fluids and drugs that cannot be given by any other route e.g. oral.

Despite the many advantages of their use, PVCs can result in complications. Reports indicate that often PVCs are inserted unnecessarily, are not removed in a timely manner when inserted, and are the cause of a number of patient complications including insertion site phlebitis and most importantly cause catheter related blood stream infections (CRBSIs).1-5

There has been a focus on ensuring optimal care of PVCs by the use of quality improvement tools and as a result, the PVC care bundle and associated tools were published on the Health Protection Scotland (HPS) website in March 2008. A review of the content alongside the currently available guidelines and evidence has now been undertaken to ensure that these key infection prevention recommendations are still the most important for optimal maintenance of PVCs and subsequent safety of patients with PVCs.

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 a PVC maintenance quality improvement tool now are:

- Ensure that the clinical need for the PVC is reviewed and recorded every day (on a daily basis) (Category 1A)
- Ensure that medical staff review the need for intravenous (IV) therapy including antibiotics on a daily basis- switch to oral if possible (Category 1B)
- Ensure that hand hygiene is performed immediately before accessing the line/site (WHO Moment 2) (Category 1A)
- Ensure that timely removal of PVCs is considered i.e. if in longer than 72 hours Category 1B)
- Ensure that the PVC site is assessed; removing the PVC where there is phlebitis or other inflammation at the site (Category 1B)
- Ensure that PVC dressings are intact (Category 1A)
- Ensure that an antiseptic containing 70% isopropyl alcohol is used to clean the access hub before accessing – rub the access hub for at least 15 seconds (‘scrub the hub’) (Category 1B)

* to find out more information on the categories of these recommendations see 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 PVC management. A review and recommendations on PVC insertion is available on HPS web pages.

In conclusion: It is advised that the key recommendations listed 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).

2. **Aim of the review**

To review the previous HPS PVC maintenance quality improvement tool content, alongside the currently available guidelines and evidence to ensure that the key recommendations are still the most critical for optimal maintenance of PVCs in patients who require these.

3. **Background**

3.1 **The problem**

PVCs are the most commonly used invasive medical devices within all acute care settings. NHSScotland National HAI Prevalence Surveys of 2007 and 2011 reported that around 30% of inpatients have PVCs\(^3\)\(^6\). Reports indicate that often PVCs are inserted unnecessarily, are not removed in a timely manner when inserted, and are the cause of a number of patient complications including insertion site phlebitis and most importantly cause CRBSIs\(^3\)\(^5\). PVCs can cause CRBSIs by enabling microorganisms to gain direct access to the bloodstream. Infections can arise from microorganisms at the insertion site through contamination of PVCs caused by the hands of healthcare workers, the patient's own skin around the insertion site, as well as contaminated drugs/infusions and entry ports where drugs are administered. Once microorganisms enter and settle on the PVC surface, biofilm can form on the catheter lumen and if the catheter remains in situ long enough, parts of the biofilm can float into the blood stream giving rise to a CRBSI, which is considered a significant morbidity and mortality issue in NHSScotland.\(^5\)

3.2 **Why PVCs are needed**

PVCs are designed to provide vascular access for the administration of fluids and drugs that cannot be given by any other route, e.g. orally. Crucially, they provide this access during actual or potential life-threatening situations when the administration of fluids and or drugs must be immediate. In achieving this they contribute to saving countless lives each day; they also reduce the need for more advanced and invasive vascular access devices such as central vascular catheters.

3.3 **How infections associated with the maintenance of PVCs can be prevented**

The main aim of this PVC maintenance review is to present the evidence for removing PVCs in a timely manner to prevent infection. Other aspects considered critical for preventing infections are care of the insertion site and any ports being accessed to administer drugs or take blood and the need for hand hygiene at the most critical moments when accessing a PVC.
This review of current scientific literature, as well as the process of scoring the resulting recommendations using the health impact and expert opinion framework, aims to ascertain whether there is any new guidance or evidence to inform key recommendations from HPS, including if those existing are still relevant or should be modified to ensure optimal PVC care.

3.4 Out of scope for this review

This literature review does not address any issues specific to:

- Paediatric patients

Activities relating to other lines including:

- Central vascular catheters (CVCs)
- Peripherally inserted central catheters (PICCs)

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 PVCs 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 a review of the current evidence. The previous recommended criteria within the HPS bundles and checklists were used as a basis for the question set in Appendix 1. To further aid the process of deciding what final key recommendations 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 methodology for this is described within Appendix 3; the specific search strategy in Appendix 4 and finally a summary page of the resulting recommendations can be found in Appendix 5.

4.1 Review of evidence base

4.1.1 Final recommendation - Ensure that the clinical need for the PVC is reviewed and recorded every day (on a daily basis) (Category 1A)

This recommendation is based on reports that often PVCs are inserted unnecessarily and evidence that the longer the catheter is in place the greater the risk of complications such as phlebitis and infection.\textsuperscript{1-4,7,8} It is therefore vital that there is clinical indication that PVCs are still required otherwise they should be removed. The Centers for Disease Control and Prevention (CDC) guidelines do not specifically mention this, though there is a recommendation that staff should be educated on the indications for intravascular catheter use.\textsuperscript{9} The Department of Health (DH) high impact intervention however recommends that the continuing clinical indication for intravascular catheters is assessed twice daily and catheters are removed where no longer indicated. Although the DH high impact intervention gives clear instruction about how often PVCs should be assessed, there is no direct supporting evidence reported for the necessity of twice daily checking of clinical requirement for ongoing PVC use.\textsuperscript{10} In addition it may also be practically difficult to ensure and record compliance of twice daily checking. The effect of including this action, in line with the DH high impact intervention, would therefore need to be considered with respect to whether it would improve compliance/safety and reduce the risk of infection for the patient. Epic3 guidelines from England states that insertions sites should be inspected at a minimum during each shift\textsuperscript{11}.

4.1.2 Final recommendation - Ensure that timely removal of PVCs is considered i.e. if in longer than 72 hours (Category 1B)

The HPS PVC maintenance quality improvement tool currently recommends that consideration should be given to removal of PVCs in situ longer than 72 hours. This was based on evidence which showed that the longer a PVC is in situ the greater the risk of complication.\textsuperscript{4,12-14} A recent study examined the effect of increasing the routine replacement from 48-72 hours to 72-96 hours, and although it concluded that this extension was not a risk factor for complication, e.g. phlebitis or infection, it was noted that the absence of a dedicated intravenous (IV) team was a risk.\textsuperscript{15} Further uncertainties have arisen resulting from a recent debate regarding the routine removal of PVCs after 72 or 96 hours versus removal only when clinically indicated. A Cochrane review has been published which concluded that there was insufficient evidence of benefit from routinely removing catheters every 72 to 96 hours and suggested that catheters including PVCs, should be changed on clinical indication.\textsuperscript{16,17}
CDC guidelines state that replacement of PVCs in adults as clinically indicated is an unresolved issue and cites insufficient current evidence specifically on CRBSIs to recommend this.\textsuperscript{9} Conversely, recent epic3 HAI guidelines from England recommend that PVCs should be replaced only when clinically indicated, following the Cochrane Review evidence of 2014\textsuperscript{11}. Due to the ambiguous nature of these recommendations, the evidence which underpins the Cochrane review was further reviewed and critically appraised to determine if it could impact on this key recommendation. Further examination of the evidence underpinning the recommendations that PVCs should be changed when clinically indicated\textsuperscript{1;8;18-20} reveals that it stems largely from studies carried out in Australia and the majority used a dedicated intravenous (IV) team in their studies, which are rare within NHSScotland.\textsuperscript{18;20-22}

The main outcome evaluated within all the studies included was phlebitis, and although CRBSI was measured in five studies, there were only 3 cases in total described in both the intervention and non-intervention groups. Despite the reasonably high number of patients (~5000) included within the studies in the Cochrane review, it may not currently provide sufficient evidence that moving away from routine to clinical indication replacement of PVCs would not result in increased CRBSIs. As PVCs are the most commonly used invasive medical devices within all acute care settings this therefore needs to be taken into account when interpreting these data/studies.\textsuperscript{5}

The nature of the inclusion and exclusion criteria for Cochrane reviews means that only evidence considered high quality, e.g. randomised control trials (RCTs) are included in the assessment of evidence. While the results of RCTs when available in this field are valuable, there are some limitations and challenges that result from taking this approach to the review of literature and assessment of evidence, particularly within the field of infection prevention and control as it can cause some difficulties in assessing the effect of interventions when examined within the wider clinical context. Although interventions have been well described, they are often within a structured, formal study. In this situation, much of the evidence included results from studies where a dedicated intravenous (IV) team trained in recognition of clinical complications of PVC use, were present. NHSScotland quality improvement tools however are designed to be used in clinical settings, which are unlikely to have such specialist staff. In addition, much of the existing evidence for infections associated with PVC use results from outbreak reports and observational studies. This evidence is considered as low quality customarily within the field of evidence based methodology, however in order to form a sound recommendation for practice, the ‘body of evidence’ resulting from these studies needs to be considered alongside the RCTs to ensure there is a full clinical context of the effect of the suggested interventions. Any key recommendations need to be cognisant of this overall clinical context. It is possible therefore that a change in the recommendation may result in less active monitoring/care of the PVC, which would not be desirable.

4.1.3 Final recommendation - Ensure that hand hygiene is performed immediately before accessing the line/site (WHO Moment 2) (Category 1A)

This recommendation, and the importance of hand hygiene performance, is consistent with all current evidence and guidelines. The WHO Guidelines on Hand Hygiene in Health Care (2009)\textsuperscript{23} 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 HAI. These 5 Moments have been widely promoted within NHSScotland for a number of years and hand hygiene performance is measured against these Moments. This recommendation now provides two opportunities; to emphasise the hand hygiene moment when risk is highest in relation to PVC maintenance care/acquisition of infection, rather than attempting to use a resulting quality improvement tool as a means of general hand hygiene promotion, and to allow for monitoring of hand hygiene practices to be consistent across all hand hygiene auditing and quality improvement tool monitoring as is currently taking place in NHSScotland.

Accessing the site has been emphasised as a key factor in acquiring infection and therefore this moment is crucial to protect the patient at a vulnerable time.9,10

In summary, in relation to the risk associated with PVC maintenance, the clearest indication for hand hygiene is Moment 2 ‘before clean/aseptic procedures’ and therefore is considered an essential step in preventing PVC related infections in NHSScotland.

4.1.4 Final recommendation - Ensure that medical staff review the need for intravenous (IV) therapy including antibiotics on a daily basis- switch to oral if possible (Category 1B)

PVCs are commonly inserted for antibiotic therapy in acute admissions.24 The median duration of intravenous (IV) therapy has been shown to be four days in one study.25 The results of the 2009 European Surveillance of Antimicrobial Consumption (ESAC) survey of Scottish hospitals showed that out of a total of 8,732 patients surveyed 2,425 (27.8%, hospital range 5.6%-47.1%) were prescribed 3,511 antimicrobials. Of the total number of antimicrobials prescribed 50.5% (hospital range 0% - 85.7%) were given by the parenteral route.26 The majority are given through PVCs, and some occasionally through Central Vascular Catheters (CVCs).

Antibiotic review is a key component of hospital antimicrobial stewardship programmes. The clinical and cost effectiveness of stewardship programmes as part of overall HAI reduction strategies is well documented.27-30 A clear example of this is the impact of improved compliance with the choice of empiric treatment in Scotland on Clostridium difficile infection (CDI) rates.31

‘Continuing care’ prescribing is now being addressed following progress on ‘front end’ hospital prescribing. There has been an association between the long duration of PVCs and the development of CRBSIs including Staphylococcus aureus bacteraemia (SABs), which remains a source of concern. In addition, there is evidence to indicate that the quality of prescribing in continuing care is also an area of concern with a practice of inadequate review of the antibiotic indication/need, route, duration and supporting microbiology.32 This could undoubtedly contribute to CDI, antibiotic resistance, line related infections and their complications.

There is therefore a clear need for a more robust method to support antibiotic review in the workplace. This review is ideally timed between 48-92 hours post admission to hospital, when the patient’s clinical progress/stability and prognosis is more certain, and there is more laboratory and imaging information available to allow an informed adjustment to the treatment.
This would also fit into the time frame for considering the removal of PVCs in situ longer than 72 hours (a recommendation of the PVC quality improvement tool).

The evidence base to support this antibiotic review intervention has been appraised. Existing evidence is not based on randomised control trials (RCTs) but is primarily experiential and often in the form of quality improvement tests, is biologically plausible, and has some consistency of association and some evidence to support that the proposed changes influences outcomes. All of these are core components of Bradford Hill’s criteria for examining cause and effect when reviewing evidence for the effectiveness of interventions.

For note: The antibiotic review should include the following components: review of the indication for the antibiotic, review of the patient’s clinical progress and original indication for the antibiotic, review of the microbiology so that the antibiotic choice can be further streamlined and the review of the need for further IV therapy and duration of treatment/antibiotic stop date.

4.1.5 Final recommendation - Ensure that the PVC site is assessed; removing the PVC where there is phlebitis or other inflammation at the site (Category 1B)

There is substantial evidence to support the removal of PVCs if clinically indicated e.g. signs of complications such as phlebitis, infection or if the catheter is blocked, with the aim of preventing further complications/infection. The DH high impact intervention does not specifically include this as a key action, but does recommend site inspection, which is a documented review of the catheter site for signs of infection at least daily e.g. using visual infusion phlebitis (VIP) score tool. The CDC guidelines state ‘Remove peripheral vascular catheters if the patient develops signs of phlebitis (warmth, tenderness, erythema or palpable vascular cord), infection or a malfunctioning catheter.’ This evidence based recommendation is therefore very clearly described in relation to potential for harm and consistent with current quality improvement tools recommendations. Additionally, epic3 guidelines advise that the catheter “should be removed when complications occur or as soon as it is no longer needed.”

4.1.6 Final recommendation - Ensure that PVC dressings are intact (Category 1A)

The DH high impact intervention includes a care action, which is ‘a sterile, semi permeable, transparent dressing is used therefore allowing observation of insertion site.’ This is also in line with epic3 guidelines from England. Although the recommendation to use a transparent dressing includes no supporting evidence, it is clear that this is a practical consideration to enable easy visualisation of the PVC site. The CDC guidelines report that the rates of colonisation and occurrence of phlebitis from catheters dressed with either gauze or semi-permeable transparent dressings are comparable. It has been concluded that the choice of dressing is based on preference or factors like the presence of blood oozing from the catheter site, as well as visualisation. It is therefore recommended that either sterile gauze or transparent, semi-permeable dressings are used to cover the catheter site, while assessment of the PVC site occurs daily by palpation through the dressing or inspection if the dressing is transparent. If the dressings are not intact or have become loosened this increases the risk of microorganisms gaining entry via the PVC. Therefore dressings should always be replaced if damp, loosened or visibly soiled.
4.1.7 Final recommendation - Ensure that an antiseptic containing 70% isopropyl alcohol is used to clean the access hub before accessing – rub the access hub for at least 15 seconds ('scrub the hub') (Category 1B)

It has been previously reported that hubs and connection points are generally contaminated and must be disinfected before being accessed by healthcare workers (HCWs).\(^\text{14,40,42}\)

On a separate issue, needleless ports were originally introduced to reduce the risk to staff from needlestick injuries.\(^\text{43}\) Subsequent developments in this technology have resulted in numerous different connectors which include split-septum devices, mechanical valve devices and mechanical valve devices with positive fluid displacement. Since their introduction unfortunately there have been a number of reports of increased CRBSIs.\(^\text{44-46}\)

There has subsequently been a focus on the importance of adequate and thorough decontamination of access hubs and connection points and specifically these needleless ports. The DH high impact intervention\(^\text{47}\) and epic3 guidelines\(^\text{11}\) currently include a care action which states that 2% chlorhexidine in 70% isopropyl alcohol should be used to decontaminate the port and surrounding area and allowed to dry prior to access. The CDC guidance however recommends that access ports should be ‘scrubbed’ with the appropriate antiseptic (chlorhexidine, or 70% isopropyl alcohol).\(^\text{9}\) The evidence for the use of 2% chlorhexidine gluconate in 70% isopropyl alcohol is extrapolated mainly from studies on CVCs where catheters are left in situ long term.\(^\text{40}\) There is little specific evidence on effective decontamination and disinfection of hubs in PVC use.\(^\text{48}\) There is however some debate on whether it is the design of the hubs/ports or the method of cleaning itself which is important in the effective decontamination. Two recent microbiological studies which examined decontamination of different designs of access hubs showed that 15 seconds of a scrubbing action with 70% isopropyl alcohol was as effective as 2% chlorhexidine in 70% isopropyl alcohol. Although these studies are relatively small scale, they have provided further evidence that it is the method of action of cleaning the hubs which is important rather than the use of a specific disinfectant, e.g. chlorhexidine, in this regard. This is of particular importance when considering the different designs of the needleless port components.\(^\text{48,49}\) It is therefore concluded, based on a review of the evidence, that this is a key recommendation consistent with the CDC guidelines to ‘scrub the hub’ with 70% isopropyl alcohol.\(^\text{9}\) It could also be argued that the use of such a recommendation will perhaps encourage staff to remember, aiding compliance with port access care and therefore is consistent with the overall ethos of quality improvement tools and ensuring reliable good practice. In summary, this is a microbiologically driven recommendation, given the evidence with regards to known contamination and effectiveness of cleansing, as well as the obvious potential for PVC connectors to become easily contaminated and pose a risk of infection on a day to day basis.

4.2 Review of additional evidence based on initial search findings

4.2.1 Administration set replacement (Category 1A)

The Department of Health (DH) high impact intervention recommends replacement immediately after administration of blood, blood products and all other fluid sets after 72 hours.\(^\text{50}\) The Centers for Disease Control and Prevention (CDC) guidelines recommend that administration sets which are continuously used,
including secondary sets and add-on devices, are changed no more frequently than at 96 hour intervals but at least every 7 days\textsuperscript{9} (and immediately after blood, blood products or lipid). This is consistent with a Cochrane Review.\textsuperscript{51,52} Epic3 guidelines advise that “administration sets in continuous use do not need to be replaced more frequently than every 96 hours” unless for blood and blood components in which case they should be changed “when the transfusion episode is complete or every 12 hours, whichever is sooner.”\textsuperscript{11}

Despite the availability of evidence on the timing of administration set replacement, it is clear that there is not one single recommendation that can be incorporated in a quality improvement tool, but rather a list of instructions would need to be incorporated within procedures to ensure clear guidance for practice. The inclusion of this recommendation was considered within the context of the overall aims of NHSScotland quality improvement tools and it was concluded that this would not fit as it is a description of a procedure rather than one single recommendation. Changing administration sets should therefore be considered separately to avoid confusion in practice with regards to the critical elements for preventing PVC infections and CRBSI. It is concluded that specific information regarding the timing of administration set replacement will be included within other supporting tools or advice e.g. cause and effect chart.

\textbf{In conclusion:} It is advised that the key recommendations listed 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).
Targeted literature review: What are the key infection prevention and control recommendations to inform the peripheral vascular catheter (PVC) maintenance care quality improvement tool?

5. References


18. Rickard CM, McCann D, Munnings J, McGrail MR. Routine resite of peripheral intravenous devices every 3 days did not reduce complications compared with clinically indicated resite: a randomised controlled trial. BMC Medicine 2010;8:53.


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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

The PVC care bundle and associated tools were first published on the HPS website in May 2008.

The criteria below were used as the question set to frame this review of the evidence base.

- Checking that the PVCs in situ are still required.
- Removing the PVCs where there is extravasation or inflammation.
- Checking that the PVC dressings are intact.
- Considering removal of PVCs in situ longer than 72 hours.
- Performing hand hygiene before and after all PVC procedures.
## Appendix 2: Framework – tool to evaluate evidence based recommendations alongside the health impact contribution and expert opinion (based on the target group covered by this review)

<table>
<thead>
<tr>
<th>Recommendation for review</th>
<th>Ensure that the clinical need for the PVC is reviewed and recorded every day (on a daily basis).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of recommendation</td>
<td>Category 1A</td>
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</table>

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

<table>
<thead>
<tr>
<th>Safe:</th>
<th>This recommendation encourages timely removal of a PVC, reducing the chance of associated infectious complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective:</td>
<td>This recommendation reduces the risk of complications from this invasive device, including on occasions systemic (blood stream) infections.</td>
</tr>
<tr>
<td>Efficient:</td>
<td>This recommendation reduces the risk of infection complications by ensuring that a PVC is only in place if there is a clinical need, this may result in releasing time for other care and a reduction in associated NHS costs</td>
</tr>
<tr>
<td>Equitable:</td>
<td>This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all</td>
</tr>
<tr>
<td>Timely:</td>
<td>This recommendation, daily checking, fits with other aspects of care required on a daily basis, contributing to streamlining of care</td>
</tr>
</tbody>
</table>

### Person Centred: This is a person centred action to reduce harm which could be caused by the invasive device; in every patient with a PVC and provides the opportunity to undertake simple, safe checks and care on each and every patient with a PVC

### 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>
<th>Training and informing (Y/N/?)</th>
</tr>
</thead>
<tbody>
<tr>
<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>Potential for consistent delivery</td>
<td>Easily implemented based on reliably available resources/products/prompts</td>
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<tr>
<td>Stealth integration into natural workflow/logical clarity of concept (also see Cause &amp; Effect Chart)</td>
<td>Unambiguous</td>
<td>Potential for applicability to a wide range of settings</td>
<td>Avoids unintended consequences/perverse behaviour</td>
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<th>Potential for congruency in design and meaning, with HCW, trainer and observer training and education</th>
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| Y | Y | Y | Y | Y | Y | Y | Y | ? | Y |

### Is this a key recommendation?

Yes
**Recommendation for review**

Ensure that medical staff review the need for intravenous (IV) therapy including antibiotics on a daily basis; switch to oral if possible

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

Category 1B

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

**Safe**: This recommendation encourages timely removal of a PVC, reducing the chance of associated infectious complications

**Effective**: This recommendation reduces the risk of complications from this invasive device, including on occasions systemic (blood stream) infections.

**Efficient**: This recommendation reduces the risk of infectious complications by ensuring that a PVC is only in place if there is a clinical need, this will result in releasing time for other care and a reduction in associated NHS costs. Antibiotic review is a key component of hospital antimicrobial stewardship programmes as part of overall HAI reduction strategies and this recommendation helps streamlining of care.

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

**Timely**: This recommendation, daily checking, fits with other aspects of care required on a daily basis, contributing to streamlining of care. This recommendation combines both infection prevention and control strategies with patient and clinical management and will fit well into the patient care routine and should aid efficient use of time.

**Person Centred**: This is a person centred action to reduce harm which could be caused by the invasive device; in every patient with a PVC and provides the opportunity to undertake simple, safe checks and care on each and every patient with a PVC

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**Expert opinion/consultation and practical considerations**

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</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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</table>
**Recommendation for review**

Ensure that hand hygiene is performed immediately before accessing the line/site (WHO Moment 2).

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

Category 1A

<table>
<thead>
<tr>
<th>Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)</th>
<th>Safe: Not implementing this recommendation would put the patient at risk of harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective: This recommendation has been shown to be effective in reducing the risk of complications resulting from contaminated hands of healthcare workers. This includes contamination of the insertion/access site which enables access to the patient’s blood stream which can result in systemic blood stream infections.</td>
<td></td>
</tr>
<tr>
<td>Efficient: This recommendation reduces the risk of infectious complications and may result in releasing time for other care in a reduction in associated NHS costs</td>
<td></td>
</tr>
<tr>
<td>Equitable: This recommendation promotes a standard of care for all patients that may result in a reduction in avoidable personal and NHS costs, which is also beneficial to all</td>
<td></td>
</tr>
<tr>
<td>Timely: This recommendation should be an integral part of healthcare worker activity and patient/individual care</td>
<td></td>
</tr>
<tr>
<td>Person Centred: This is a patient centred action to reduce harm caused by the invasive device in every patient with a PVC. It also provides the opportunity to undertake simple, safe checks and care on each and every patient with a PVC and allows for patients/individuals to be aware of the importance of hand hygiene and their role in this</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expert opinion/consultation and practical considerations</th>
<th>Measurement and feedback (Y/N/?)</th>
<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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<tbody>
<tr>
<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>Potential for consistent delivery</td>
<td>Stealth integration into natural workflow/logical clarity of concept (also see Cause &amp; Effect Chart)</td>
<td>Unambiguous</td>
</tr>
<tr>
<td>Easily implemented based on reliably available resources/products/prompts</td>
<td></td>
<td></td>
<td>Potential for applicability to a wide range of settings</td>
<td>Avoids unintended consequences/ perverse behaviour</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Potential for congruency in design and meaning, with HCW, trainer and observer training and education</td>
</tr>
</tbody>
</table>

| Y | Y | Y | Y | ? | Y | Y | Y |

**Is this a key recommendation?** Yes
<table>
<thead>
<tr>
<th>Recommendation for review</th>
<th>Ensure that timely removal of PVCs is considered i.e. if in longer than 72 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of recommendation (based on review of evidence)</td>
<td>Category 1B</td>
</tr>
</tbody>
</table>
| **Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)** | **Safe:** This recommendation encourages timely removal of a PVC, reducing the chance of associated infectious complications  
**Effective:** This recommendation reduces the risk of complications from this invasive device, including on occasions systemic (blood stream) infections.  
**Efficient:** This recommendation reduces the risk of infectious complications by ensuring that a PVC is only in place if there is a clinical need, this may result in releasing time for other care and a reduction in associated NHS costs  
**Equitable:** This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all  
**Timely:** This recommendation, daily checking, fits with other aspects of care required on a daily basis, contributing to streamlining of care  
**Person Centred:** This is a person centred action to reduce harm which could be caused by the invasive device; in every patient with a PVC and provides the opportunity to undertake simple, safe checks and care on each and every patient with a PVC |
| **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 | 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 |
| **Is this a key recommendation?** | Yes |

Health Protection Scotland       v2.0. September 2014
**Recommendation for review**

Ensure that the PVC site is assessed; removing the PVC where there is phlebitis or other inflammation at the site

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

Category 1B

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

- **Safe:** This recommendation encourages timely removal of a PVC, reducing the chance of associated infectious complications.
- **Effective:** This recommendation reduces the risk of complications from this invasive device, including on occasions systemic (blood stream) infections.
- **Efficient:** The removal of PVCs as soon as complications are evident may result in releasing time for other care and a reduction in the NHS costs associated with complications such as CRBSIs.
- **Equitable:** This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all.
- **Timely:** This recommendation, daily checking, fits with other aspects of care required on a daily basis, contributing to streamlining of care.
- **Person Centred:** This is a person centred action to reduce harm which could be caused by the invasive device; in every patient with a PVC and provides the opportunity to undertake simple, safe checks and care on each and every patient with a PVC.

**Expert opinion/consultation and practical considerations**

- **Measurement and feedback (Y/N/?)**
  - Easily implemented within current culture and will improve the quality of care now
  - 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

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<tr>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Is this a key recommendation?**

Yes
**Recommendation for review**
Ensure that PVC dressings are intact

**Grade of recommendation (based on review of evidence)**
Category 1A

<table>
<thead>
<tr>
<th>Health impact contribution (based on Healthcare Quality Strategy for NHSScotland)</th>
<th>Safe: This recommendation reduces the risk of complications from this invasive device</th>
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</tr>
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<td>Efficient: This recommendation reduces the risk of infectious complications and may result in releasing time for other care and in a reduction in associated NHS costs</td>
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<td>Easily implemented within current culture and will improve the quality of care now</td>
<td>Potential for consistent delivery</td>
<td>Easily implemented based on reliably available resources/products/prompts</td>
</tr>
</tbody>
</table>

| Y | Y | Y | Y | ? | Y | ? | Y |

**Is this a key recommendation?** Yes
**Recommendation for review**

Ensure that a single use antiseptic containing 70% isopropyl alcohol is used to clean the access hub before accessing – rub the access hub for at least 15 seconds (‘scrub the hub’)

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

Category 1B

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

<table>
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<td>This recommendation reduces the risk of complications from this invasive device, including on occasions systemic (blood stream) infections</td>
</tr>
<tr>
<td>Efficient:</td>
<td>This recommendation reduces the risk of infectious complications and may result in releasing time for other care and in a reduction in associated NHS costs</td>
</tr>
<tr>
<td>Equitable:</td>
<td>This recommendation promotes a standard of care for all patients, that may result in a reduction in avoidable personal and NHS costs, which is beneficial for all</td>
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<tr>
<td>Timely:</td>
<td>This recommendation, fits with other aspects of care required on a daily basis, contributing to stream lining of care</td>
</tr>
<tr>
<td>Person Centred:</td>
<td>This is a person centred action to reduce harm which could be caused by the invasive device; in every patient with a PVC</td>
</tr>
</tbody>
</table>

**Expert opinion/consultation and practical considerations**

<table>
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<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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<tr>
<td>Y</td>
<td>?</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Is this a key recommendation?**

Yes
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 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 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. 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) |
| Category 1C – a mandatory recommendation |
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{34,36,55-59} 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{60}

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 Organisation, among others, in identifying the critical factors from the evidence to ensure patient safety in a range of fields.\textsuperscript{56,61} 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 April Week 3 2011>

Search Strategy:
---------------------------------------------------------------------
1 Catheterization/ or exp Catheterization, Peripheral/ (37696)
2 peripheral vascular catheter.mp. (79)
3 venflon.mp. (40)
4 1 or 2 or 3 (37751)
5 phlebitis.mp. (4605)
6 extravasation.mp. (11103)
7 exp Bacteremia/ or bacteraemia.mp. (18980)
8 blood stream infection$.mp. (346)
9 thrombophlebitis.mp. (22148)
10 5 or 6 or 7 or 8 or 9 (56084)
11 4 and 10 (1378)
12 limit 11 to (english language and humans and yr="2006 -Current") (215)
13 from 12 keep 1-212 (212)

Search Strategy for 2014 update:
Database: Ovid MEDLINE(R) 1946 to Present with Daily Update, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations May 09, 2014

Search Strategy:
---------------------------------------------------------------------
1 exp Catheterization/ or exp Catheterization, Peripheral/ (186447)
2 peripheral vascular catheter.mp (5)
3 peripheral venous catheter.mp (129)
3 venflon.mp (44)
4 1 or 2 or 3 (186528)
5 phlebitis.mp (4999)
6 extravasation.mp (13268)
7 exp Bacteremia/ or bacteraemia.mp (23292)
8 bacteremia.mp (27609)
9 blood stream infection$.mp (658)
10 bloodstream infection$.mp (4811)
11 thrombophlebitis.mp (22871)
12 5 or 6 or 7 or 8 or 9 or 10 or 11 (76251)
13 4 and 12 (4543)
14 limit 13 to (English language and yr="2011-Current") (582)

Key literature from e.g. the relevant Cochrane reviews was also sourced and critically appraised using SIGN methodology
Appendix 5: Summary of key recommendations for PVC insertion and maintenance

Preventing infections when inserting and maintaining a PVC

Patient who needs a peripheral vascular catheter (PVC)

When inserting a PVC

Ensure that:
- a PVC is clinically indicated for this patient
- hand hygiene is performed immediately before all PVC insertion procedures (WHO Moment 2)
- a single-use skin antiseptic containing 70% isopropyl alcohol is used to cleanse skin and left to dry before insertion
- aseptic technique is maintained throughout insertion procedure i.e. ‘critical parts are not touched’
- a sterile transparent, semipermeable dressing is used to cover the catheter site

When maintaining an inserted PVC and accessing the insertion site and line

Ensure that:
- the clinical need for the PVC is reviewed and recorded every day (on a daily basis)
- medical staff review the need for intravenous (IV) therapy including antibiotics on a daily basis - switch to oral if possible
- hand hygiene is performed immediately before accessing the line/site (WHO Moment 2)
- removal of PVCs is considered if in longer than 72 hours
- the PVC site is assessed: removing the PVC where there is phlebitis or inflammation at the site
- PVC dressings are intact
- a single-use antiseptic containing 70% isopropyl alcohol is used to clean the access hub before accessing – rub the access hub for at least 15 seconds (“scrub the hub”)

Practice points

Documenting date and time of catheter insertion is an important step to achieve timely line removal.
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](http://www.hps.scot.nhs.uk) as well as referring to your local teams and policies.