

RESEARCH

Maintaining asepsis in paramedicine: A Delphi study

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Abstract

Background: The body's natural defences are breached during invasive procedures conducted during paramedic clinical care. Despite the complexity of these procedures, asepsis is a clinical goal for all invasive procedures. In doing so, it is critical that 'key-parts' and 'key-sites' are protected to decrease the risk of transmitting healthcare-associated infections (HAIs). Although a national framework in Australia for the prevention of HAIs exists, this advice needs adapting to the field of paramedicine to account for variation in practice setting and clinical practice. This project aimed to reach consensus among experts regarding how to maintain asepsis in paramedic practice.

Methods: A modified Delphi process was used with four iterative online rounds. Participants were sought nationally using a snowball (bias) technique and included professionals within healthcare who met the inclusion criteria of extensive experience in one or more of three areas: paramedicine, infection prevention and control (IPC) and evidence-based policy development.

Results: Eleven experts in the field of IPC and paramedicine contributed to a consensus project regarding how to maintain asepsis in paramedic practice.

Conclusion: This project provides a consensus statement that will allow operational procedures to be reviewed, techniques specific to paramedic practice to be developed and implemented, and scientific research to be conducted.

Keywords

infection control; asepsis; paramedicine

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BACKGROUND

Acquiring a healthcare-associated infection (HAI) is a complicated interaction between risk factors, pathogenic microorganisms and their modes of transmission, and susceptible hosts.(1) This interaction has been described as the *chain of infection* (1) and, despite the complexity of procedures, asepsis is a clinical goal for all invasive clinical procedures.(2) The importance of aseptic techniques in paramedic practice is demonstrated in national policies, for example utilising aseptic techniques is a key component of the National Safety and Quality Health Service (NSQHS) 'Standard 3: preventing and controlling healthcare associated infections'.(3) The National Health and Medical Research Council (NHMRC) (4) recommends that to prevent infectious agents gaining access to sterile tissues, an aseptic technique should be used during any procedure that breaches the body's natural defences. To achieve this aim the aseptic non-touch technique (ANTT®) (2) is a standardised framework that prevents infectious agents being introduced in sufficient quantity from a healthcare worker or the immediate healthcare environment to critical parts of procedural medical

equipment (key-parts) and open wounds or medical device access sites (key-sites) (Table 1).

As paramedic clinical care includes procedures that breach the body's natural defences, such as peripheral intravenous catheterisation,(6) it is important that key-parts and key-sites are protected to decrease the risk of transmitting HAIs. The ANTT® framework includes a choice between standard and surgical aseptic techniques to protect these key sites.(5) In paramedic practice the standard aseptic technique within the ANTT® framework would be suitable most of the time as most of the procedures within paramedicine are technically simple and short in duration. The standard aseptic technique for procedures that involve few key-parts or key-sites uses hand hygiene, non-sterile gloves, a general aseptic field combined with critical micro-aseptic fields, and a non-touch technique to achieve asepsis.(7)

In May 2018 the inaugural 'Asepsis and hand hygiene workshop', hosted by the NSW Ambulance Service, called for a paramedicine specific approach to maintaining asepsis. The warrant for this recommendation came from industry observation and

Table 1. The principles of the ANTT® framework grouped by clinical practice and organisational management

Principle	Clinical practice details
Principle 1	The aim of ANTT® for invasive and clinical procedures is always asepsis.
Principle 2	Asepsis is achieved by protecting key-parts and key-sites from microorganism transfer from the healthcare worker and the immediate environment.
Principle 3	ANTT® needs to be efficient as well as safe. Surgical ANTT® is used for complicated procedures and standard ANTT® for uncomplicated procedures.
Principle 4	Choice of surgical or standard ANTT® is based on an ANTT® risk assessment, according to the technical difficulty of protecting key-part and key-site asepsis. This principle relies on four safeguards. <ul style="list-style-type: none"> • Safeguard 1: <i>Basic infective precautions:</i> precautions include hand cleaning and environmental controls; significantly reduce the risk of contaminating key-parts and key-sites. • Safeguard 2: <i>Identification of key-parts and key-sites:</i> key-parts are the critical parts of the procedure equipment that, if contaminated, are most likely to cause infection. Key-sites are open wounds and medical device access sites. • Safeguard 3: <i>Non-touch technique:</i> non-touch technique is a critical skill that protects key-parts and key-sites from the healthcare worker and the procedure environment; used in both surgical and standard ANTT®. • Safeguard 4: <i>Aseptic field management:</i> ANTT® is a critical skill that protects key-parts and key-sites from the healthcare workers and the procedure environment; surgical and standard ANTT® require different aseptic field management.
Principle	Organisational management details
Principle 5	Aseptic practice should be standardised.
Principle 6	Safe aseptic technique relies on effective training of healthcare workers, and environments and equipment that are fit for purpose.

Adapted from the ANTT® clinical practice framework. (5)

ANTT®: aseptic non-touch technique.

a national study into infection prevention and control (IPC) in paramedic care using a custom designed survey, semi-structured interviews and focus groups.(8) The national study demonstrated that although participants viewed asepsis as important, compliance with aseptic technique during urgent and non-urgent procedures needed to be improved.(8) The national study also demonstrated that for the management of high acuity life-threatening cases in the paramedic work environment, some deviation in standards of asepsis was required when compared to that of hospital-based healthcare. As such, research into asepsis in paramedicine needs to be targeted at multiple areas. This project aimed to reach consensus among experts regarding how the principles of ANTT® can be maintained in paramedic practice.

METHODS

Research project setting

The project took place entirely online due to the complexities of meeting in person geographically. An online meeting occurred with participants to discuss aspects of an 'asepsis in paramedicine framework' prior to multiple iterations of an online survey. The survey rounds were conducted during the following periods: round 1 from 22 July 2019 to 9 August 2019; round 2 from 1 October 2019 to 25 November 2019; round 3 from 16 March 2020 to 28 May 2020; round 4 from 13 July 2020 to 23 August 2020.

Methodological approach

As this project aimed to reach consensus among experts a modified Delphi process (9) was used with four iterative rounds. The Delphi process was conducted online using MS Forms® to survey participants to achieve a consensus opinion regarding how to maintain asepsis in paramedic practice.

Participants were sought nationally using a snowball (bias) technique and included professionals within healthcare who met the inclusion criteria of extensive experience in one or more of three areas: paramedicine (operational and management), IPC and evidence-based policy (EBP) development. Strict inclusion criteria to participate were implemented as the reliability of data from Delphi studies is improved when subjects are drawn from the specialised area of knowledge related to the target issue.(10) While there is no compelling evidence on the appropriate size of a Delphi, it has been shown that small Delphi panels drawn from a limited number of experts in a field of study are able to develop reliable criteria that inform effective decision-making.(11)

The initial online video conference provided reading materials on asepsis, clinical governance and the framework developed from the national survey of paramedics on infection control and focus groups.(8) The purpose of the video conference was to provide stimulus for discussion, to clarify concepts, discuss evidence and to motivate participants to provide comments regarding the suitability of the framework during the survey phase.

In the survey phase of the Delphi process, participants were asked to provide feedback on the framework sections with iterative changes based on previous comments until consensus was reached or attempts were deemed futile.

Inclusion and exclusion criteria

To create an action-based approach to develop an 'explanatory', 'descriptive' and 'prescriptive' framework and minimise the difficulty policy makers have implementing the principles of EBP, input was sought from those who use EBP, such as experienced practitioners, who are able to combine a wealth of experience with rigorous evidence. This was to ensure that EBP was appropriate, applicable and consistent.(4,12–15) To this end, participants were drawn from paramedics, risk managers within ambulance services, and special-interest groups within industry bodies, such as the Australian and New Zealand College of Paramedicine (ANZCP), Paramedics Australasia (PA), Council of Ambulance Authorities (CAA), and the Australasian College for Infection Prevention and Control (ACIPC).

Participant recruitment strategies and timeframes

Initially, emails were sent by the professional organisations (CAA, ACIPC, ANZCP, PA) inviting eligible members to contact the research team if they were interested in participating in this Delphi study. Once initial participants had been recruited, more were identified using a snowball approach utilising the professional contacts of the early recruits.

All participants met the inclusion criteria. Secondary selection criteria were not used as the number of expressions of interest did not exceed that required.

Data analysis involved thematic analysis for textual data and descriptive statistics for numerical data following established recommendations.(16) Due to the nature of the Delphi study and the objective of reaching a

consensus, the issue of confounding factors or statistical power calculation was not a concern for this study.

Consensus was defined as 80% (9) of the panellists agreeing on items in the framework.

Survey instruments

Four custom designed surveys were used in the study (see Supplementary Materials section A). The survey was based on the ANTT® framework, then face validity and content validity tested through peer review. The survey was piloted among non-study participants and a reference group through invitation. Pilot participants were asked to comment on item stems, response choices, time for completion, ambiguity, functionality of the online platform and provide further suggestions.

Three rounds were planned a priori as per published advice,(9) however four rounds were required to complete the project.

Ethical review

Ethics approval was provided by the USC HREC (A191224).

RESULTS

Eleven experts who met the inclusion criteria were recruited to participate in this study. The participants included six males and five females. Table 2 provides a description of the participants in this study characterised by role, employer type, discipline and area of postgraduate education. Of the 11 participants, nine contributed to survey rounds 1 to 3, and seven contributed to the fourth round.

For all survey rounds, a summary of the survey items and response level is found in Supplementary Materials section A, and a summary of outcomes is shown in Supplementary Materials section B. The surveys were open for different lengths of time due to slower than expected response times.

Table 2. Participant primary professional background

Participant	Employer type	Discipline	Role	Postgraduate qualification
R1	EMS	Nursing	Infection control practitioner	IPC
R2	EMS	Nursing	Infection control practitioner	IPC
R3	University	Paramedicine	Academic	Paramedicine, PhD
R4	University	Paramedicine Nursing Midwifery	Clinical and academic	Midwifery, PhD
R5	EMS	Paramedicine	Clinical	–
R6	EMS	Paramedicine Nursing	Senior operations (clinical)	Education
R7	Hospital	Nursing	Infection control practitioner	IPC
R8	EMS	Nursing	Infection control practitioner	IPC
R9	University	Paramedicine	Academic	Paramedicine, PhD candidate
R10	EMS	Paramedicine	Executive management	Paramedicine
R11	University	Paramedicine	Academic	Paramedicine, PhD

EMS: emergency medical services; IPC: infection prevention and control; PhD: Doctoral studies; R: respondent.

Round 1

The aim of this survey was to reach consensus on the content areas that should be included in the general framework. All participants supported inclusion of all the seven proposed content sections: definition, rationale, indications, evidence, responsible person(s), procedural advice, and practical tips. One participant requested a reference section.

Round 2

The second round of the Delphi survey was open for six weeks. This survey asked the participants to consider the wording for the sections of the proposed framework. Sections agreed to in round 1 were presented with descriptors. The participants were asked for each section if they supported the wording in its current form, rejected it entirely or supported it with a change. In the case of accepting with a change, specific feedback was sought to improve the wording. The detail of the procedural advice was part of round 3.

Round 3

The third round of the Delphi survey was open for 10 weeks. This survey had two sections. The first section contained six questions regarding comments from the previous Delphi round. In the previous round, each category was accepted by participants. However, several comments were made that could add value to the advice and were presented as suggested changes to accept or reject. The second section of round 3 regarded the wording for the procedural advice. In this section, the advice to generally describe how to maintain asepsis in paramedic practice was presented. A word version was also sent to participants by email to allow participants a global view of the proposed advice on one page. For the survey, the procedural advice was split into 11 'activities'. For each area of activity, the participants were asked to: (a) support its inclusion in the procedural advice, (b) support it with a change, or (c) reject it. If a change was requested, a brief comment was required. General comments were also sought at the end of the survey to allow opportunity to provide further feedback.

All procedural areas were accepted but some required changes to be presented to the group in a fourth survey.

Round 4

The fourth round of the Delphi survey has 15 survey items and was open for six weeks. The purpose of this survey was to clarify comments submitted during the third round. The survey added a new item for consideration: the rationale for the advice on deviation from procedure. All suggested changes achieved consensus.

Consensus statement

Tables 3 and 4 show the consensus statement providing advice for maintaining asepsis in paramedic practice. Specifically, Table 3 is a preamble to the procedural advice in Table 4.

Table 3. Consensus statement for maintaining asepsis in paramedic practice

Definition:

The term *asepsis* refers to the absence of pathogenic microorganisms. It has replaced the terms *sterile technique* and *clean technique*. Sterile technique required the complete absence of microorganisms, which is not possible in typical healthcare settings due to the prevalence of microorganisms in the air. The term clean technique has been discouraged as it was considered too ambiguous. Asepsis in paramedic practice is achieved using an aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.

Rationale:

Maintaining asepsis in paramedic practice, despite the complexity, will reduce the risk of healthcare-associated infections (HAIs) in patients of paramedic services.

Indications:

Asepsis is to be maintained during invasive clinical procedures to prevent contamination of key-parts and key-sites by microorganisms that could cause infection.

Deviation from guideline is acceptable if a true life-threat needs to be dealt with, as the patient will significantly deteriorate if immediate action is not taken, for example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites.

Once the immediate threat has been resolved, further deviation is not warranted.

Evidence:

Transfer of pathogens that cause HAIs is well documented.

Contact is the most common mode of transmission, and usually involves transmission by touch or via contact with blood or body substances.

Contact may be:

- Direct when infectious agents are transferred from one person to another,
- Indirect when the transfer of an infectious agent is through a contaminated intermediate object or person,
 - For example, paramedic's contaminated hands or gloves – where hand hygiene has not been performed before an aseptic procedure, or
 - Intermediate objects in an ambulance, such as patient monitoring equipment, that are contaminated.

The summary of the evidence can be found at <https://nhmrc.gov.au> in the publication 'Australian Guidelines for the Prevention and Control of Infection in Healthcare' (2019).

Responsible person(s):

The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations, from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately supported, educated, trained and equipped, and ensuring the use of a risk management framework for managing infection risks.

Procedure:

Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.

The advice aims to reduce variable practices by standardising practice, encouraging efficient technique, encouraging rationalisation of equipment choices and suggesting explicit sequencing.

Definition of asepsis based on NHMRC guidelines.(1)

Table 4. Procedural advice for maintaining asepsis in paramedic practice

Maintaining asepsis in paramedic practice		
Purpose: To generally describe a method to maintain asepsis in paramedic practice.		
Activity	Critical action	Rationale
Perform hand hygiene	If the hands are not soiled, use ABHR. If the hands are soiled, use soap and water or detergent-based wipe suitable for hand hygiene, and dry with a single-use towel.	Removing soiling and pathogens from hands prior to contact with a patient or clinical environment lowers the transmission of HAIs.
Prepare patient	Obtain informed consent from the patient. Use gloves only when appropriate such as when removing a bloodstained dressing or where there is a risk of BBF contamination. After preparing the patient, remove gloves (if worn) and perform hand hygiene (ABHR).	Patients must be informed prior to giving consent for a procedure. Decreases risk of contact with BBF. Reduces pathogens on hand post patient contact.
Prepare the work area	Clean and make ready the work surface with detergent/disinfectant wipe and/or new disposable absorbent underpad (bluey) as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe.	Reduces risk of pathogen transmission.
Assemble the equipment	Identify and gather equipment for procedure, such as dressing kits, disposable medication trays, and disposable tourniquets, skin preparation, cannulas, etc.	Ensures the risk of unnecessary interruptions is avoided to gather missing items. Interruptions to procedures increases the risk of contamination and pathogen transmission.
Prepare the fields	Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites: <ul style="list-style-type: none"> • Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. • Clean fields – ensure placement of clinical equipment in open packets on the clean field to maintain the integrity of micro critical aseptic fields that will be used in conjunction with a clean field. 	Reduces the risk of contamination of key-parts, micro critical aseptic fields or sterile fields as packaging is opened or clinical items are placed on the field.
Prepare procedural equipment	After preparing the field, open procedural equipment packaging in a way that maintains asepsis: <ul style="list-style-type: none"> • Sterile field – carefully drop the required sterile equipment into the appropriate place on sterile field. • Clean fields – gather and open procedural equipment packaging to form micro critical aseptic field. 	Maintains the asepsis of key-parts.
Prepare to perform procedure	Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply gloves if there is a risk of BBF contamination, and use eye protection and masks as required. Use sterile gloves with semi-critical or critical procedures such as when the hands are entering semi-critical body areas, eg, the vagina during procedures to assist birthing.	Protects the paramedic and patient from pathogen transmission.
Perform procedure	Ensure all key-parts/components are protected: <ul style="list-style-type: none"> • Sterile items are used once and disposed of appropriately. • Only sterile items contact a key-part or key-site. 	Maintains asepsis of key-parts and key-sites during procedures.
Post procedure	Remove and dispose of gloves if worn and perform hand hygiene (ABHR). Wearing appropriate PPE, clean work surface with a detergent/disinfectant wipe. Remove PPE (if applicable) and then perform hand hygiene (ABHR).	Contamination of a clinician's hands may occur through small defects in the gloves or during glove removal. Hand hygiene post glove removal decreases the risk of pathogen transmission. The wearing of PPE is recommended when cleaning to reduce potential contamination of clinician's hands and to reduce exposure to cleaning chemicals.
Record	Record procedure in the patient care record including compliance issues with aseptic technique.	Provides identification and notification of increased risk of HAI that enables early intervention.
Deviations	Deviation from procedural guideline is acceptable if a true life-threat needs to be dealt with as the patient will significantly deteriorate if immediate action is not taken, eg, to provide compression to a life-threatening haemorrhage. In such cases, the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites and maintains their safety. Once the immediate threat has been resolved, further deviation is not warranted.	A deviation from procedure that breaks the guidance should be adequately recorded on the patient record.

ABHR: alcohol-based hand rubs or gel; BBF: blood or bodily fluid; HAI: healthcare-associated infection; PPE: personal protective equipment.

DISCUSSION

Application to practice

There is a paucity of research regarding the practice of aseptic techniques in the paramedic work setting. To address this, we have collated the responses of an expert panel assembled to produce a consensus statement for maintaining asepsis in paramedic practice. This consensus statement aligns with the NHMRC guidance (1) and contextualises aseptic practice to the paramedicine work setting. The consensus from the expert panel was that all employees, from individual clinician to the chief executive officer, are responsible for safe aseptic practice in health organisations. As such, our consensus statement provides the rationale underpinning the procedural advice to facilitate individual organisations to operationalise expert opinion into EBP and procedures. The definition, rationale, indications and evidence sections of the consensus-based guidance align with evidence-based practice across health disciplines (1) and consolidate aseptic practice as an important concept and practice for registered paramedics.

Guidelines and frameworks that are evidence-based help to ensure that activities can continue safely while achieving the best possible health outcomes.(1,17,18) Any framework or guideline developed from this consensus statement must describe what needs to be done by whom, when and how it should be done, how these activities can be quality assured and reported, and who is responsible for education and training. In this regard, Table 5 shows the questions that should be considered during the drafting of guidelines based on the NHMRC guide to the development, implementation and evaluation of clinical practice guidelines.(4)

Table 5. Considerations during the drafting of evidence-based guidelines for IPC in paramedicine

Staff responsibility:
Who should implement the new IPC clinical practices?
Under what circumstances should the new IPC clinical practice be used?
By what means should the new IPC clinical practice be used?
Monitoring and reporting:
By what method will compliance with IPC practice be monitored?
On what time basis (frequency) will auditing of the new IPC clinical practice occur?
Who is responsible for monitoring and auditing of compliance with IPC by in-field staff?
Education and training:
By what means should/will paramedics be trained in IPC?
When in their career should training occur (undergraduate, graduate)?
When will training be repeated?
Who is responsible for ensuring competency in IPC is met, documented and ongoing?

Adapted from the NHMRC guide to the development, implementation and evaluation of clinical practice guidelines.(4)

During implementation, engagement and acceptance is increased when guidelines are presented in a format and style that is suitable for the target audience.(4) Australian paramedics prefer IPC information that includes a rationale, indications for practice, implementation advice and directions mandating the level of obligation rather than simply providing choices.(8) These aspects should be built into the initial design of any operating procedure framework presented to the participants. As such any operational procedure developed from this statement must include a definition of asepsis in practice, rationale for asepsis, indication of when to use, evidence including brief account of the epidemiology of healthcare-associated infections as applicable, responsible person(s), procedural advice, exemplars describing acceptable deviations/variations in high acuity emergency primary healthcare practice, and practical tips for navigating difficulties.

Limitations

The sampling technique aimed to recruit participants with particular expertise in the field of either paramedicine, IPC or both. As such, a convenience sampling technique was used. The participation rate in the final two rounds of the Delphi process decreased and this may have affected the results. Of the 11 participants, nine participants responded to the first three surveys and seven participants responded to the last survey. As the responses were anonymous, the researchers are unable to identify which participants responded in each round. Nevertheless, we believe the Delphi methodology and participant selection mitigated this risk. The participants recruited for this project were experts (4) informed in two ways. First, even though years of experience was not collected in the data, across the group of experts there was a depth of knowledge of the research evidence. Second, professional practice experience of the participants had given them insight into issues that affect operationalising policy, for example identification of ethical issues, the needs of clinicians, problems with IPC adherence, the availability of resources, current infrastructure, the acceptance of previously implemented changes, what clinical staff and management value in terms of results, and procedures.

CONCLUSION

There is a clear requirement for registered paramedics to follow established IPC practices. A lack of rigorous in-field audit of clinical IPC practices limits the understanding of how IPC practices are implemented, despite the potential for complications to occur well after the registered paramedic has completed their care. Our consensus statement developed in conjunction with an expert panel provides an exemplar of how a guideline can be established specifically to inform paramedic practice. The guidance reported in this study has been produced from consensus among experts regarding how to maintain asepsis in paramedic practice. This project provides a consensus statement that will allow operational procedures to be reviewed, techniques specific to paramedic practice to be developed and implemented, and scientific research exploring the

implementation of paramedic specific infection control practices to be conducted.

COMPETING INTERESTS

The authors declare no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

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SUPPLEMENTARY MATERIALS

Supplementary materials section A: Survey instruments

Survey round 1

Table S1. Delphi round 1: variable code, question stem and response choice

Variable name	Stem	Response levels
D1_def	Definition: The advice should provide a definition of asepsis in practice.	0 = not support 1 = support section 2 = support with change
D1_def_com	Please describe the change requested to the definition section.	Comments
D1_rat	Rationale: The advice should provide a rationale for maintaining asepsis in practice.	0 = not support 1 = support section 2 = support with change
D1_rat_com	Change requested to rationale section.	Comments
D1_ind	Indications: Advice should provide indication of when to use the guidance. This would include content regarding when deviation from the advice about maintaining asepsis in paramedicine would be considered appropriate and inappropriate. The advice would be based on a HACCP approach to put critical limits and advise what should occur if asepsis could not be maintained.	0 = not support 1 = support section 2 = support with change
D1_ind_com	Change requested to indications section.	Comments
D1_evid	Evidence: This advice should provide a brief account of the epidemiology of healthcare-associated infections as applicable and related to paramedicine.	0 = not support 1 = support section 2 = support with change
D1_evid_com	Change requested to evidence section.	Comments
D1_res	Responsible person(s): The advice should state who the framework has been written for and who should be responsible for ensuring it is followed.	0 = not support 1 = support section 2 = support with change
D1_res_com	Change requested to responsible person(s) section.	Comments
D1_pro	Procedural advice: The advice should provide a concise recommended standardised procedure to maintain asepsis in paramedic practice. In addition, this section should provide an exemplar procedure using the advice that includes acceptable deviations/variations (e.g. changes in practice for time critical events)	0 = not support 1 = support section 2 = support with change
D1_pro_com	Change requested to procedural advice section.	Comments
D1_tip	Practical tips: The advice should provide suggestions for navigating difficulties. The suggestions would be targeted at common issues that affect the maintenance of asepsis in paramedic practice.	0 = not support 1 = support section 2 = support with change
D1_tip_com	Change requested to practical tips section.	Comments
D1_other_com	Please indicate if there are any other sections you think should be included in the final consensus statement.	Comments
D1_fin_com	Thank you for participating, please leave any further comments below.	Comments

Survey round 2

Table S2. Delphi round 2: variable code, question stem and response choice

Variable name	Stem	Response levels
D2_def	<p>'Definition' proposed wording:</p> <p>The term asepsis refers to the absence of pathogenic microorganisms. It has replaced the terms sterile technique and clean technique. Sterile technique required the complete absence of microorganisms, which is not possible to achieve in typical healthcare settings due to the prevalence of microorganisms in the air. The term clean technique has been discouraged as it was considered too ambiguous.</p> <p>Asepsis in paramedic practice is achieved using aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.</p>	
D2_def_com	Requested change to the wording for the definition section:	Comments
D2_rat	<p>'Rationale' proposed wording:</p> <p>Maintaining asepsis in paramedic practice, despite the complexity, will reduce the risk of healthcare-associated infections (HAIs) in patients of paramedic services.</p>	1 = support in current form 2 = support with change
D2_rat_com	Requested change to the wording for the rationale section:	Comments
D2_ind	<p>'Indications' proposed wording:</p> <p>Asepsis is to be maintained during clinical procedures to prevent contamination of key-parts and key-sites by microorganisms that could cause infection.</p> <p>Deviation from guidance is acceptable if a true life-threat needs to be dealt with as the patient will significantly deteriorate if immediate action is not taken. For example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites.</p> <p>Once the immediate life-threat has been resolved further deviation is not warranted.</p>	1 = support in current form 2 = support with change
D2_ind_com	Requested change to the wording for the indications section:	Comments
D2_evid	<p>'Evidence' proposed wording:</p> <p>Contact transmission is the route of concern for maintaining of asepsis in paramedic practice. Contact transmission may occur through direct or indirect contact and usually involves transmission by touch. Direct transmission occurs when infectious agents are transferred from one person to another – for example, a patient's blood entering a paramedic's body through an unprotected cut in the skin. Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object or person. For example, if a paramedic does not remove contaminated gloves and perform hand hygiene prior to performing a procedure. Or if a paramedic does not remove contaminated gloves and perform hand hygiene after contact with a patient or the contaminated environment.</p> <p>The transfer of pathogens that cause HAIs is well documented, a summary of the evidence can be found at https://nhmrc.gov.au in the publication 'Australian Guidelines for the Prevention and Control of Infection in Healthcare' (2019).</p>	1 = support in current form 2 = support with change
D2_evid_com	Requested change to the wording for the evidence section:	Comments
D2_res	<p>'Responsible persons' proposed wording:</p> <p>The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations, from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately trained and equipped, and auditing is conducted to evaluate practice.</p>	1 = support in current form 2 = support with change
D2_res_com	Requested change to the wording for responsible persons section:	Comments
D2_pro	<p>'Procedure' proposed wording:</p> <p>Asepsis in paramedic practice is achieved using aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice provided should standardise practice, encourages efficient technique, the rationalisation of equipment choices and suggests explicit sequencing to 'prescribe out' variable practices.</p> <p>An exemplar is provided later in the advice.</p>	1 = support in current form 2 = support with change
D2_pro_com	Requested change to the wording for the procedure section:	Comments
D2_tip	We will be releasing the draft procedural advice for review in the next survey. For the tips section, please indicate any tips that you would like included in the procedural advice.	1 = support in current form 2 = support with change
D1_tip_com	Change requested to practical tips section:	Comments
D2_fin_com	Thank you for your participation, if you have any further comments please use the space below.	Comments

Survey round 3, section 1

Table S3. Delphi round 3.1: variable code, question stem and response choice

Variable name	Stem	Response levels
D3_def	For the area 'Definition', the words 'an aseptic non-touch technique and' have been added to improve clarity. The revised wording is: Asepsis in paramedic practice is achieved using an aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.	1 = accept change 2 = reject change
D3_ind	For the area 'Indications', the word invasive was added to improve clarity. The revised wording is: Asepsis is to be maintained during invasive clinical procedures to prevent contamination of key-parts and key-sites by microorganisms that could cause infection.	1 = accept change 2 = reject change
D1_res	For the area 'Responsible person(s)', several comments centred on grammar and modal verbs. It is proposed the wording align more closely with legislative requirements. To achieve this change, two options have been developed. Please indicate which option you support. Option 1: The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations; from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately trained and competent, equipped and supported, and auditing is conducted to evaluate practice. Option 2: The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately supported, educated, trained and equipped, and ensuring the use of a risk management framework for managing infection risks.	0 = accept either option 1 = accept option 1 2 = accept option 2
D3_res_com	Do you have any comments regarding the wording for responsible person(s)?	Comments
D3_pro_S1	For the area 'Procedure', additional words have been added to improve clarity. Changes have been made in both sentences and will be presented separately. In the first sentence 'aseptic non-touch technique and aseptic' was added. The revised wording is: Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice aims to reduce variable practices by standardising practice, encouraging efficient technique, encouraging rationalisation of equipment choices and suggesting explicit sequencing.	0 = reject addition of 'aseptic non-touch technique and aseptic' to first sentence 1 = accept addition of 'aseptic non-touch technique and aseptic' to first sentence
D3_pro_S2	For the area 'Procedure', additional words have been added to improve clarity. Changes have been made in both sentences and will be presented separately. In the second sentence 'aims to reduce variable practices' was added. The revised wording is: Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice aims to reduce variable practices by standardising practice, encouraging efficient technique, encouraging rationalisation of equipment choices and suggesting explicit sequencing.	0 = reject addition of 'aims to reduce variable practices' to the second sentence 1 = accept addition of 'aims to reduce variable practices' to the second sentence

Survey round 3, section 2

Table S4. Delphi round 3.2: variable code, question stem and response choice

Variable name	Stem	Response levels
D3_HH_act	Activity: Perform hand hygiene. Critical action: If the hands are soiled – use soap and water or a detergent wipe to clean. Post hand hygiene allow the hands to air dry or dry with a single use towel. If the hands are not soiled use an alcohol-based hand rub (ABHR).	0 = reject 1 = accept 2 = accept with changes
D3_HH_actcom	Hand hygiene rationale change requested.	Comments
D3_HH_rat	Activity: Perform hand hygiene. Rationale: Removing soiling and pathogens from hands prior to contact with a patient or clinical environment lowers the transmission of HAIs.	0 = reject 1 = accept 2 = accept with changes
D3_HH_ratcom	Hand hygiene rationale change requested.	Comments
D3_PPt_act	Activity: Prepare patient. Critical action: Obtains consent from the patient. Use gloves only when appropriate, such as when removing a bloodstained dressing or where there is a risk of blood or body fluid (BBF) contamination. After preparing the patient remove gloves (if worn) and perform hand hygiene (ABHR).	0 = reject 1 = accept 2 = accept with changes
D3_PPt_com	Prepare patient critical action change requested.	Comments
D3_PPt_rat	Activity: Prepare patient. Rationale: Patients must be informed prior to giving consent for a procedure. Decrease risk of contact with BBF. Reduces pathogens on hand post patient contact.	0 = reject 1 = accept 2 = accept with changes
D3_PPt_ratcom	Prepare patient rationale change requested.	Comments
D3_PW_act	Prepare the work area. Critical action: Clean and make ready the work surface with sanitising/detergent wipe and or new bluey as applicable. If working in an ambulance this includes cleaning the work surface with a sanitising/detergent wipe.	0 = reject 1 = accept 2 = accept with changes
D3_PW_actcom	Prepare work area critical action change requested.	Comments
D3_PW_rat	Prepare the work area Rationale: Reduces risk of pathogen transmission.	0 = reject 1 = accept 2 = accept with changes
D3_PW_ratcom	Prepare work area rationale change requested.	Comments
D3_AE_act	Assemble the equipment. Critical action: Identify and gather equipment for procedure, such as dressing kits, disposable medication trays, and disposable tourniquets, skin preparation, cannulas, etc.	0 = reject 1 = accept 2 = accept with changes
D3_AE_actcom	Assemble the equipment critical action change requested.	Comments
D3_AE_rat	Assemble the equipment. Rationale: Ensures procedure is not broken to gather missing items. Breakages in procedure increases the risk of contamination and pathogen transmission.	0 = reject 1 = accept 2 = accept with changes
D3_AE_ratcom	Assemble the equipment rationale change requested.	Comments
D3_PF_act	Prepare the fields. Critical action: Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites: • Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. • Clean fields – ensure placement to maintain integrity of micro-fields that will be used in conjunction with a clean field.	0 = reject 1 = accept 2 = accept with changes
D3_PF_actcom	Prepare the fields critical action change requested.	Comments
D3_PF_rat	Prepare the fields. Rationale: Packaging of clinical supplies can become contaminated with pathogens when stored.	0 = reject 1 = accept 2 = accept with changes
D3_PF_ratcom	Prepare the fields rationale change requested.	Comments

Table S4. Delphi round 3.2: variable code, question stem and response choice (*continued*)

Variable name	Stem	Response levels
D3_PEq_act	Prepares procedural equipment. Critical action: After preparing the field, open procedural equipment packaging in a way that maintains asepsis: • Sterile field – carefully drop the required sterile equipment into the appropriate place on sterile field. • Clean fields – gather and open procedural equipment packaging in a way that maintains asepsis of key parts. Place on the clean field and use the sterile packaging as a micro-field.	0 = reject 1 = accept 2 = accept with changes
D3_PEq_actcom	Prepare procedural equipment critical action change requested.	Comments
D3_PEq_rat	Prepares procedural equipment. Rationale: Maintains the asepsis of key-parts	0 = reject 1 = accept 2 = accept with changes
D3_PEq_ratcom	Prepare procedural equipment rationale change requested.	Comments
D3_PPP_act	Prepare to perform procedure. Critical action: Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply new gloves if there is a risk of blood and bodily fluid contamination and use eye protection and masks as required. Use sterile gloves with procedures such as intraosseous needle insertion or if the hands are entering semi-critical body areas such as the vagina during procedures to assist birthing.	0 = reject 1 = accept 2 = accept with changes
D3_PPP_actcom	Prepare to perform procedure critical action change requested.	Comments
D3_PPP_rat	Prepare to perform procedure. Rationale: Protects the paramedic from BBF contamination and pathogen transmission.	0 = reject 1 = accept 2 = accept with changes
D3_PPP_ratcom	Prepare to perform procedure rationale change requested.	Comments
D3_PerP_act	Perform the procedure. Critical action: Ensure all key parts/components are protected: • sterile items are used once and disposed into waste bag. • only sterile items contact a key-site. • sterile items do not come into contact with non-sterile items.	0 = reject 1 = accept 2 = accept with changes
D3_PerP_actcom	Perform the procedure critical action change requested.	Comments
D3_PerP_rat	Perform the procedure. Rationale: Maintains asepsis of key-parts and key-sites during procedures.	0 = reject 1 = accept 2 = accept with changes
D3_PerP_ratcom	Perform the procedure rationale change requested.	Comments
D3_PoP_act	Post procedure. Critical action: Remove gloves and perform hand hygiene (ABHR). Clean work surface after use with a sanitising wipe if applicable, and perform hand hygiene (ABHR).	0 = reject 1 = accept 2 = accept with changes
D3_PoP_actcom	Post procedure critical action change requested.	Comments
D3_poP_rat	Post procedure. Rationale: The outside of gloves will be inoculated with pathogens during procedures. Gloves are also porous and can aerosol pathogens during doffing. This ensures decreased risk of pathogen transmission.	0 = reject 1 = accept 2 = accept with changes
D3_PoP_ratcom	Post procedure rationale change requested.	Comments
D3_Rec_act	Record. Critical activity: Record procedure in notes including compliance issues with aseptic technique.	0 = reject 1 = accept 2 = accept with changes
D3_Rec_actcom	Record critical action change requested.	Comments
D3_Rec_rat	Record. Rationale: Allows identification and notification of increased risk of HAI.	0 = reject 1 = accept 2 = accept with changes
D3_Rec_ratcom	Record rationale change requested.	Comments

Table S4. Delphi round 3.2: variable code, question stem and response choice (*continued*)

Variable name	Stem	Response levels
D3_Dev_act	Deviations. Critical action: Deviation from procedural guideline is acceptable if a true life-threat needs to be dealt with as the patient will significantly deteriorate if immediate action is not taken, for example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites and maintains their safety. Once the immediate threat has been resolved further deviation is not warranted.	0 = reject 1 = accept 2 = accept with changes
D3_Dev_actcom	Deviations critical action change requested.	Comments 0 = reject 1 = accept 2 = accept with changes
D3_FC	This is the end of the survey – please use this text box to make any further comments.	Comments

Table S5. Procedural advice prior to Delphi voting

Maintaining asepsis in paramedic practice		
Purpose: To generally describe a method to maintain asepsis in paramedic practice.		
Activity	Critical action	Rationale
Perform hand hygiene	If the hands are soiled – use soap and water or detergent wipe and dry with a single use towel. If the hands are not soiled use alcohol-based hand rubs or gel (ABHR).	Remove soiling and pathogens from hands prior to contact with a patient or clinical environment lowers the transmission of HAIs.
Prepare patient	Obtains informed consent from the patient. Use gloves only when appropriate such as when removing a bloodstained dressing or where there is a risk of blood or body fluid (BBF) contamination. After preparing the patient remove gloves (if worn) and perform hand hygiene (ABHR).	Patients must be informed prior to giving consent for a procedure. Decrease risk of contact with BBF. Reduces pathogens on hand post patient contact.
Prepare the work area	Clean and make ready the work surface with sanitising/detergent wipe and or new bluey as applicable. If working in an ambulance this includes cleaning the work surface with a sanitising/detergent wipe.	Reduces risk of pathogen transmission.
Assemble the equipment	Identify and gather equipment for procedure, such as dressing kits, disposable medication trays, and disposable tourniquets, skin preparation, cannulas, etc.	Ensures procedure is not broken to gather missing item. Breakages in procedure increases the risk of contamination and pathogen transmission.
Prepare the fields	Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites: <ul style="list-style-type: none"> • Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. • Clean fields – ensure placement to maintain integrity of micro-fields that will be used in conjunction with a clean field. 	Packaging of clinical supplies can become contaminated with pathogens when stored.
Prepares procedural equipment	After preparing the field, open procedural equipment packaging in a way that maintains asepsis: <ul style="list-style-type: none"> • Sterile field – carefully drop the required sterile equipment into the appropriate place on sterile field. • Clean fields – gather and open procedural equipment packaging in a way that maintains asepsis of key-parts. Place on the clean field and use the sterile packaging as a micro-field. 	Maintains the asepsis of key-parts.
Prepare to perform procedure	Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply new gloves if there is a risk of blood and bodily fluid contamination and use eye protection and masks as required. Use sterile gloves with procedures such as intraosseous needle insertion or if the hands are entering semi-critical body areas such as the vagina during procedures to assist birthing.	Protects the paramedic from BBF contamination and pathogen transmission.
Perform procedure	Ensure all key parts/components are protected: <ul style="list-style-type: none"> • sterile items are used once and disposed into waste bag, • only sterile items contact a key-site, • sterile items do not come into contact with non-sterile items. 	Maintains asepsis of key-parts and key-sites during procedures.
Post procedure	Remove gloves and perform hand hygiene (ABHR). Clean work surface after use with a sanitising wipe if applicable, and perform hand hygiene (ABHR).	The outside of gloves will be inoculated with pathogens during procedures. Gloves are also porous and can aerosol pathogens during doffing. This ensures decreased risk of pathogen transmission.
Record	Record procedure in notes including compliance issues with aseptic technique.	Allows identification and notification of increased risk of HAI.
Deviations	Deviation from procedural guideline is acceptable if a true life-threat needs to be dealt with as the patient will significantly deteriorate if immediate action is not taken, for example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites and maintains their safety. Once the immediate threat has been resolved further deviation is not warranted.	

Survey round 4

Table S6. Delphi round 4: variable code, question stem and response choice

Variable name	Stem	Response levels
D4_HH_actword	The critical action of hand hygiene was supported overall. However, a clarification was suggested in the second sentence. As such, 'a detergent wipe' is replaced with 'detergent-based wipe suitable for hand hygiene'. The full second sentence is: 'If the hands are soiled – use soap and water or detergent-based wipe suitable for hand hygiene and dry with a single-use towel.'	1 = accept change 0 = reject change
D4_HH_act_ord	The critical action of hand hygiene was supported overall. However, comments received advised changing the order of the sentences to begin the section with advice regarding non-soiled hands followed by the advice for soiled hands. The new sentence order is: 'If the hands are not soiled, use an alcohol-based hand rub (ABHR). If the hands are soiled, use soap and water or detergent-based wipe suitable for hand hygiene and dry with a single use towel.'	1 = accept change 0 = reject change
D4_PW_act_word	Prepare the work area critical action was supported with a change to the use of the word 'bluey' and how a cleaning agent is described. The suggested new wording is: 'Clean and make ready the work surface with detergent/disinfectant wipe and or new bluey (disposable absorbent underpad) as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe.'	1 = accept change 0 = reject change
D4_PW_actcom	Do you have any further comment on the new wording? 'Clean and make ready the work surface with detergent/disinfectant wipe and or new bluey (disposable absorbent underpad) as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe.'	Comments
D4_AEq_rat_word	Assembling the equipment rationale was supported; however, comments were received that suggested improving the wording. The suggested new wording is: 'Ensures procedure is not interrupted to gather missing item. Interruption to procedures increases the risk of contamination and pathogen transmission.'	1 = accept change 0 = reject change
D4_EEq_ratcom	Do you have any further comment on the wording? 'Ensures procedure is not interrupted to gather missing item. Interruption to procedures increases the risk of contamination and pathogen transmission.'	Comments
D4_Pf_act_word	Preparing the fields critical action was supported with a change to the wording. The suggested new wording is: 'Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites: <ul style="list-style-type: none"> • Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. • Clean fields – ensure placement of clinical equipment in open packets on the clean field to maintain the integrity of micro critical aseptic fields.' 	1 = accept change 0 = reject change
D4_Pf_actcom	Do you have any further comment regarding preparing the fields critical action?	Comments
D4_Pf_rat_word	Prepare the fields rationale was accepted with a change to the wording. The suggested new wording is: 'Reduces the risk of contamination of key-parts, micro critical aseptic fields or sterile fields as packaging is opened or clinical items and placed on the field.'	1 = accept change 0 = reject change
D4_PrPP_act_word	In the original version for preparing to perform the procedure action was supported. However, the inclusion of an IO device as an example was questioned. Other comments centred on grammar. The suggested new wording is: 'Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply gloves if there is a risk of blood and bodily fluid contamination and use eye protection and masks as required. Use sterile gloves with semi-critical or critical procedures such as when the hands are entering semi-critical body areas, for example the vagina during procedures to assist birthing.'	1 = accept change 0 = reject change
D4_PosP_act_word	The post-procedure critical action was supported with a change to the wording: The suggested new wording is: 'Remove and dispose of gloves if worn and perform hand hygiene (ABHR). Wearing appropriate PPE, clean work surface with a detergent/disinfectant wipe. Remove PPE (if applicable) and then perform hand hygiene (ABHR).'	1 = accept change 0 = reject change
D4_PosP_actcom	Do you have any further comments regarding the post-procedure critical action wording?	Comments
D4_PosP_rat_word	Post-procedure rationale was supported with a change to the wording particularly regarding glove use. The suggested new wording is: 'Contamination of a clinician's hands may occur through small defects in the gloves or during glove removal. Hand hygiene post glove removal decreases the risk of pathogen transmission. The wearing of PPE is recommended when cleaning to reduce potential contamination of clinician's hands and to reduce exposure to cleaning chemicals.'	1 = accept change 0 = reject change

Table S6. Delphi round 4: variable code, question stem and response choice (*continued*)

Variable name	Stem	Response levels
D4_Rec_rat_word	Recording the procedure rationale wording reached consensus. Nevertheless, an astute comment suggested including early intervention as part of the statement. The suggested new wording is: 'Provides identification and notification of increased risk of HAI that enables early intervention.'	1 = accept change 0 = reject change
D4_Dev_rat	The original survey did not include a rationale for the advice on deviation. The suggested new wording is: 'A deviation from procedure that breaks the guidance should be adequately recorded on the patient record.'	1 = accept change 0 = reject change
D4_fin_com	Thank you for participating, please leave any further comments below.	Comments

Supplementary materials section B: Survey results full**Results survey 1****Table S7.** Results of Delphi round 1

Variable name	Stem	Response level/distribution	Level of consensus and comments
D1_def	Definition: The advice should provide a definition of asepsis in practice.	0 = not support 1 = support section 2 = support with change	100% support
D1_def_com	Please describe the change requested to the definition section.	Comments	No comments
D1_rat	Rationale: The advice should provide a rationale for maintaining asepsis in practice.	0 = not support 1 = support section 2 = support with change	100% support
D1_rat_com	Change requested to rationale section.	Comments	No comments
D1_ind	Indications: Advice should provide indication of when to use the guidance. This would include content regarding when deviation from the advice about maintaining asepsis in paramedicine would be considered appropriate and inappropriate. The advice would be based on a HACCP approach to put critical limits and advise what should occur if asepsis could not be maintained.	0 = not support 1 = support section 2 = support with change	100% support
D1_ind_com	Change requested to indications section.	Comments	No comments
D1_evid	Evidence: This advice should provide a brief account of the epidemiology of healthcare-associated infections as applicable and related to paramedicine.	0 = not support 1 = support section 2 = support with change	100% support
D1_evid_com	Change requested to evidence section.	Comments	No comments
D1_res	Responsible person(s): The advice should state who the framework has been written for and who should be responsible for ensuring it is followed.	0 = not support 1 = support section 2 = support with change	> 80% support, other response was support with change
D1_res_com	Change requested to responsible person(s) section.	Comments	1 comment: 'Why it should be followed on ethical and moral grounds in preventing sepsis in the out of hospital environment?'
D1_pro	Procedural advice: The advice should provide a concise recommended standardised procedure to maintain asepsis in paramedic practice. In addition, this section should provide an exemplar procedure using the advice that includes acceptable deviations/variations (e.g. changes in practice for time critical events)	0 = not support 1 = support section 2 = support with change	100% support
D1_pro_com	Change requested to procedural advice section.	Comments	No comments
D1_tip	Practical tips: The advice should provide suggestions for navigating difficulties. The suggestions would be targeted at common issues that affect the maintenance of asepsis in paramedic practice.	0 = not support 1 = support section 2 = support with change	100% support
D1_tip_com	Change requested to practical tips section.	Comments	No comments

Table S7. Results of Delphi round 1 (*continued*)

Variable name	Stem	Response level/distribution	Level of consensus and comments
D1_other_com	Please indicate if there are any other sections you think should be included in the final consensus statement.	Comments	3 comments: <ul style="list-style-type: none"> • Reference section. • Possibly rating of evidence used? Could be in a supporting document. • Importantly, and infection control rationale, which includes risks of infection.
D1_fin_com	Thank you for participating, please leave any further comments below.		2 comments: <ul style="list-style-type: none"> • Q5. Not all jurisdictions have data pertaining to HALs and paramedicine and while it is good to link the epidemiology to practice with evidence it could be a challenge. • The analogy I like here is an aircraft engineering one. When you perceive there is a risk that the aircraft will fail and fall out of the sky you don't wait for it to happen to provide evidence. You go ahead and fix it before you have evidence of planes falling out of the sky.

Results survey 2

Table S8. Round 2 outcomes

Variable name	Stem	Response level/distribution	Level of Consensus, comments and response to comments
D2_def	<p>'Definition' proposed wording:</p> <p>The term asepsis refers to the absence of pathogenic microorganisms. It has replaced the terms sterile technique and clean technique. Sterile technique required the complete absence of microorganisms, which is not possible to achieve in typical healthcare settings due to the prevalence of microorganisms in the air. The term clean technique has been discouraged as it was considered too ambiguous.</p> <p>Asepsis in paramedic practice is achieved using aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.</p>	<p>0 = not support</p> <p>1 = support section</p> <p>2 = support with change</p>	<p>Support overall, consensus less than 80%. Comments to inform Delphi 3.</p> <ul style="list-style-type: none"> 6 support in current form. 3 support with change.
D2_def_com	Requested change to the wording for the definition section:	Comments	<p>3 comments:</p> <ul style="list-style-type: none"> Change the following: Asepsis in paramedic practice is achieved using aseptic fields and non-touch technique to ensure asepsis of key-parts and key-sites within the immediate procedural environment. I think we should also include a definition for 'non-touch technique', eg, non-touch technique is a technique where the clinician's hands do not touch, and thereby contaminate, key-parts and key-sites. <p>Response: Accepted – include ANTT in last sentence of advice section. Retest in Delphi 3.</p> <ul style="list-style-type: none"> Asepsis is achieved with several work practices, including the use of aseptic fields, such as hand hygiene, use of sterile equipment, a non-touch technique. The definition could be confusing in that we are saying asepsis is 'the absence of' while later saying that sterile means 'the complete absence of' ... what is the difference between absence of and complete absence of?? <p>Response: Other comments: Not accepted – This reflects wording in the national guidelines. Absence under national guidelines means less than a critical number of colony forming units within a procedural area. Adding additional information would be verbose and not add value. This is a training issue.</p> <p>Rewording from Delphi 3:</p> <p>Response: Upheld. Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.</p>
D2_rat	<p>'Rationale' proposed wording: Maintaining asepsis in paramedic practice, despite the complexity, will reduce the risk of healthcare-associated infections (HAIs) in patients of paramedic services.</p>	<p>0 = not support</p> <p>1 = support section</p> <p>2 = support with change</p>	<p>Consensus > 80%.</p> <ul style="list-style-type: none"> 8 support in current form. 1 support with change.
D2_rat_com	Requested change to the wording for the rationale section:	Comments	<p>1 comment:</p> <p>I'm not convinced it is always achievable to maintain asepsis in all circumstances and the definitions for HAIs can exclude infections that may arise from paramedic care. 'Striving for asepsis' ... or 'Maintaining asepsis in paramedic practice' in many cases is achievable and when it is not achievable, working as far as possible towards it, will reduce the risk of infection in patients of paramedic services.</p> <p>Response: Not accepted –this concept is dealt with later in the advice. This does not change the rationale for the advice.</p>

Table S8. Round 2 outcomes (*continued*)

Variable name	Stem	Response level/distribution	Level of Consensus, comments and response to comments
D2_ind	'Indications' proposed wording: Asepsis is to be maintained during clinical procedures to prevent contamination of key-parts and key-sites by microorganisms that could cause infection. Deviation from guidance is acceptable if a true life-threat needs to be dealt with as the patient will significantly deteriorate if immediate action is not taken. For example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites. Once the immediate life-threat has been resolved further deviation is not warranted.	0 = not support 1 = support section 2 = support with change	Supported overall, consensus < 80%. Comments to inform Delphi 3. <ul style="list-style-type: none"> 6 support. 3 support with change.
D2_ind_com	Requested change to the wording for the indications section:	Comments	<ul style="list-style-type: none"> Invasive clinical procedures? The term 'clinical procedures' is too broad? Response: Accepted - although inferred, invasive added to increase clarity. Presented in Delphi round 3. Rewording for Delphi 3: 'Asepsis is to be maintained during invasive clinical procedures to prevent contamination of key-parts and key-sites by microorganisms that could cause infection.' <ul style="list-style-type: none"> I think 'required' is better than 'warranted' at the end of the last sentence. Response: Not accepted – grammatically warranted has a different modal meaning to required. In this circumstance warranted is being used to indicate justification rather than obligation. <ul style="list-style-type: none"> Asepsis is maintained during clinical procedures by preventing contamination of key-parts and key-sites by microorganisms that could cause infection. Deviation from guidance may be unavoidable when there is a risk of significant patient deterioration if immediate action is not taken. For example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites. Once the immediate life-threat has been resolved further deviation is not warranted. Response: Not accepted – suggestion grammatically incorrect; in addition, softens the obligation. 89% support. Consensus reached.
D2_evid	'Evidence' proposed wording: Contact transmission is the route of concern for maintaining of asepsis in paramedic practice. Contact transmission may occur through direct or indirect contact and usually involves transmission by touch. Direct transmission occurs when infectious agents are transferred from one person to another – for example, a patient's blood entering a paramedic's body through an unprotected cut in the skin. Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object or person. For example, if a paramedic does not remove contaminated gloves and perform hand hygiene prior to performing a procedure. Or if a paramedic does not remove contaminated gloves and perform hand hygiene after contact with a patient or the contaminated environment. The transfer of pathogens that cause HAIs is well documented, a summary of the evidence can be found at https://nhmrc.gov.au in the publication 'The Australian Guidelines for the Prevention and Control of Infection in Healthcare' (2019).	0 = not support 1 = support section 2 = support with change	<ul style="list-style-type: none"> 8 support in current form. 1 support with change.
D2_evid_com	Requested change to the wording for the evidence section:	Comments	1 comment: <ul style="list-style-type: none"> Using the terminology 'contact transmission' runs the risk of confusion occurring between 'Transmission based/contact precautions' and this area. Response: Not accepted – contact transmission is the correct terminology in this instance. This section of the advice is not discussing transmission based precautions and as such the comment is not upheld.

Table S8. Round 2 outcomes (*continued*)

Variable name	Stem	Response level/distribution	Level of Consensus, comments and response to comments
D2_res	'Responsible person(s)' proposed wording: The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations, from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately trained and equipped, and auditing is conducted to evaluate practice.	0 = not support 1 = support section 2 = support with change	Supported overall, consensus < 80%. Comments to inform Delphi 3. <ul style="list-style-type: none"> 7 support in current form. 1 support with change.
D2_res_com	Requested change to the wording for responsible person(s) section:	Comments	2 comments: <ul style="list-style-type: none"> 'Responsible person(s)' proposed wording: The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations, from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately trained, equipped, and supported and that auditing is conducted to evaluate practice.' Response: Comment support for addition of supported. <ul style="list-style-type: none"> 'The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations, from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately educated, competent and equipped, and auditing is conducted to evaluate practice.' Response: Support and competency to be included. Draft options for new wording based on the comments provided. Vote in Delphi 4.
D2_pro	'Procedure' proposed wording: Asepsis in paramedic practice is achieved using aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice provided should standardise practice, encourages efficient technique, the rationalisation of equipment choices and suggests explicit sequencing to 'prescribe out' variable practices. An exemplar is provided later in the advice.	0 = not support 1 = support section 2 = support with change	Supported overall, consensus < 80%. Comments to inform Delphi 3. <ul style="list-style-type: none"> 4 support in current form. 5 support with change.
D2_pro_com		Comments	5 comments: <ul style="list-style-type: none"> Second sentence is complex and I don't understand the use of 'prescribe out' in the context. Response: Agreed – change prescribe out to eliminate. <ul style="list-style-type: none"> Grammar needs work – doesn't flow. Response: Grammar reviewed. <ul style="list-style-type: none"> Change the first sentence to: Asepsis in paramedic practice is achieved using aseptic fields and non-touch technique to ensure asepsis of key-parts and key-sites within the immediate procedural environment in maintained. Response: Accept – to keep continuity with previous changes, non-touch technique has been inserted. <ul style="list-style-type: none"> Relates to the first question, the use of aseptic fields is part of the procedure, along with hand hygiene, use of sterile equipment, cleaning of existing key-parts, etc. Response: As per comment 3, adding ANTT resolves this. <ul style="list-style-type: none"> I'm not sure about standardising practice in the context of being unable to standardise the setting, however the advice and risk assessment 'tools' should certainly be standardised. Asepsis in paramedic practice is achieved using aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice provided should standardise a framework for practice, encourage efficient technique, the rationalisation of equipment choices and suggest explicit sequencing to 'prescribe out' variable practices. An exemplar is provided later in the advice. Response: Taken on board for next round. New wording for Delphi 3: Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice aims to reduce variable practices by standardising practice, encouraging efficient technique, encouraging rationalisation of equipment choices and suggesting explicit sequencing.

Table S8. Round 2 outcomes (*continued*)

Variable name	Stem	Response level/distribution	Level of Consensus, comments and response to comments
D2_tip_com	We will be releasing the draft procedural advice for review in the next survey. For the tips section, please indicate any tips that you would like included in the procedural advice.	Comments	3 comments: <ul style="list-style-type: none"> • Tips for taking the immediate environment into account, eg, dirty, wet, windy. • Would it be of value to include 'accepted variations' section to whatever procedural advice is given. • Prepare equipment ready for procedure using non-touch technique to preserve the asepsis/sterility of key-parts. Open packaging using easy peel tabs. Equipment remains capped, covered or placed in packaging cradle (micro-aseptic field) until required.
D2_fin_com	Thank you for your participation, if you have any further comments please use the space below.	Comments	No comments provided.

Results survey 3, part 1

Table S9. Delphi round 3, part 1 results for changes to the definitions of sections

Variable name	Stem	Response level/distribution	Level of consensus, comments and response to comments
D3_def	For the area 'Definition', the words 'an aseptic non-touch technique and' have been added to improve clarity. The revised wording is: Asepsis in paramedic practice is achieved using an aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment.	1 = accept change 0 = reject change	Consensus reached. <ul style="list-style-type: none"> • 9 accept change. • 0 reject change.
D3_ind	For the area 'Indications', the word invasive was added to improve clarity. The revised wording is: Asepsis is to be maintained during invasive clinical procedures to prevent contamination of key-parts and key-sites by microorganisms that could cause infection.	1 = accept change 0 = reject change	Consensus reached. <ul style="list-style-type: none"> • 8 accept change. • 1 reject change.
D3_res	For the area 'Responsible person(s)', several comments centred on grammar and modal verbs. It is proposed the wording align more closely with legislative requirements. To achieve this change two options have been developed. Please indicate which option you support. Option 1: The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations; from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately trained and competent, equipped and supported, and auditing is conducted to evaluate practice. Option 2: The responsibility of maintaining asepsis in paramedic practice falls on all levels of organisations from individual clinicians performing appropriate actions to executive management ensuring the workforce is adequately supported, educated, trained and equipped, and ensuring the use of a risk management framework for managing infection risks.	1 = accept option 1 2 = accept option 2 0 = accept either option	Consensus reached – option 2 accepted. <ul style="list-style-type: none"> • 1 accept option 1. • 7 accept option 2. • 1 accept either option.
D3_res_com	Do you have any comments regarding the wording for 'Responsible person(s)'?	Comments	9 comments: <ul style="list-style-type: none"> • No (7 participants). • Option 2 identifies the need for risk management. • Point 5 – too many uses of asepsis and aseptic in one sentence?
D3_pro_1	For the area 'Procedure', additional words have been added to improve clarity. Changes have been made in both sentences and will be presented separately. In the first sentence 'aseptic non-touch technique and aseptic' was added. The revised wording is: Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice aims to reduce variable practices by standardising practice, encouraging efficient technique, encouraging rationalisation of equipment choices and suggesting explicit sequencing.	1 = accept addition of 'aseptic non-touch technique and aseptic' to first sentence. 0 = reject addition of 'aseptic non-touch technique and aseptic' to first sentence.	Consensus reached. <ul style="list-style-type: none"> • 7 accept addition. • 2 reject addition.
D3_pro_2	For the area 'Procedure', additional words added to improve clarity. Changes have been made in both sentences and will be presented separately. In the second sentence 'aims to reduce variable practices' was added. The revised wording is: Asepsis in paramedic practice is achieved using aseptic non-touch technique and aseptic fields to ensure asepsis of key-parts and key-sites within the immediate procedural environment. The advice aims to reduce variable practices by standardising practice, encouraging efficient technique, encouraging rationalisation of equipment choices and suggesting explicit sequencing.	1 = accept addition of 'aims to reduce variable practices' to the second sentence. 0 = reject addition of 'aims to reduce variable practices' to the second sentence.	Consensus reached. <ul style="list-style-type: none"> • 7 accept. • 2 reject.

Results survey 3, part 2

Table S10. Delphi round 3, part 2: result for procedural advice

D3_HH_action	Perform hand hygiene critical action: If the hands are soiled – use soap and water or a detergent wipe to clean. Post hand hygiene allow the hands to air dry or dry with a single use towel. If the hands are not soiled use an alcohol-based hand rub (ABHR).	0 = reject 1 = accept 2 = accept with change	Generally supported, consensus < 80%. Comments to inform Delphi 4. <ul style="list-style-type: none"> • 1 reject. • 6 accept. • 2 accept with change.
D3_HH_actcom	Hand hygiene critical action change requested.	Comments	2 comments: <ul style="list-style-type: none"> • Paramedics do not usually have access to either soap or water. Possibly will if providing care in an RACF so worth including as an option. Including the words detergent wipe might mean they use the cleaning wipes, so more clarity needed there. Suggest changing the order to highlight ABHR is first preference. If the hands are not soiled use an alcohol-based hand rub (ABHR). If the hands are soiled – use soap and water if available and dry with a single use towel, or a hand wipe to clean all visible soil, allow to dry and followed by ABHR. Post hand hygiene allow the hands to air dry or dry with a single use towel. Response: <ul style="list-style-type: none"> • if the hands are soiled – optimally, use soap and water or, if unable to do so, use a detergent wipe to clean. Response: Change order of advice and edit advice on soap and water. D4 accept/reject comment. New suggested wording for Delphi 4: If the hands are not soiled use alcohol-based hand rubs or gel (ABHR). If the hands are soiled – use soap and water or detergent based wipe suitable for hand hygiene and dry with a single use towel.
D3_HH_rationale	Perform hand hygiene rationale: Removing soiling and pathogens from hands prior to contact with a patient or clinical environment lowers the transmission of HAIs.	0 = reject 1 = accept 2 = accept with change	Support 89% accept. Consensus reached. <ul style="list-style-type: none"> • 8 accept. • 1 accept with change.
D3_HH_ratcom	Hand hygiene rationale change requested.	Comments	1 comment: <ul style="list-style-type: none"> • Removing soiling and pathogens from hands prior to contact with a patient or clinical environment lowers the risk of transmission of HAIs. Response: No change consensus reached.
D3_PrePt_action	Prepare patient critical action: Obtains consent from the patient. Use gloves only when appropriate, such as when removing a bloodstained dressing or where there is a risk of blood or body fluid (BBF) contamination. After preparing the patient remove gloves (if worn) and perform hand hygiene (ABHR).	0 = reject 1 = accept 2 = accept with change	Consensus reached after review of comments. 1 comment regarded grammar not content. <ul style="list-style-type: none"> • 7 accept. • 2 accept with change.
D3_PrePt_actcom	Prepare patient critical action change requested.	Comments	2 comments: <ul style="list-style-type: none"> • Obtain consent ... instead of 'Obtains'. Response: Accepted – grammar to be reviewed in final framework. <ul style="list-style-type: none"> • I am a bit lost with context. The last line is a bit confusing. Preparing patient for what? Response: Face validity and content validity will be reviewed post guidance drafting.

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_PrePt_rat	Prepare patient rationale: Patients must be informed prior to giving consent for a procedure. Decrease risk of contact with BBF reduces pathogens on hand post patient contact.	0 = reject 1 = accept 2 = accept with change	Support 89.8%. Consensus reached after review of comments. 1 comment regarded grammar not content. <ul style="list-style-type: none"> • 7 accept. • 2 accept with changes.
D3_PrePt_ratcom	Prepare patient rationale change requested.	Comments	2 comments: <ul style="list-style-type: none"> • Not all patients can give informed consent, eg, ALOC, etc. Response: Advice is consistent with guidelines on consent. <ul style="list-style-type: none"> • Decreases instead of decrease, or change reduces to reduce. Suggest you need consistency in these. Response: Accepted – guidance will be reviewed by editor prior to final version.
D3_Pre_Wk_action	Prepare the work area critical action: Clean and make ready the work surface with sanitising/detergent wipe and or new bluey as applicable. If working in an ambulance this includes cleaning the work surface with a sanitising/detergent wipe.	0 = reject 1 = accept 2 = accept with change	Consensus < 80%, comments regarded name of bluey and wipe. Comments to inform Delphi 4. <ul style="list-style-type: none"> • 6 accept. • 3 accept with change.
D3_Pre_Wk_actcom	Prepare work area critical action change requested.	Comments	3 comments: <ul style="list-style-type: none"> • What will we do if they ever change the colour of the blueys? Just a thought. • Suggest using word other than 'bluey'. That is a brand name, and think you should be generic. Perhaps use 'disposable absorbent surface protecting underpad' and if you don't think this will be understood, add eg, 'Bluey'. • Replace sanitising/detergent with detergent/disinfectant. Response: Accept issues around nomenclature. Delphi round 4. New wording: Clean and make ready the work surface with detergent/disinfectant wipe and or new bluey (disposable absorbent underpad) as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe. Response choice accept/reject/comment.
D3_PreWk_rat	Prepare the work area rationale: Reduces risk of pathogen transmission.	0 = reject 1 = accept 2 = accept with change	Consensus > 80%. <ul style="list-style-type: none"> • 8 accept. • 1 accept with change.
D3_PreWk_ratcom	Prepare work area rationale change requested.	Comments	<ul style="list-style-type: none"> • Reduce or reduces ... need to be consistent in the use of reduce or reduces, decrease or decreases ... semantics but important. Response: Accepted – guidance will be reviewed by editor prior to final version.
D3_Ass_Eq_action	Assemble the equipment critical action: Identify and gather equipment for procedure, such as dressing kits, disposable medication trays, and disposable tourniquets, skin preparation, cannulas, etc.	0 = reject 1 = accept 2 = accept with change	Consensus > 80%. <ul style="list-style-type: none"> • 8 accept. • 1 accept with change.

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_Ass_Eq_actcom	Assemble the equipment critical action change requested.	Comments	1 comment.
D3_Ass_Eq_rat	Assemble the equipment rationale: Ensures procedure is not broken to gather missing items. Breakages in procedure increases the risk of contamination and pathogen transmission.	0 = reject 1 = accept 2 = accept with change	Support < 80%. Consensus not reached. Comments regarding explanation of contamination to inform Delphi 4. <ul style="list-style-type: none"> • 7 accept. • 2 accept with change.
D3_Ass_Eq_ratcom	Assemble the equipment rationale change requested.	Comments	2 comments: <ul style="list-style-type: none"> • Ensure or ensures depending on what is being used throughout. Consider interrupted instead of broken, but no big deal. Response: Accepted – guidance will be reviewed by an editor prior to final version. <ul style="list-style-type: none"> • Move 'Packaging of clinical supplies can become contaminated with pathogens when stored.' from the field below to here. Response: Accepted – wording redrafted to be put to participants in D4. Response level accept/reject/ comment. New wording: Ensures procedure is not interrupted to gather missing item. Interruptions to procedures increases the risk of contamination and pathogen transmission.
D3_Pre_Fie_action	Prepare the fields critical action: Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites: <ul style="list-style-type: none"> • Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. • Clean fields – ensure placement to maintain integrity of micro-fields that will be used in conjunction with a clean field. 	0 = reject 1 = accept 2 = accept with change	Support > 80% when comments reviewed. One comment regarded grammar only not content. However, one participant raised an important point that would strengthen guidance. As such carried through to D4 accept/reject basis. <ul style="list-style-type: none"> • 7 accept. • 2 accept with change.

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_Pre_Fie_actcom	Prepare the fields critical action change requested.	Comments	<p>2 comments:</p> <ul style="list-style-type: none"> No need for hyphen in key sites, clean field instead of clean fields so consistent with sterile field. <p>Response: Not accepted – key-site and key-part is consistent with NHMRC nomenclature.</p> <ul style="list-style-type: none"> Clean fields – ensure placement to maintain integrity of micro-aseptic fields that will be used in conjunction with a clean field. <p>Response: Accepted – critical action redrafted for Delphi 4.</p> <p>New wording:</p> <p>Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites:</p> <ul style="list-style-type: none"> Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. Clean fields – ensure placement to maintain integrity of micro critical aseptic fields that will be used in conjunction with a clean field.
D3_Pre_Fie_rat	Prepare the fields rationale: Packaging of clinical supplies can become contaminated with pathogens when stored.	0 = reject 1 = accept 2 = accept with change	<p>Support < 80%. Consensus not reached. Comments to inform Delphi 4.</p> <ul style="list-style-type: none"> 7 accept. 2 accept with change.
D3_Pre_Fie_ratcom	Prepare the fields rationale change requested.	Comments	<p>2 comments:</p> <ul style="list-style-type: none"> Over time or where stored improperly. Reduces the risk of contaminating packaging and/or items as they are opened and placed on the field. <p>Response: Accepted – 'prepare fields rationale' redrafted for next round.</p> <p>New wording:</p> <p>Reduces the risk of contamination of key-parts, micro critical aseptic fields or sterile fields as packaging is opened or clinical items and placed on the field.</p>
D3_Pre_PEq_action	<p>Prepares procedural equipment critical action: After preparing the field, open procedural equipment packaging in a way that maintains asepsis:</p> <ul style="list-style-type: none"> Sterile field – carefully drop the required sterile equipment into the appropriate place on sterile field. Clean fields – gather and open procedural equipment packaging in a way that maintains asepsis of key-parts. Place on the clean field and use the sterile packaging as a micro-field. 	0 = reject 1 = accept 2 = accept with change	<p>Support 89%. Consensus reached.</p> <ul style="list-style-type: none"> 8 accept. 1 accept with change.
D3_Pre_PEq_actcom	Prepare procedural equipment critical action change requested.	Comments	<p>1 comment:</p> <ul style="list-style-type: none"> As per previous comment re clean field or clean fields. <p>Response: Accepted – grammar will be reviewed by an editor.</p>
D3_Pre_PEq_rat	Prepares procedural equipment rationale: Maintains the asepsis of key-parts.	0 = reject 1 = accept 2 = accept with change	<p>100% support. Consensus reached.</p> <ul style="list-style-type: none"> 9 accept.
D3_Pre_PEq_ratcom	Prepare procedural equipment rationale change requested.	Comments	No comments.

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_Pre_PP_action	Prepare to perform procedure critical action: Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply new gloves if there is a risk of blood and bodily fluid contamination and use eye protection and masks as required. Use sterile gloves with procedures such as intraosseous needle insertion or if the hands are entering semi-critical body areas such as the vagina during procedures to assist birthing.	0 = reject 1 = accept 2 = accept with change	Support 44%. Consensus not reached. Comments to inform Delphi 4. Remove IO from section as example and redraft using semi-critical and critical for D4. <ul style="list-style-type: none"> • 4 accept. • 5 accept with change.
D3_Pre_PP_actcom	Prepare to perform procedure critical action change requested.	Comments	<ul style="list-style-type: none"> • Is IO insertion indicated to use sterile gloves? Maybe time critical procedure in which changing of gloves from non-sterile to sterile is impracticable? <p>Response: Review examples used.</p> <ul style="list-style-type: none"> • I have inserted notes and suggested changes into the body of the text. Perform hand hygiene (use ABHR) prior to donning PPE. NB sterile gloves aren't necessarily PPE in some of these procedures. Don required PPE. Apply new gloves and eye protection for invasive procedures and a face mask or shield if facial splashing is anticipated. Use sterile gloves with procedures such as intraosseous needle insertion or if the hands are entering semi-critical body areas such as the vagina during procedures to assist birthing. NB rather than using the term 'such as' perhaps provide a more structured form of guidance about the types of invasive procedures that require sterile gloves? • Why is IO used as an example? Is this practical in the pre-hospital setting, to use sterile gloves for IO? I know we are aiming for the gold standard but it also has to be practical in its application. Normal ambulance gloves are not sterile. <p>Response: Review examples.</p> <ul style="list-style-type: none"> • Sterile gloves for IO in the pre-hospital setting? <p>Response: Review examples.</p> <ul style="list-style-type: none"> • Consider removing 'new' – apply new gloves implies they are already on. When did this occur? The ones that were worn to prepare the patient have already been removed and gloves are not required to set up for the procedure – needs clarification. <p>Response: Review grammar for Delphi 4.</p> <p>New wording critical action D4:</p> <p>Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply gloves if there is a risk of blood and bodily fluid contamination and use eye protection and masks as required. Use sterile gloves with semi-critical or critical procedures such as when the hands are entering semi-critical body areas such as the vagina during procedures to assist birthing.</p>
D3_Pre_PP_rat	Prepare to perform procedure rationale: Protects the paramedic from BBF contamination and pathogen transmission.	0 = reject 1 = accept 2 = accept with change	Support 89%. Consensus reached. <ul style="list-style-type: none"> • 8 accept. • 1 accept with change.
D3_Pre_PP_ratcom	Prepare to perform procedure rationale change requested.	Comments	<p>1 comment:</p> <ul style="list-style-type: none"> • Protects the paramedic from BBF contamination and the patient from pathogen transmission. <p>Response: Not accepted as consensus reached.</p>

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_Per_Pr_action	Perform the procedure critical action: Ensure all key parts/components are protected: • Sterile items are used once and disposed into waste bag. • Only sterile items contact a key-site. • Sterile items do not come into contact with non-sterile items.	0 = reject 1 = accept 2 = accept with change	Support 89% on review of comments. Consensus reached as only 1 comment regarded content. • 7 accept. • 2 accept with change.
D3_Per_Pr_actcom	Perform the procedure critical action change requested.	Comments	• Maybe it comes back to the term sterile. Cannot recall earlier discussion around this. Are we clearly defining sterile somewhere in the document? Response: Dealt with in definitions. • Consider 'only sterile items contact a key-part or a key-site'. Response: Accept – suggested wording is more concise wording with same meaning. Consensus reached 100%. • 9 accept.
D3_Per_Pr_rat	Perform the procedure rationale: Maintains asepsis of key-parts and key-sites during procedures.	0 = reject 1 = accept 2 = accept with change	No comment.
D3_Per_Pr_ratcom	Perform the procedure rationale change requested.	Comments	Support 78%. Consensus not reached. Comments to inform Delphi 4. • 7 accept. • 2 accept with change.
D3_Pos_Pr_action	Post procedure critical action: Remove gloves and perform hand hygiene (ABHR). Clean work surface after use with a sanitising wipe if applicable, and perform hand hygiene (ABHR).	0 = reject 1 = accept 2 = accept with change	2 comments: • Critical action: Remove protective equipment and perform hand hygiene (ABHR). Clean work surface after use with a cleaning wipe if applicable, and perform hand hygiene (ABHR). Response: Accept suggestions and redraft. • Remove and dispose of gloves. Use ABHR ... Response: Accept addition of dispose. New wording: Post procedure critical action: Remove and dispose of gloves if worn and perform hand hygiene (ABHR). Clean work surface after use with a detergent/disinfectant wipe if applicable, and perform hand hygiene (ABHR).
D3_Pos_Pr_actcom	Post procedure critical action change requested.	Comments	Support 44%. Consensus not reached. Comments to inform Delphi 4. • 5 accept. • 4 accept with change.
D3_Pos_Pr_rat	Post procedure rationale: The outside of gloves will be inoculated with pathogens during procedures. Gloves are also porous and can aerosol pathogens during doffing. This ensures decreased risk of pathogen transmission.	0 = reject 1 = accept 2 = accept with change	

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_Pos_Pr_ratcom	Post procedure rationale change requested.	Comments	4 comments:
			<ul style="list-style-type: none"> Rationale: The outside of gloves will be contaminated with pathogens during procedures. Hands can be contaminated during the doffing process. This ensures decreased risk of pathogen transmission. Gloves are also porous and pathogens can be aerosolised during doffing. The outside of the gloves are likely to be contaminated. Aerosol pathogens? That's not a rationale for doffing. It's the rationale for carefully doffing so as to agitate and disturb any potential pathogens which may be on the gloves. The outside of gloves and work surfaces can be contaminated with pathogens during procedures. Removing gloves and cleaning work surfaces on completion of the procedure reduces the risk of cross contamination for subsequent procedures, patients and clinicians.
			<p>Response: Review advice and redraft with suggestions. New wording: Pathogen contamination of a clinician's hands may occur through small defects in the gloves or during glove removal. This ensures decreased risk of pathogen transmission.</p>
D3_Rec_action	Record critical activity: Record procedure in notes including compliance issues with aseptic.	0 = reject 1 = accept 2 = accept with change	Support 89%. Consensus reached.
D3_Rec_actcom	Record critical action change requested.	Comments	<p>1 comment:</p> <ul style="list-style-type: none"> 8 accept. 1 accept with change.
D3_Rec_rat	Record rationale: Allows identification and notification of increased risk of HAI.	0 = reject 1 = accept 2 = accept with change	<p>Response: Suggestion accepted to replace notes with patient care record for precision of terms. Support 89%. Consensus reached. However, comment to inform Delphi 4.</p> <ul style="list-style-type: none"> 8 accept. 1 accept with change.
D3_Rec_ratcom	Record rationale change requested.	Comments	<p>1 comment:</p> <p>Provides identification and notification of increased risk of HAI and enables (or facilitates) early intervention. Response: Consider for Delphi 4. New wording: Provides identification and notification of increased risk of HAI that enables early intervention.</p>
D3_Dev_action	Deviations critical action: Deviation from procedural guideline is acceptable if a true life-threat needs to be dealt with as the patient will significantly deteriorate if immediate action is not taken, for example to provide compression to a life-threatening haemorrhage. In such cases the paramedic should perform the procedure in a way that minimises the risk of pathogen contamination of key-parts and key-sites and maintains their safety. Once the immediate threat has been resolved further deviation is not warranted.	0 = reject 1 = accept 2 = accept with change	<p>Support 89%. Consensus reached. However comment to inform Delphi 4 regarding whether advice about deviations requires a rationale.</p> <ul style="list-style-type: none"> 8 accept. 1 accept with change.

Table S10. Delphi round 3, part 2: result for procedural advice (*continued*)

D3_Dev_actcom	Deviations critical action change requested.	Comments	1 comment: <ul style="list-style-type: none">• A deviation from procedure should be adequately recorded on the patient record. Response: Delphi 4 to ask participants if the deviations advice requires a rationale. New wording: A deviation from procedure that breaks the guidance should be adequately recorded on the patient record.
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Results survey 4

Table S11. Results of survey 4

Variable name	Stem	Response level/distribution	Level of consensus, comments and response to comments
D4_CAHH	1. The critical action of hand hygiene was supported overall. However, a clarification was suggested in the second sentence. As such, 'a detergent wipe' is replaced with 'detergent-based wipe suitable for hand hygiene'. The full second sentence is: 'If the hands are soiled – use soap and water or detergent-based wipe suitable for hand hygiene and dry with a single use towel.'	1 = accept change 0 = reject change	100% support. Consensus reached. • 7 accept change. • 0 reject change.
D4_CAHH2	2. The critical action of hand hygiene was supported overall. However, comments received advised changing the order of the sentences to begin the section with advice regarding non-soiled hands followed by the advice for soiled hands. The new sentence order is: 'If the hands are not soiled, use an alcohol-based hand rub (ABHR). If the hands are soiled, use soap and water or detergent-based wipe suitable for hand hygiene and dry with a single use towel.'	1 = accept change 0 = reject change	100% support. Consensus reached. • 7 accept change. • 0 reject change.
D4_CAPWA	3. Prepare the work area critical action was supported with a change to the use of the word 'bluey' and how a cleaning agent is described. The suggested new wording is: 'Clean and make ready the work surface with detergent/disinfectant wipe and/or new bluey (disposable absorbent underpad) as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe.'	1 = accept change 0 = reject change	86% support. Consensus reached. • 6 accept change. • 1 reject change.
D4_PTWA_comments	4. Do you have any further comment on the new wording? 'Clean and make ready the work surface with detergent/disinfectant wipe and/or new bluey (disposable absorbent underpad) as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe.'	Comments	(n = 4) • Perhaps remove reference to 'bluey', whilst understood is not a good definition. The absorbent underpad should also perhaps mention a water proof/resistant outer layer. • There is no need to include the word bluey. Disposable absorbent underpad is what it should be on its own. • Bluey is a slang term. Suggest changing to 'Clean and make ready the work surface with detergent/disinfectant wipe and/or new disposable absorbent underpad ('bluey') as applicable. If working in an ambulance this includes cleaning the work surface with a detergent/disinfectant wipe.' • Are we implying that only within an ambulance the work surface needs cleaning and disinfection? Surely ANY work surface should be cleaned prior to use?? Or do we assume they think all work surfaces in an ambulance are already clean?
	5. Assembling the equipment rationale was supported, however comments were received that suggested improving the wording. The suggested new wording is: 'Ensures procedure is not interrupted to gather missing item. Interruptions to procedures increases the risk of contamination and pathogen transmission.'	1 = accept change 0 = reject change	86% support. Consensus reached. • 6 accept change. • 1 reject change.

Table S11. Results of survey 4 (*continued*)

Variable name	Stem	Response level/distribution	Level of consensus, comments and response to comments
	6. Do you have any further comment on the wording 'Ensures procedure is not interrupted to gather missing item. Interruptions to procedures increases the risk of contamination and pathogen transmission.'	Comments	(n = 1) It isn't always possible to avoid interruptions, ie, if an item is dropped or contaminated it will need to be replaced so I'd suggest 'Ensures the risk of unnecessary interruption to the procedure is avoided to gather missing item. Interruptions to procedures increases the risk of contamination and pathogen transmission. Contaminated equipment requires replacement regardless of interruptions.'
	7. Preparing the fields critical action was supported with a change to the wording. The suggested new wording is: 'Perform hand hygiene (ABHR) and prepare a field for the protection of key-parts and key-sites:	1 = accept change 0 = reject change	100% support. Consensus reached. <ul style="list-style-type: none"> • 7 accept change. • 0 reject change.
	<ul style="list-style-type: none"> • Sterile field – open procedure packs to maintain sterility of contents. Arrange in a way to maintain the integrity of the sterile field and its contents. • Clean fields – ensure placement of clinical equipment in open packets on the clean field to maintain the integrity of micro critical aseptic fields.' 		
	8. Do you have any further comments regarding preparing the fields critical action?	Comments	Nil.
	9. Prepare the fields rationale was accepted with a change to the wording. The suggested new wording is: 'Reduces the risk of contamination of key-parts, micro critical aseptic fields or sterile fields as packaging is opened or clinical items and placed on the field.'	1 = accept change 0 = reject change	71% sought. Consensus reached as not a change to content only wording. Greater than 50%. <ul style="list-style-type: none"> • 5 accept change. • 2 reject change.
	10. In the original version for preparing to perform the procedure action was supported. However, the inclusion of an IO device as an example was questioned. Other comments centred on grammar. The suggested new wording is: 'Perform hand hygiene (use ABHR) prior to donning PPE. Don required PPE. Apply gloves if there is a risk of blood and bodily fluid contamination and use eye protection and masks as required. Use sterile gloves with semi-critical or critical procedures such as when the hands are entering semi-critical body areas, for example the vagina during procedures to assist birthing.'	1 = accept change 0 = reject change	100% support. Consensus reached. <ul style="list-style-type: none"> • 7 accept change. • 0 reject change.
	11. The post-procedure critical action was supported with a change to wording. The suggested new wording is: 'Remove and dispose of gloves if worn and perform hand hygiene (ABHR). Wearing appropriate PPE, clean work surface with a detergent/disinfectant wipe. Remove PPE (if applicable) and then perform hand hygiene (ABHR).'	1 = accept change 0 = reject change	86% support. Consensus reached. <ul style="list-style-type: none"> • 6 accept change. • 1 reject change.

Table S11. Results of survey 4 (*continued*)

Variable name	Variable name	Variable name	Variable name
	12. Do you have any further comments regarding the post-procedure critical action wording?	Comments	N = 1 I actually accept the wording but does 'Wearing appropriate PPE, clean work surface with a detergent/disinfectant wipe' need to include disposal of the bluey? I.e, Wearing appropriate PPE, clean work surface with a detergent/disinfectant wipe and appropriately dispose of the bluey if used.
	13. Post-procedure rationale was supported with a change to the wording particularly regarding glove use. The suggested new wording is: 'Contamination of a clinician's hands may occur through small defects in the gloves or during glove removal. Hand hygiene post glove removal decreases the risk of pathogen transmission. The wearing of PPE is recommended when cleaning to reduce potential contamination of clinician's hands and to reduce exposure to cleaning chemicals.'	1 = accept change 0 = reject change	100% support. Consensus reached. • 7 accept change. • 0 reject change.
	14. Recording the procedure rationale wording reached consensus. Nevertheless, an astute comment suggested including early intervention as part of the statement. The suggested new wording is: 'Provides identification and notification of increased risk of HAI that enables early intervention.'	1 = accept change 0 = reject change	100% support. Consensus reached. • 7 accept change. • 0 reject change.
	15. The original survey did not include a rationale for the advice on deviation. The suggested new wording is: 'A deviation from procedure that breaks the guidance should be adequately recorded on the patient record.'	1 = accept change 0 = reject change	100% support. Consensus reached. • 7 accept change. • 0 reject change.