



Version history

Version	Date	Summary of changes
V4.0	December 2025	Three-year update of the literature review
		 Updated using a new methodology as outlined in the development process.
		The following questions were modified from the
		previous review.
		 Are there any legislative requirements for the use of footwear as PPE for infection control purposes? (modification: added the phrase "or standards (BS/EN/ISO)")
		 Should overshoes be used? (modification: removed the word "when")
		When should specialist footwear be worn? (modification: previously "When/Where should dedicated footwear be used)
		 Where and how should footwear be donned? (modification: previously "How should dedicated footwear be donned?")
		 Where and how should footwear be doffed? (modification: previously "How should dedicated footwear be doffed?")
		 When and how should footwear be cleaned? (modification: combined the two separate questions "When should footwear be cleaned?" and "How should footwear be cleaned?")
		 How should footwear be stored? (modification: previously "How should dedicated footwear be stored?")
		 When and how should footwear be disposed of? (modification: previously "How/when should footwear be disposed of?")



Version	Date	Summary of changes
		Databases were searched for evidence published between 1 January 2020 and 19 March 2024 for all questions Search strategies added as Appendix 4
V3.0	August 2021	This literature review has been updated using two- person systematic review methodology. Five additional research questions were added and two existing research questions were modified
V2.0	August 2015	Updates after review of current literature
V1.0	January 2012	Defined as final

Approvals

Version	Date Approved	Group/Individual
V4.0	November 2025	National Policy, Guidance and Evidence (NPGE) Working Group
V3.0	July 2021	Steering (Expert Advisory) Group for SICPs and TBPs
V2.0	August 2015	Steering (Expert Advisory) Group for SICPs and TBPs
V1.0	January 2012	Steering (Expert Advisory) Group for SICPs and TBPs



Key information

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Document information

Document information	Description	
Description:	This literature review examines the available	
	professional literature on footwear within health and	
	care settings	
Purpose:	To inform the sections on Personal Protective	
	Equipment (PPE): Footwear in the National Infection	
	Prevention and Control Manual in order to facilitate	
	the prevention and control of healthcare associated	
	infections in NHS Scotland health and care settings.	
Target Audience:	All NHS staff involved in the prevention and control of	
	infection in NHS Scotland.	
Update/review schedule:	A formal review will be conducted in 5 years (2030)	
Cross reference:	National Infection Prevention and Control Manual	
Update level:	Practice – No significant changes to practice.	
	Research – Several areas of research require higher	
	quality primary research to allow the formation of	
	evidence-based recommendations regarding the use	
	of footwear for IPC in health and care settings.	

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1 Objectives

The aim of this review is to examine the extant professional literature regarding the use of footwear as Personal Protective Equipment (PPE) for infection control purposes in health and care settings to inform evidence-based recommendations for practice.

The specific objectives of the review are to determine:

- Are there any legislative requirements or standards (BS/EN/ISO) for the use of footwear as PPE for infection control purposes?
- What types of footwear are suitable for health and other care settings?
- Should overshoes be used?
- When should specialist footwear be worn?
- Where and how should footwear be donned?
- Where and how should footwear be doffed?
- When and how should footwear be cleaned?
- How should footwear be stored?
- When and how should footwear be disposed of?

2 Methodology

This targeted literature review was produced using a defined systematic methodology as described in the <u>National Infection Prevention and Control Manual:</u>

Development Process.

In addition to the exclusion criteria outlined in the NIPCM: Development Process the following exclusion criteria were used in this review.

 The review did not assess the use of footwear in certain health and care settings where there may be a health and safety requirement for wearing specialist footwear, for example in either estates or kitchen environments.



 Additionally, this review did not assess the use of footwear as PPE for high consequence infectious diseases (HCIDs). The literature review that examines the extant professional literature regarding <u>PPE for HCIDs</u> is available.

A search strategy is included in <u>Appendix 1</u>. Definitions for grades of evidence are provided in <u>Appendix 2</u>. A PRISMA flowchart is presented in <u>Appendix 4</u> and is adapted from: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097.

3 Discussion

3.1 Implications for practice

3.1.1 Are there any legislative requirements or standards (BS/EN/ISO) for the use of footwear as PPE for infection control purposes?

Only legislation, policy, and standards documents were considered relevant for this research question. Eight pieces of evidence were included. This consisted of four legislation documents,¹⁻⁴ and one Scottish Government DL⁵ (all graded 'mandatory') and three British Standards graded SIGN 50 level 4.⁶⁻⁸ Four documents were carried over from version 3.0 of this review,²⁻⁵ and four were identified in this current update.^{1, 6-8}

There are no specific legislative requirements regarding the use of footwear as personal protective equipment (PPE) for infection control purposes. However, there are broader legislative requirements and standards such as the Health and Safety at Work etc. Act (1974), Control of Substances Hazardous to Health 2002 Regulations (as amended), the Personal Protective Equipment at Work (Amendment) Regulations 2022 and BS/EN/ISO 20347:2022+A1:2024, that provide guidance on the safety and hygiene of workers in various occupational settings. These typically focus on general health and safety rather than infection control. As such, while some



types of footwear may be classified as PPE in certain work environments, within health and care settings, footwear is generally not considered PPE for IPC purposes

Legislation

The use of PPE in health and care settings is covered by the Health and Safety at Work etc. Act (1974), Control of Substances Hazardous to Health 2002 Regulations (as amended), and the Personal Protective Equipment at Work (Amendment) Regulations 2022.¹⁻³

The Health and Safety at Work etc. Act is the generic health and safety legislation for the UK and broadly covers the use of PPE and risk, but is not healthcare specific.¹ Employers are required by the Health and Safety at Work etc. Act 1974 to ensure the health, safety, and welfare of employees at work, which includes providing necessary PPE.¹

The Control of Substances Hazardous to Health (COSHH) is more specific and provides details in relation to hazardous materials and the use of PPE.² COSHH can almost be viewed as a detailed schedule of the Health and Safety at Work etc. Act, which would include infectious agents in health and care settings and the use of appropriate PPE. It mandates that employers prevent or control exposure to hazardous substances and provide suitable PPE, such as respiratory equipment, protective clothing, gloves, footwear, and eye protection, when other measures are insufficient.² The Personal Protective Equipment at Work (Amendment) Regulations 2022 further require employers to provide and maintain PPE for workers exposed to health or safety risks, ensuring it is kept in good condition.³

Regulation 2016/425 associated with the PPE (Enforcement Regulations) 2018 and the Regulation (EU) 2016/425, outline that PPE available on the market must be supplied with information on, "storage, use, maintenance, servicing, cleaning and disinfecting; the level of protection provided by the PPE; suitable PPE accessories and appropriate spare parts; limitations on use and the obsolescence period [expiry date] for the PPE or certain of its components".⁴ The PPE (Enforcement Regulations) 2018 further set out the essential health and safety requirements that must be met before PPE products can be placed on the Great Britain market. For



example, PPE should be UKCA (UK Conformity Assessed) marked, indicating compliance with these standards.

British Standards

British Standard BS ISO 15190:2020 for medical laboratories requires the use of disposable, fluid-resistant shoe covers during tasks where splashing is likely.⁷ For large spills or potential shoe contamination, water-impermeable shoe covers are recommended. Specialised footwear, like disposable or rubberised boots, may be necessary in high infection containment areas.

British Standard BS EN ISO 20347:2022+A1:2024 for Personal Protective Equipment — Occupational Footwear specifies that occupational footwear should not harm the user's health or hygiene and is classified into Class I, II, and III according to the material it's made of.⁸ Although broadly applicable to occupational footwear, it can be applicable to health and care settings. The standard advises regular cleaning, maintenance, inspection, and replacement of footwear to ensure optimal performance, and mandates slip resistance per ISO 13287.

British Standard BS EN ISO 20344:2021+A1:2024 details test methods for personal protective footwear, including tests for occupational safety, protective clothing, water absorption, performance, and water resistance.⁶ These tests ensure the footwear meets safety and performance standards

Specific standards relating to footwear in health and care settings are further detailed in Appendix 3.

Policy

The Scottish Government National Uniform Policy, Dress Code and Laundering Policy 2018 (DL(2018)4) recommends that appropriate health and safety requirements for staff should always be met, which includes wearing soft-soled, closed-toe shoes.⁵

In summary, these documents provide an overview of the legislative requirements and standards related to the use of footwear, emphasising the importance of suitable, well-maintained, and properly classified footwear in ensuring safety in



medical laboratories and occupational settings. However, they are not specifically related to footwear that would be used as PPE for IPC purposes.

3.1.2 What type(s) of footwear are suitable for health and care settings?

In total 17 pieces of evidence were included for this research question. Thirteen of these documents were identified in this current update,^{7, 9-24} and four were carried over from version 3.0 of the review.²⁰⁻²³ Two evidence-based guidelines were graded AGREE 'recommend with modifications', ^{14, 22} and 15 were guidance documents graded SIGN 50 level 4 expert opinion as they lacked a systematic review of the literature and were based on expert opinion.^{7, 9-13, 15-21, 23, 24} Five were from the UK (including Wales and England), ^{7, 11, 12, 16, 17} three from Ireland^{13, 15, 24}, two from France,^{14, 21} two from Australia,^{10, 19} two from USA,^{20, 23} one from Canada,⁹ and one was an international guidance published by the World Health Organization (WHO).²² No primary research studies were included.

While footwear is not typically classified as PPE for IPC in health and care settings, it plays a significant role in ensuring the safety, comfort, and wellbeing of staff. This question explores what types of footwear are deemed suitable within these environments. Despite regional variations noted within the evidence, common themes emerge regarding the characteristics of appropriate footwear for these settings, including safety, and worker comfort. There is general consistency in the following areas:

Protective features

Ten guidance documents, including one AGREE 'recommend with modifications' guideline¹⁴ emphasise the need for closed-toed shoes to protect against hazards such as spills, dropped sharps, and fluid exposure. This is seen in recommendations from UK guidance (NHS England,¹⁶ NHS Wales,¹⁷ Health and Safety Executive (HSE) ¹²) and international bodies such as the WHO²², Canadian Centre for Occupational Health & Safety,⁹ the Australian and New Zealand College of Anaesthetists (ANZCA),¹⁹ the Australian National Health & Medical Research Council,¹⁰ the Department of Health of Ireland,²⁴ and the American College of Surgeons.²³ NHS England and NHS Wales provide specific recommendations for

healthcare settings. ^{16, 17} The NHS England guidance on uniform and workwear suggests wearing closed-toed shoes to protect against spills and risk from foot injury as well as soft soles to assist with noise reduction in clinical areas. ¹⁶ Similar recommendations are made by NHS Wales in their Dress Code guidance, but with low heels advised for manual handling. ¹⁷ The Department of Health in England suggests wearing soft-soled, closed-toed shoes that offer protection against spills and dropped sharps, as outlined in their information resource on infection prevention in care homes. ¹¹ This is similar to advise by the Department of Health, Ireland and the National Health and Medical Research Council, Australia that recommend wearing footwear designed to minimise the risk of injury from dropped sharps and minimise exposure to blood and bodily substances. ^{10, 24} Additionally, the WHO guidelines for epidemic- and pandemic-prone acute respiratory infections, graded AGREE 'recommend with modifications', advise that heavy-duty tasks, such as environmental cleaning, require more resistant PPE, including closed shoes. ²²

Non-slip soles

The focus on slip-resistant soles is consistent across six guidance documents including one AGREE 'recommend with modifications' graded guideline, ²² with advice for non-slip, rubber-soled shoes to prevent falls and maintain balance. ^{12, 13, 15, 20}. The UK HSE suggests selecting footwear with sole patterns and materials suited to varied conditions to help prevent slips. ¹² Likewise, The Health and Safety Authority in Ireland recommends rubber-soled shoes with broad heels for good grip and balance, discouraging slip-ons and clog types. ¹³ Additionally, in their information pack on managing hazards at the work place, they emphasise that footwear should be slip-resistant, although this guidance broadly covers all workplaces. ¹⁵ The American College of Surgeons also advises traction for dedicated footwear used in operating rooms to prevent accidents. ²³

Comfort and ergonomics

Five SIGN 50 guidance documents^{7, 16, 17, 19, 23} emphasise the importance of comfort, particularly in settings where healthcare workers are on their feet for long periods. Soft soles, low heels, and ergonomic designs are recommended.^{7, 16, 17, 19, 23} The British Standards for medical laboratories specify that shoes should be comfortable and provide full coverage, including the heel and instep.⁷ NHS England,¹⁶ and NHS

Wales¹⁷ recommend soft-soled footwear to minimise noise and enhance comfort during extended periods of wear. Similarly, the American College of Surgeons emphasises the need for comfortable operating room shoes.²³

Durability and cleanability

Four guidance documents,^{15, 21} including two AGREE 'recommend with modifications' graded guidelines^{14, 22} describe a requirement for footwear to be easy to clean and durable, particularly in environments prone to contamination.^{15, 21} The Health and Safety Authority in Ireland underscores the importance of footwear that is easy to clean and maintain.¹⁵ While, the French Society of Gastro-Intestinal Surgery advises using clogs that remain in the operating theatre and are washed daily or disposable overshoes for each surgical procedure.²¹

Compliance with health and safety standards

Four SIGN 50 level 4 guidance documents advise that footwear must adhere to occupational health and safety standards, with emphasis on performance tests for slip resistance and durability. ^{8, 17, 18, 20} The UK Association for Perioperative Practice requires footwear to have antistatic properties as outlined in British Standard BS EN ISO 20347. ¹⁸ The Australian and New Zealand College of Anaesthetists also recommends that footwear meet occupational health and safety standards and be kept clean, although these standards are not defined. ¹⁹ Similarly, the Society for Healthcare Epidemiology of America (SHEA) also recommend that footwear should meet occupational health and safety standards. ²⁰

Tailored recommendations for specific environments

Four expert opinion documents,^{7, 18, 21, 23} and one AGREE 'recommend with modifications' graded guidelines,¹⁴ provide recommendations for specific environments, such as those for operating theatres,¹⁸ and laboratories.⁷

For medical laboratories, the British Standards emphasise the use of leather or synthetic fluid-impermeable footwear to ensure safety and hygiene.⁷ In operating theatres, the American College of Surgeons²³ advocates for shoes that are easy to clean, while the Association for Perioperative Practice recommends specialised footwear with antistatic properties.¹⁸



The French Society for Anaesthesia & Intensive Care, in their guidelines graded 'AGREE recommend with modifications', specify that footwear reserved for operating theatres should be weatherproof, closed at the front, and without perforations at the back. This design aims to protect the foot from sharp, jagged, or pointed objects.¹⁴

Additional recommendations from the French Society of Gastro-Intestinal Surgery suggest clogs reserved for operating theatres, cleaned daily, or disposable overshoes for each surgical intervention.²¹

Generally, the evidence makes reference to recommended footwear for health and care settings as being comfortable, nonslip, closed-toed, and fluid-impermeable, however this is not in relation to PPE for IPC purposes. Specific guidelines emphasise the importance of protection against spills, dropped sharps, and other hazards. There is consistency in the evidence base for footwear to be cleanable and to meet occupational health and safety standards. Some guidelines are tailored to specific settings such as operating theatres where in some instances, boots or clogs are recommended for use. Others provide general advice suitable for various healthcare environments.

3.1.3 Should overshoes be used?

Eleven pieces of evidence were included for this research question. ^{14, 25} ^{19, 21, 24, 26-31} This consists of two evidence-based guidelines graded AGREE 'recommend with modifications' ^{14, 30} and nine guidance documents graded SIGN 50 level 4 expert opinion. ^{19, 21, 24-29, 31} Three were from the UK, ²⁸⁻³⁰ one from Ireland, ²⁴ two from France, ^{14, 21} two from America, ^{25, 31} two from Australia, ^{19, 26} and one for international audiences (published by the WHO). ²⁷Ten were identified in the current update ^{14, 19, 21, 24-30} and one was carried over from the previous version of this review (version 3.0). ³¹

Various health organisations provide guidance on the use of overshoes in healthcare settings, highlighting differing opinions on their necessity and effectiveness.

Guidelines from the National Institute for Health and Care Excellence (NICE) graded AGREE 'recommend with modifications' emphasise wearing non-sterile theatre wear which may include overshoes to minimise the risk of surgical site infections (SSI),



supported by expert opinion.³⁰ This recommendation is reiterated in their quality standard for prevention of surgical site infections.²⁹

Guidelines from the French Society for Anaesthesia and Intensive Care graded AGREE 'recommend with modifications' ¹⁴ and two SIGN 50 level 4 expert opinion guidance from the American Society of Anaesthesiologists (ASA)²⁵ and the Department of Health in Ireland advise²⁴ against using overshoes with dedicated theatre shoes, citing ineffectiveness in reducing contamination and potential hand contamination risks. However, the ASA reproduce this recommendation from the 1999 CDC guideline for the prevention of surgical site infections which falls outside the search dates of this review.³²

Similarly, two SIGN 50 level 4 expert opinion from the Australian Government, Department of Health and Aged Care²⁶ and the American Association of Nurse Anaesthesiology (AANA)³¹ advise against boots or shoe covers unless gross or splash contamination is anticipated. While, SIGN 50 level 4 guidance from the Australian and New Zealand College of Anaesthetists recommends that clean shoes dedicated to theatre use do not require overshoes, unless there is a risk of bringing dirt into the theatre.¹⁹

In contrast, the WHO suggests (SIGN 50 level 4) using non-slip, impermeable shoe covers if boots are unavailable ²⁷ while the French Society of Gastro-Intestinal Surgery (SIGN 50 level 4) recommends the use of clogs that stay in the theatre and are washed daily, or the use of disposable overshoes.²¹

Overall, extant guidance is consistent in advising that overshoes should not be routinely used in health and care settings, citing insufficient evidence of effectiveness and the potential risk of hand contamination during removal, particularly when clean, dedicated theatre shoes are available. Overshoes are mainly recommended in situations where there is a high risk of contamination or if there is a possibility of dirt on the shoes.



3.1.4 When should specialist footwear be worn?

Three guidance documents were included for this question. ^{14, 19, 33} Two of these documents were identified in the current review update ^{14, 19} and one carried over from the previous version of the review (version 3.0). One document was graded AGREE 'recommend with modifications' because, while a systematic search for literature was conducted, no details on the search strategy were provided. ¹⁴ Two documents were graded as SIGN 50 level 4 expert opinion. ^{19, 33} These guidance documents were published in the UK, ³³ Australia, ¹⁹ and France. ¹⁴ No primary studies were included for this research question.

Guidelines from France by the Society for Anaesthesia and Intensive Care, graded AGREE 'recommend with modifications' recommend that staff wear shoes that adhere to the EN ISO 20347:2012 standard and are exclusively reserved for the operating theatre. These shoes should be changed at least daily or more frequently if visibly soiled and should be regularly machine-washed. The guidelines view these shoes as PPE for hospital staff and advise maintaining a collective stock for proper laundering and distribution. Similarly, the Association of Anaesthetists of Great Britain & Ireland advise that dedicated footwear should be worn in the operating department and cleaned after use. This also extends to visitors who they advise should wear designated footwear in the operating theatre.

The Australian and New Zealand College of Anaesthetists advocate for the use of dedicated footwear in restricted areas, although do not specify which areas are included.¹⁹

In summary, extant guidance is consistent in advising the use of dedicated footwear in specific areas such as operating theatres to allow routine and effective decontamination of the footwear. The included guidelines highlight the importance of wearing dedicated, easily cleanable shoes and changing them regularly to ensure optimal hygiene. However, it should be noted that while the available literature supports the use of dedicated footwear in such settings, there was no evidence identified regarding the use of footwear as PPE specifically for IPC purposes.



3.1.5 Where and how should footwear be donned?

Three guidance documents were included with no primary studies identified in relation to this question.^{27, 31, 33} These were graded SIGN 50 Level 4 expert opinion, owing to a lack of a systematic review of the literature. One was identified in the current review update²⁷ and two were carried over from the previous version of this review (version 3.0).^{31, 33}

The guidance documents originated from different geographical locations: one from the UK,³³ one global guidance published by WHO,²⁷ and one from the USA.³¹

Sequence of donning

Two guidance documents graded SIGN 50 level 4 provide advice on the sequence of donning.^{27,31} A PPE for isolation rooms resource from the WHO recommends putting on rubber boots in the changing areas as the second step after removing all personal items, before performing hand hygiene and donning other PPE.²⁷ Similarly, the AANA advises putting coverings over shoes prior to donning gloves and other PPE.³¹

Location of donning

Two SIGN 50 level 4 guidance document provides advice on where to don footwear. ³³The Association of Anaesthetists of Great Britain & Ireland advises that staff (and visitors) should change into designated footwear before entering the operating theatre. ³³ While, the WHO recommends donning occurs in the changing areas. ²⁷

In summary, the evidence is limited with no evidence supporting footwear use as PPE for IPC purposes. Only the WHO and AANA provide clear steps for integrating footwear into the PPE donning process, while the Association of Anaesthetists of Great Britain & Ireland emphasise the importance of donning designated footwear prior to entering the operating theatre with the WHO advising that this should occur in the changing areas.

3.1.6 Where and how should footwear be doffed?

Four pieces of evidence were included for this question, this did not include any primary studies. ^{18, 31, 34, 35} This includes one AGREE 'recommend' graded guideline, ³⁴ and three SIGN 50 level 4 expert opinion guidance documents. ^{18, 31, 35}



Three were identified in the current review update, ^{18, 34, 35} and one was carried over from the previous version of this review (version 3.0). ³¹

One SIGN 50 level 4 guidance document was published for the UK,¹⁸ and one AGREE 'recommend' guideline published by the Healthcare Infection Society (HIS) and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) is intended for the EU.³⁴ Additionally, one document was published by WHO,³⁵ and intended for a global audience, and one guidance document was published in the USA.³¹

Location of doffing

This body of evidence is consistent in advising that theatre footwear should be removed just outside the operating theatre before leaving the area, however there is no consistency regarding other types of footwear.

The HIS and ESCMID, in their joint guidelines on rituals and behaviours in the operating theatre, advise changing footwear when leaving the operating theatre complex "with the intention of returning" but do not specify an exact location.³⁴ The Association for Perioperative Practice (AfPP), in their guidelines on operating theatre standards and recommendations, state that footwear should be removed in an area outside the operating theatre and not left in a contaminated state or on changing room floors.¹⁸ The AANA, in their infection prevention and control guidelines for anaesthesia care, advise that shoe coverings must be changed each time a worker exits the area, although they don't specify an exact location.³¹

How to doff

A resource from the WHO that advises on the sequence of removing PPE for isolation rooms suggests that boots or overshoes should be removed after taking off the apron, head and neck covering, gown, eye or face protection, and masks, but before removing gloves.³⁵ Hand hygiene should be performed on gloves before removal of the boots or overshoes. If the same boots are to be used outside elsewhere, they should be cleaned and decontaminated appropriately before leaving the doffing area.



The AANA, in their IPC guidelines for anaesthesia care, advise that if donning double gloves, the outer glove should be disposed of before removing shoe covers.³¹

In summary, there is limited evidence to support footwear used as PPE for IPC purposes. However, there is consistency in the limited evidence available that theatre footwear should be removed just outside the operating theatre before leaving the area. Although only the WHO provides detailed steps for doffing footwear, guidance is consistent with that of AANA that footwear should be removed after removing all other PPE but prior to gloves (if worn), and in a manner that minimises the risk of self-contamination.

3.1.7 When and how should footwear be cleaned?

Seven pieces of evidence were included for this question.^{14, 28, 33, 35-38} Six guidance documents were graded SIGN 50 level 4 expert opinion^{28, 33, 35-38} owing to a lack of a systematic review of the literature, and one guideline was graded AGREE recommend with 'modifications' because, while a systematic search for literature was conducted, no details on the search strategy were provided.¹⁴ Six documents were identified in the current review update, ^{14, 28, 35-38} and one was carried over from the previous version of this review (version 3.0).³³

The evidence identified for this question mainly focuses on theatre footwear and general PPE, with the majority published by UK bodies (including UK, England, and Wales). 28, 33, 36-38

When to clean

Five SIGN 50 level 4 guidance documents, ^{28,34,36, 37, 38} and one AGREE recommend with 'modifications' guideline¹⁴ provide consistent advice surrounding the cleaning of footwear, particularly theatre footwear.

Expert opinion from two Health Building Notes in England, offering best practice guidance for the design and construction of new healthcare facilities, suggests that theatre footwear should be cleaned daily or when visibly contaminated.^{36, 37} They recommend that a washer be located near changing facilities. This aligns with guidance from the Association of Anaesthetists of Great Britain and Ireland that



recommends cleaning theatre footwear after every use and ensuring procedures are in place to clean footwear at the end of every session.³³

Guidelines from the French Society for Anaesthesia and Intensive Care, graded AGREE 'recommend with modifications' also highlight the importance of regularly machine-washing theatre shoes, although the frequency of cleaning is not specified.¹⁴

Guidance from the HSE for general PPE, though not specific to footwear, advises regular cleaning and maintenance of PPE.²⁸ Public Health Wales suggests arrangements for cleaning and disinfecting PPE to prevent health risks associated with reuse by another employee.³⁸ However, it should be noted that both sets of guidance broadly cover PPE rather than specifically addressing footwear.

How to clean

One guidance document graded SIGN 50 level 4,³⁵ and one AGREE 'recommend with modifications' guideline address how to clean footwear.¹⁴ According to the WHO, boots should be decontaminated or disinfected at least once by soaking in a 0.5% chlorine solution for 30 minutes, followed by rinsing and drying.³⁵ Before this process, dirt should be removed if heavily soiled with mud or organic materials using a brush. While French Society for Anaesthesia and Intensive Care advises that theatre shoes should be machine washed regularly.¹⁴

In summary, guidance emphasises the importance of regular cleaning and maintenance of PPE including theatre footwear, however there was no available evidence specifically relating to the cleaning and reuse of footwear used as PPE for IPC purposes. However, general PPE guidelines from HSE and Public Health Wales do not specifically address footwear.^{28, 38} In contrast, specific guidance for theatre footwear from English health building notes,^{36, 37} the Association of Anaesthetists of Great Britain and Ireland,³³ and the French Society for Anaesthesia and Intensive Care¹⁴ stress the need for daily or session-based cleaning or when visibly soiled or contaminated. Notably, only the WHO provides a specific cleaning solution and procedure for disinfecting footwear.³⁵



3.1.8 How should footwear be stored?

Six pieces of evidence were included for this question; this did not include any primary studies. ^{12, 18, 36, 37, 39, 40} Five were graded SIGN 50 level 4 expert opinion guidance owing to a lack of a systematic review of the literature, ^{12, 18, 36, 37, 39} and one was a mandatory legislation, graded 'mandatory'. ⁴⁰ All the documents were from the UK, with one from Scotland, ³⁹ two from England, ^{36, 37} and three not specific to any nation but the whole UK. ^{12, 18, 40}

The Control of Substances Hazardous to Health Regulations (COSHH) mandates that employers provide safe storage facilities for PPE, when not in use to protect it from contamination, loss, or damage by harmful substances, dampness, or sunlight.⁴⁰ This storage can include labelled lockers, pegs, shelves, or containers, depending on the quantity and type of PPE. The HSE, through its guidance on the use of PPE to control risks at work, also recommends that PPE be properly maintained and stored in a dry, clean cupboard when not in use. Reusable PPE must be cleaned and kept in good condition. However, this guidance broadly covers all types of PPE, it is not specific to footwear.

This aligns with health building notes from England and Scotland. ^{36, 37, 39} The health building note from Scotland recommends designated spaces for changing areas, including storage and disposal of scrub suits and footwear. ³⁹ Similarly, two health building notes from England, applicable to different units, also recommend designated rooms or storage spaces for footwear, equipped with mechanical ventilation. ^{36, 37} These documents primarily offer best practices for designing and constructing new facilities.

Additionally, the Association for Perioperative Practice in their 2022 guidance for safe perioperative practice advise that footwear should be clean when stored and ready for use. Although these recommendations are specific to perioperative practice, they could be extended to other areas.¹⁸

In summary, evidence for this research question is consistent in advising that footwear should be stored in designated, clean spaces and that it should be cleaned before being stored, although it is not specific to footwear constituted as PPE for IPC purposes



3.1.9 When and how should footwear be disposed of?

Four pieces of evidence were included for this question; this did not include any primary studies. ^{8, 9, 14, 31} Three guidance documents were graded SIGN 50 Level 4 expert opinion^{8, 9, 31} owing to a lack of a systematic review of the literature, and one guideline was graded AGREE 'recommend' with modifications because, while a systematic search for literature was conducted, no details on the search strategy were provided .¹⁴ These came from various regions, including the UK,⁸ France,¹⁴ the USA,³¹ and Canada.⁹ Three documents were identified for the current review update ^{8, 9, 14} with one carried over from the previous version of this review (version 3.0).³¹

When to dispose

There is limited guidance across the documents reviewed regarding when to dispose of footwear, particularly in health and care settings.

The British Standard BS EN ISO 20347 for personal protective equipment related to occupational footwear suggests that footwear should be cleaned, maintained, inspected, and replaced as necessary to ensure optimal performance. Similarly, guidance from the Canadian Centre for Occupational Health and Safety recommends regular inspection of footwear for damage, such as cracks, breaks in the leather, or exposed toe caps, and advises replacing footwear if any visible damage is observed. However, this guidance is broad covering all industries and not specifically tailored to footwear within health and care settings including footwear considered as PPE for IPC purposes.

Guidelines published by the French Society for Anaesthesia and Intensive Care, graded AGREE 'recommend' recommends establishing a collective stock of shoes dedicated to the operating theatre, and replacing footwear when its protective functions can no longer be ensured.¹⁴

How to dispose

Evidence on how to dispose of footwear in healthcare is limited. The AANA offers the only direct guidance on disposal, though it applies to shoe covers rather than footwear. They recommend that shoe covers must be changed each time a worker exits an area and should be disposed of in a 'proper waste bin'.³¹



In summary, there is no consistency across these documents regarding footwear disposal within health and care settings. The AANA³¹ provides specific recommendations for the disposal of shoe covers, whereas the British Standard, Canadian Centre for Occupational Health and Safety, and the French Society for Anaesthesia and Intensive Care focus on when to replace footwear,^{8, 9, 14} generally stating that replacement should occur when there are visible signs of damage. Notably, the British and Canadian guidance address occupational footwear broadly rather than focusing specifically on healthcare settings.

3.2 Implications for research

There is a notable lack of scientific primary evidence regarding the use of footwear in health and care settings, not a single primary research study was included for this review. Evidence consisted entirely of extant guidance documents, the majority graded SIGN 50 level 4 expert opinion owing to the low-quality development processes underpinning these.

Most guidance documents broadly cover PPE and are not specific to footwear use within health and care settings, necessitating cautious extrapolation of these recommendations to common footwear use. Additionally, several guidance documents apply PPE principles across various industries and settings rather than being tailored to health and care environments.

In summary, there is a significant gap in scientific primary evidence on the use of footwear in health and care settings. The majority of guidelines regarding footwear use in health and care settings are based on mandatory legislation and expert opinion, lacking scientific evidence to support them. Most guidance available focuses predominantly on surgical attire, and footwear in restricted and semi-restricted areas, with an emphasis on dedicated footwear in theatre settings. However, the absence of primary research makes it difficult to determine whether specific types of footwear (for example, overshoes, boots, closed-toe shoes) or practices (for example, cleaning frequency, donning and doffing protocols) contribute meaningfully to IPC.

• Firstly, there is a need for consensus on the use of shoe covers in health and care settings. Expert opinions on this matter are both scant and inconsistent,

- with some experts citing health and safety concerns and the potential for increased risk of cross-contamination during the doffing of PPE.
- Secondly, comparative effectiveness studies are needed to assess whether
 different types of footwear for example reusable vs. disposable significantly
 reduce contamination or transmission risks across various healthcare settings,
 including high-risk environments such as operating theatres and isolation
 units.
- Thirdly, primary studies evaluating different cleaning frequencies
 (for example, after each use, daily, weekly) and methods (brushing, machine-washing, chemical disinfection).
- Further, observational studies to explore which clinical procedures or settings are most likely to result in gross contamination or splash risk to the feet.



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Appendix 1: Search Strategy

Searches were conducted to cover the period from 1 January 2020 - 19 March 2024

Medline

- 1 Shoes/
- 2 (shoe* adj3 cover*).mp.
- 3 overshoe*.mp. 37
- 4 over shoe*.mp. 9
- 5 footwear.mp.
- 6 shoe*.mp.
- 7 boot*.mp.
- 8 Specialist footwear.mp.
- 9 shoe cover.mp. 17
- 10 clog* or theatre clog*.mp.
- 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
- 12 clog wash* or shoe wash*.mp.
- exp Hospitals/ or hospital*.mp.
- 14 Health Facilities/
- 15 healthcare facilit*.mp.
- 16 exp Infections/ or infection*.mp.
- 17 hospital acquired infection*.mp.
- 18 universal precaution*.mp. or exp Universal Precautions/
- infection control*.mp. or exp Infection Control/
- 20 exp Disease Transmission, Infectious/
- 21 cross infection*.mp. or exp Cross Infection/
- 22 Decontamination/ or decontamina*.mp.
- 23 exp Sterilization/ 34643
- 24 sterili*.mp. 74977

- 25 (Don* or doff*).mp. 851397
- 26 dispos*.mp. 159450
- 27 stor*.mp. 508579
- 28 clean*.mp. 119076
- 29 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
- 30 11 and 29
- 31 limit 30 to (english language and humans and yr="2019 -Current")

Embase

- 1 shoe/ 11504
- 2 (shoe* adj3 cover*).mp.
- 3 overshoe*.mp.
- 4 over shoe*.mp.
- 5 footwear.mp.
- 6 shoe*.mp.
- 7 boot*.mp.
- 8 Specialist footwear.mp.
- 9 shoe cover.mp.
- 10 (clog* or theatre clog*).mp.
- 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
- 12 (clog wash* or shoe wash*).mp.
- exp hospital/ or hospital*.mp.
- 14 health care facility/
- 15 healthcare facilit*.mp.
- 16 exp infection/ or infection*.mp.
- 17 hospital acquired infection*.mp.
- 18 exp universal precaution/ or universal precaution*.mp.
- 19 exp infection control/ or infection control*.mp.

- 20 exp disease transmission/
- 21 cross infection/ or cross infection*.mp.
- 22 decontamination/ or decontamina*.mp.
- 23 instrument sterilization/
- 24 sterili*.mp.
- 25 (Don* or doff*).mp.
- 26 dispos*.mp.
- 27 stor*.mp.
- 28 clean*.mp.
- 29 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
- 30 11 and 29
- 31 limit 30 to (human and english language and yr="2019 -Current")

CINAHL

- S1 (MH "Shoes")
- S2 "shoe* n3 cover*"
- S3 "overshoe*"
- S4 "over shoe*"
- S5 "footwear"
- S6 "boot"
- S7 "shoe*"
- S8 clog*
- S9 S1-S8
- S10 (MH "Hospitals+") or hospital*
- S11 (MH "Infection+") or infection*
- S12 (MH "Infection Control+")
- S13 (MH "Disease Transmission+")

S14	"hospital acquired infection*"
S15	(MH "Universal precautions")
S16	(MH "Cross Infection") OR "cross infection"
S17	"decontaminat*" OR (MH "Decontamination, Hazardous Materials")
S18	(MH "Sterilization and Disinfection") OR "sterili*"
S19	"Don* or doff*"
S20	"Stor*"
S21	"dispos*"
S22	"clean*"
S23	clog wash* OR shoe wash*
S24	S10-S23
S25	S9 and S24
26	S25 limited to 2019-2024





SIGN 50 Evidence Levels

Grade	Description
1++	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1-	Meta analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2++	High quality systematic reviews of case-control or cohort studies. High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal
2+	Well conducted case control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2-	Case control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal
3	Non-analytic studies, for example case reports, case series
4	Expert opinion



AGREE II Evidence Levels

Grade	Description
AGREE 'Recommend'	This indicates that the guideline is of high overall quality and can be considered for use in practice without modifications.
AGREE 'Recommend with	This indicates that the guideline is of moderate
modifications'	overall quality. This could be due to insufficient or lacking information in the guideline for some items. If modifications are made, the guideline could still be considered for use in practice when no other guidelines on the same topic are available.
AGREE 'Do not	This indicates that the guideline is of low overall
Recommend'	quality and has serious shortcomings. Therefore, it should not be recommended for use in practice.



Appendix 3: Specific standards relating to the use, quality and performance of footwear in health and care settings

Standard	Title	Description	Publication Date
BS ISO 15190:2020	Medical laboratories — Requirements for safety	This document outlines the requirements for establishing and sustaining a secure working environment within a medical laboratory. While primarily intended for use across recognized disciplines of medical laboratory services, it may also prove beneficial to other related services and disciplines	March 2020
PD ISO/TS 20141:2022	Personal Safety - Personal Protective Equipment - Guideline on Compatibility Testing of PPE	This document addresses the identification of issues and offers guidance for test procedures to evaluate the compatibility of various pieces of personal protective equipment (PPE) when worn together in an ensemble, as well as between the PPE and the operating environment and processes.	October 2022
BS EN ISO 20347:2022+A1:2024	Personal protective equipment — Occupational footwear	This document outlines both fundamental and supplementary (optional) criteria for occupational footwear designed for general purposes. It encompasses considerations such as	April 2022; Amended February 2024



Standard	Title	Description	Publication Date
		protection against mechanical hazards, slip resistance,	
		thermal insulation, and ergonomic performance.	
BS EN ISO	Personal protective	This document specifies methods for testing footwear	December
20344:2021+A1:2024	equipment —Test methods	designed as personal protective equipment.	2021,
	for footwear		Amended 29
			February 2024
BS EN ISO	Personal protective	This standard outlines both fundamental and optional criteria	April 2022;
20345:2022+A1:2024	equipment — Safety	for safety footwear intended for general purposes. It	Amended
	footwear	encompasses considerations such as protection against	February 2024
		mechanical hazards, slip resistance, thermal insulation, and	
		ergonomic performance.	
BS EN ISO	Personal protective	These standards outline both essential and optional criteria	May 2022,
20346:2022+A1:2024	equipment —Protective	for protective footwear designed for general use. They cover	Amended
	footwear	aspects such as protection against mechanical hazards, slip	February 2024
		resistance, thermal insulation, and ergonomic performance.	



Appendix 4: PRISMA flow diagram



