Targeted literature review:

What are the key infection prevention and control recommendations to inform a minimising ventilator associated pneumonia (VAP) 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: October 2012
<table>
<thead>
<tr>
<th><strong>HPS ICT Document Information Grid</strong></th>
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<tbody>
<tr>
<td><strong>Purpose:</strong></td>
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<tr>
<td>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.</td>
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<tr>
<td><strong>Target audience:</strong></td>
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<td>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.</td>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>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.</td>
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<tr>
<td><strong>Update/review schedule:</strong></td>
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<tr>
<td>Every three years; however if significant new evidence or other implications for practice are published updates will be undertaken.</td>
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<td><strong>Cross reference:</strong></td>
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<td><strong>Update level:</strong></td>
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<tr>
<td>Practice – some change to practice, described throughout the document particularly the key recommendations.</td>
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<tr>
<td>Procurement – any implications will be presented on a separate summary sheet.</td>
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<tr>
<td>Research – broad recommendations are given where gaps were identified.</td>
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Targeted literature review: What are the key infection prevention and control recommendations to inform a minimising ventilator associated pneumonia (VAP) quality improvement tool

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1. Executive summary

Ventilator associated pneumonia (VAP) is the leading cause of healthcare associated infection (HAI) within intensive care units (ICUs) and results in a high level of morbidity and mortality.\textsuperscript{1,2} VAP can be caused by: aspiration of microorganisms i.e. from the oropharynx or stomach; contamination within the ICU environment, particularly immediate environment i.e. use of contaminated equipment, water, hands of healthcare workers or via humidified unsterile water or microorganisms from other sites of infection/colonisation.\textsuperscript{1-3} Risk factors which can increase the risk of VAP include prolonged duration of mechanical ventilation, factors which increase the likelihood of aspirations such as patients lying in supine position, increased gastric pH, and use of contaminated equipment.\textsuperscript{1-3} Strategies to minimise and prevent VAP focus on three main aspects for interventions which are aimed at preventing aspiration, colonisation and contamination of equipment.\textsuperscript{1}

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 ventilator associated pneumonia quality improvement tool now are:

**Key recommendations:**

- Sedation to be reviewed and, if appropriate, stopped each day.
- All patients will be assessed for weaning and extubation each day.
- Avoid supine position, aiming to have the patient at least 30-45º head up.
- Use chlorhexidine 6 hourly, as part of daily mouth care.
- Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours.

* 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 covering ventilator associated infection. Other locally available procedures and tools should address all steps related to ventilator care.
2. Aim of the review

To review the evidence base with a view to seeking 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 the minimisation of ventilator associated pneumonia (VAP). HPS Infection Control Team to undertake a review of minimisation of VAP quality improvement tool developed by Scottish Intensive Care Society Audit Group (SICSAG) in 2008.

3. Background

3.1 The problem

Mechanical ventilation can be a life saving necessity for critically ill patients however this intervention can result in VAP, which is the leading cause of HAI within ICUs and associated with a high level of morbidity and mortality.\(^1\)\(^2\) The annual report of surveillance being undertaken in Scottish ICUs reported that pneumonia was the most common HAI within these settings and VAP accounted for approximately 80% of the overall total.\(^4\) VAP can be caused by: aspiration of microorganisms i.e. from the oropharynx or stomach; contamination within the ICU environment, particularly immediate environment i.e. use of contaminated equipment, water, hands of healthcare workers or via humidified unsterile water or microorganisms from other sites of infection/colonisation.\(^1\)^\(^3\) Risk factors which can increase the risk of VAP include prolonged duration of mechanical ventilation, factors which increase the likelihood of aspirations such as patients lying in supine position, increased gastric pH, and use of contaminated equipment.\(^1\)^\(^3\)

3.2 Key interventions to minimise VAP

Infection prevention related strategies to minimise and prevent VAP focus on three main aspects for interventions which are aimed at preventing aspiration, colonisation and contamination of equipment.\(^1\)

3.3 Out of scope for this review

This literature review does not address any issues specific to:

- Pediatric patients.
- Specific care actions related to clinical management (even if it is thought there may be an association with infection prevention).

3.4 Assumptions

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 urinary catheters 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. The results of the initial rapid search and review of the evidence is presented in Appendix 2. The methodology for this is described within Appendix 3.

4.1 Review of evidence base

4.1.1 Sedation to be reviewed and, if appropriate, stopped each day

Mechanical ventilation within intensive care is a life saving process when needed, however the risk of VAP has been shown to be directly associated with its duration and a cumulative incidence of 10 to 25% has been reported. The sedation required can result in a number of adverse effects including prolonging intubation. It is therefore consistently recommended within current evidence based guidelines that there should be daily review and sedation interruption unless clinically contraindicated. This recommendation is valid and should continue to be included in a quality improvement tool.

4.1.2 All patients will be assessed for weaning and extubation each day

The duration of intubation is associated with an increased risk of VAP, therefore one of the simplest ways of reducing patients’ risk is to ensure that there are extubated as soon as clinically possible. In addition, the APIC guidelines recommend that along with review of sedation there should be a review of readiness to wean and this should be carried out on a daily basis. The DH High Impact Intervention however do not include a specific care action related to weaning or extubation. The possibility of combining the sedation and ventilator weaning protocols has been reported. However it is not within the remit or the expertise of the HPS ICT to evaluate or comment on this approach. This recommendation is valid and should continue to be included in a quality improvement tool.

4.1.3 Avoid supine position, aiming to have the patient at least 30º head up

This recommendation to avoid a supine position is consistent across all identified sources of evidence based guidance and therefore it is concluded that this recommendation is still valid. However the angle of elevation is generally stated as 30-45ºC (unless contraindicated). This recommendation is valid and should continue to be included in a quality improvement tool.

4.1.4 Use chlorhexidine as part of daily mouth care

The use of a chlorhexidine solution has been shown to be an effective way of reducing VAP in mechanically ventilated patients and this recommendation is consistent across all the current identified sources of evidence based guidance. However there is a variation between the recommended frequency of use as part of mouth care. The DH High Impact Intervention includes a more detailed recommendation;
The mouth is cleaned with chlorhexidine gluconate (≥ 1-2% gel or liquid) 6 hourly (as chlorhexidine can be inactivated by toothpaste, a gap of at least 2 hours should be left between its application and tooth brushing). This is consistent with the recommendation within the APIC guideline of ‘compliance with regular antiseptic oral care (e.g. every 2 to 4 hours, tooth brushing every 6 hours).’

In conclusion the use of chlorhexidine as part of daily mouth care is consistent with current evidence. It is suggested that modification of the wording should be considered to aid translation of this key recommendation into practice.

This recommendation is valid and should continue to be included in a quality improvement tool.

4.1.5 Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours

This is consistent with the recommendation within the DH High Impact Intervention apart from 48 hours expectation of intubation rather than 72 hours ‘a tracheal tube (endotracheal or tracheostomy) which has a subglottic secretion drainage port is used if the patient is expected to be intubated for >72 hours.’

As a result of this review it is concluded that this recommendation is valid and should continue to be included in a quality improvement tool. It is not within the remit or expertise of the HPS ICT to further evaluation duration of ventilation expected before this should be applied.

This recommendation is valid and should continue to be included in a quality improvement tool.

4.2 Review of additional evidence based on initial search findings

4.2.1 Peptic ulcer prophylaxis

There is evidence to show that the risk of VAP increases with increased gastric pH as this is associated with greater colonisation with pathogens. As a result the DH High Impact Intervention includes recommendations that stress ulcer prophylaxis is prescribed only to high risk patients according to locally developed guidelines. Although this is discussed within the APIC guidelines, it is not specifically included as a key recommendation and therefore it may warrant further consideration for inclusion.
5. References


Appendix 1: Previous criteria under review

The ventilator associated pneumonia (VAP) bundle, checklist and associated tools were first published on the HPS website in 2008. The criteria below were used as the question set to frame this review of the evidence base

- Sedation to be reviewed and, if appropriate, stopped each day.
- All patients will be assessed for weaning and extubation each day.
- Avoid supine position, aiming to have the patient at least 30º head up.
- Use chlorhexidine as part of daily mouth care.
- Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours.
### Appendix 2: Initial rapid search and review of evidence

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Comparison with evidence based guidance</th>
<th>Interpretation/Comment</th>
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<tbody>
<tr>
<td>Sedation to be reviewed and, if appropriate, stopped each day</td>
<td>The APIC guidelines recommend that there should be daily sedation interruption unless clinically contraindicated.</td>
<td>This recommendation is consistent across the most current sources of evidence based guidance and therefore it is concluded that it is still valid.</td>
</tr>
<tr>
<td></td>
<td>The DH High Impact Intervention also includes a care element of carrying out a sedation level assessment that sedation is reduced/held for assessment at least daily (unless contraindicated)</td>
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<tr>
<td>All patients will be assessed for weaning and extubation each day</td>
<td>The APIC guidelines recommend that along with review of sedation there should be a review of readiness to wean. Assessment of need for intubation is not specifically mentioned within this guideline.</td>
<td>This is included within the APIC guidelines but not the DH High Impact Intervention, therefore a targeted systematic review to fully elucidate whether this should be included within a quality improvement tool.</td>
</tr>
<tr>
<td></td>
<td>The DH High Impact Intervention does not include a specific care action related to weaning or extubation.</td>
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<tr>
<td>Avoid supine position, aiming to have the patient at least 30º head up</td>
<td>The DH High Impact Intervention includes a care element that 'the head of the bed is elevated to 30-45ºC (unless contraindicated).'</td>
<td>This is recommendation is consistent across all the current identified sources of evidence based guidance and therefore it is concluded that this recommendation is still valid.</td>
</tr>
<tr>
<td></td>
<td>This is also recommended within the APIC guidelines.</td>
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</table>
| **Use chlorhexidine as part of daily mouth care** | The DH High Impact Intervention includes a more detailed recommendation;

‘The mouth is cleaned with chlorhexidine gluconate (≥ 1-2% gel or liquid) 6 hourly (as chlorhexidine can be inactivated by toothpaste, a gap of at least 2 hours should be left between its application and tooth brushing’.

This consistent with the recommendation within the APIC guideline that ‘compliance with regular antiseptic oral care (e.g. every 2 to 4 hours, tooth brushing every 6 hours).’

This recommendation is consistent across all the current identified sources of evidence based guidance and therefore it is concluded that this recommendation is still valid. However there is a difference between the recommended timing required of daily cleaning versus 6 hourly cleaning and this should be evaluated further to determine if the wording should be modified.

| **Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours** | The DH High Impact Interventions includes 2 care elements; A tracheal tube (endotracheal or tracheostomy) which has a subglottic secretion drainage port is used if the patient is expected to be intubated for >72 hours.

Secretions are aspirated via the subglottic secretion port 1-2 hourly.

This is only included within the DH High Impact Intervention and therefore a targeted systematic review is indicated to assess the evidence base.

| **Stress ulcer prophylaxis** | The DH High Impact Intervention includes recommendations that:

Stress ulcer prophylaxis is prescribed only to high-risk patients according to locally developed guidelines.

This is also included within the APIC guidelines.
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 HPS 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 minimisation of VAP

- 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\(^{11}\) 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 Healthcare Associated Infection (HAI) Quality Improvement Tools Group in Scotland.