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Sustainable glove use of nurses and midwives when administering injections: A scoping review

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Systematic Review

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Abstract

Background

Inappropriate non-sterile glove use presents patient and healthcare worker safety risks and contributes to healthcare waste and emissions. Existing guidelines suggest gloves are not routinely required for intramuscular and subcutaneous injections however practices may vary. This review aims to describe the practices and attitudes of nurses and midwives regarding glove use during injections.

Methods

A scoping review was conducted in accordance with Joanna Briggs Institute guidelines and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR). Bibliographic databases (MEDLINE and CINAHL), Google Scholar and expert-identified grey literature were searched. Data extracted included evidence type, setting and location, glove use practices and attitudes, and information on related concepts including hand hygiene, risk assessment, sharps safety, and sustainability. Data were synthesised and mapped to the Capability-Opportunity-Motivation-Behaviour framework.

Results

A total of 31 articles from 9 countries were eligible and included primary research, clinical guidelines, educational resources and editorials. Research demonstrated substantial practice variation and provided evidence that glove use during injections contributed to poorer hand hygiene and cross-contamination. Guidelines stated that gloves were not routinely required, while educational resources presented mixed messages. Identified behavioural drivers of glove use were an understanding of infection prevention principles (capability), social and professional context (opportunity), and perceived safety (motivation).

Conclusion

Practice variation is common and may arise from misalignment between policy, education, and professional attitudes. Understanding behavioural drivers can inform the development of clear and consistent resources to support sustainable and safe glove use for injections based on risk assessment.

Highlights

• Inappropriate non-sterile glove use presents safety risks and contributes to healthcare waste.

• Key guidelines state that gloves are not routinely required for injections.

• Substantial variation in practice and attitudes exist among nurses and midwives.

• Glove use is associated with lower hand hygiene adherence and cross-contamination.

• Behavioural science can inform strategies to enable sustainable and safe practice.

1 Introduction

Climate change, pollution, and biodiversity loss are impacting human health and exacerbating inequities [1]. In 2022, healthcare contributed to 4.2% (2.15 gigatonnes of carbon dioxide equivalent [CO_2e]) of global greenhouse gas emissions [1]. Single-use medical items, including personal protective equipment, are major contributors, highlighting the critical need for more sustainable approaches to healthcare [2, 3].

The World Health Organization (WHO) introduced the concept of 'sustainable' non-sterile glove (NSG) use in the 2009 *Glove Use Information Leaflet* [4]. WHO outlined the rationale for using medical gloves to reduce the risk of contamination of health-care workers hands with blood and other body fluids, and to reduce the risk of germ dissemination to the environment. The document describes how the unnecessary and inappropriate use of gloves represents a waste of resources and may also pose patient and healthcare worker safety risks by interfering with hand hygiene adherence and increasing the risk of cross-contamination.

The carbon footprint of NSGs is approximately 26–34 grams of CO_2e per glove resulting in substantial emissions when considering the scale of glove use [2, 5]. In response to the growing recognition of the environmental impacts and safety risks associated with inappropriate NSG use, "Gloves Off!" initiatives have been implemented globally, to promote sustainable glove use while emphasising hand hygiene and risk assessment to guide decision making [6, 7]. Such programs have reduced NSG use, waste, cost and carbon emissions while also building staff confidence and adherence in hand hygiene and risk assessment [7]. Additionally, there is some evidence that improved NSG practices may reduce the rates of occupational skin conditions [6].

Strengthening the evidence and implementation of infection prevention and control (IPC) practices, including procedure-specific NSG use, is central to sustainable healthcare [8]. Regarding intramuscular or subcutaneous (IM/SC) injections, WHO guidelines explicitly state that gloves are not routinely required [4, 9], yet clinician practices and attitudes vary [10]. Given the high frequency of IM/SC injections, and the risks associated with inappropriate NSG use, understanding real-world clinician practices and attitudes is important for designing strategies to improve the safety and sustainability of injection administration.

This review aimed to describe the practices and attitudes of nurses and midwives regarding NSG use during IM/SC injections. Nurses and midwives were chosen as IM/SC medication administration is a core and frequent clinical practice for these professional groups [11]. A secondary objective was to identify behavioural drivers influencing NSG use within these professional groups.

2 Methods

A scoping review methodology was chosen to enable a broad exploration of a field of interest where existing evidence is limited [12]. The review was conducted in accordance with the Joanna Briggs Institute guidelines for scoping reviews [13] and reported in accordance with the Preferred Reporting

Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) framework [14].

2.1 Review questions

The review was guided by two research questions:

- What are the practices and attitudes of nurses and midwives regarding NSG use when administering IM/SC injections?
- What are the behavioural drivers of NSG use during IM/SC injections?

2.2 Inclusion and exclusion criteria

This review followed the 'population, concept, context' framework [13] targeting evidence that included nurses and midwives, injection-related NSG use, and healthcare settings. No restrictions were applied by geography, language or source type. Google Translate and DeepL supported eligibility assessment and data extraction to reduce geographical bias [15, 16].

Table 1
Eligibility criteria

Domain	Inclusion criteria	Exclusion criteria
Population	Nurses and midwives of any cadre (including students)	Other healthcare professionals only without explicit specification of nurses or midwives
Concept	Glove use during intramuscular and or subcutaneous injections	Intravenous or intradermal injections without explicit specification of intramuscular/subcutaneous injections
Context	Any healthcare setting or context	Operating theatres due to presence of specialised practices (such as routine double gloving) that are not generalisable to other healthcare settings
Geography	All geographical locations	Nil
Language	All languages	Nil
Source type	All source types	Nil

2.3 Search strategy

The search strategy (Supplement 1) was developed by healthcare professionals with expertise in clinical practice, research and IPC guided by a health research librarian. Preliminary searches confirmed limited evidence on the topic, reinforcing the need for a scoping review. These initial searches also informed the identification of relevant key words and Medical Subject Headings (MeSH), which were used to refine the search strategy and guide database selection.

Two electronic bibliographic databases MEDLINE (PubMed) and CINAHL (EBSCO) were selected due to their breadth and clinical relevance with both searched on the 15th of June 2025. Google Scholar was also searched on the 24th of June 2025 using a modified version of the search strategy. The first 20 pages of results (200 articles) were screened.

Content experts identified relevant grey literature sources including WHO, the United States Centers for Disease Control and Prevention, the European Centre for Disease Control, the Australian Commission on Safety and Quality in Healthcare, and the Infection Control Africa Network. Subnational and local policies were excluded. Reference lists of all included articles were hand searched.

2.4 Evidence selection

Citations were imported into EndNote (Version 21) and uploaded to Covidence. Duplicates were removed automatically within Covidence, with additional duplicates identified and excluded during manual screening. Screening was conducted in two-stages by two independent reviewers. First, titles and abstracts were assessed. Full-text articles were then retrieved and evaluated against the eligibility criteria. Any disagreements were resolved through discussion, with input from a third reviewer when consensus could not be reached. Articles were excluded in the following order: (1) NSG use not reported, (2) NSG use for injections not disaggregated from other concepts (such as sharps injuries), (3) IM and/or SC injection not specified, (4) nurses and/or midwives not specified, (5) full text not available, and (6) insufficient data for extraction.

2.5 Data extraction, analysis and synthesis

A data extraction tool was developed a priori with the study team (Supplement 2). Data were extracted by one reviewer and validated by a second reviewer. Data from non-English language articles were independently extracted by two reviewers to reduce the risk of error or misinterpretation. Any uncertainties or discrepancies in data interpretation were discussed and resolved through consensus within the study team.

Quantitative data were tabulated and described as counts and proportions for article types and characteristics. NSG practices were described as proportions of nurses and/or midwives donning NSG for either IM, SC, or both. Attitudes and behavioural drivers related to NSG use were reported narratively and visually, guided by the Capability-Opportunity-Motivation Behaviour (COM-B) model which presents human behaviour as shaped by three core components: capability (psychological or physical), opportunity (social or physical), and motivation (automatic or reflective) [17, 18].

3 Results

3.1 Selection of articles

The search resulted in 727 records and 571 following the removal of duplicates (Fig. 1. PRISMA Flow Diagram). Of these, 176 underwent full text review and a 25 met the inclusion criteria. Reference lists

yielded an additional 6 eligible articles resulting in the final inclusion of 31 articles (Table 1). Grey literature searches did not identify any additional eligible articles.

Table 1
Characteristics of Included Articles

Type of Article Method	Author and Year of Publication Country (WBIG)	Title Key Aims	Setting Participant Population (n)
Primary research **Cross sectional concealed observation study**	**[19] Al-Rawajfah and Tubishat 2017** **Jordan (LMIC)**	**A concealed observational study of infection control and safe injection practices in Jordanian governmental hospitals** **To evaluate injection practices among nurses working in Jordanian governmental hospitals.**	**Hospital (multiple sites) – nine hospitals** **Nurses** **(n = 384)**
Primary research **Cross sectional study - survey (pre and post education)**	**[20] Bergamini et al. 2009** **Italy (HC)**	**Knowledge of preventive measures against occupational risks and spread of healthcare-associated infections among nursing students. An epidemiological prevalence study from Ferrara, Italy** **To investigate the knowledge of student nurses towards prevention both of hospital infections and professional exposures that may occur during the duties needed for patient care.**	**Single university (various healthcare facilities)** **Nursing students** **(n = 85 at start, 80 at end of study)**
Primary research Cross sectional study - survey and observation	[21] **Brunelli Gonçalves de Faria et al. 2019** Brazil (UMI)	**Knowledge and adherence of the nurse to standard precautions in critical units** To identify the knowledge and adherence of nurses to standard precautions.	**Hospital (single site) – intensive and critical care units** Nurses (n = 40)
Primary research Cross sectional study - survey	[22] **Fekonja et al. 2021** Slovenia (HC)	**The assessment of knowledge and practical skills of intramuscular injection administration among nursing staff: a cross-sectional study** To assess the level of knowledge and practice of intramuscular injection among nurses and nursing assistants in primary healthcare.	**Community and primary care settings** Nurses and nursing assistants (n = 200)
Primary research	[23] **^Ferreira et al. 2009**	**Nursing team knowledge in the use of latex gloves in the hospital context**	**Hospital (single site)**

Cross sectional study - survey	Brazil (UMI)	To describe knowledge of nursing professionals regarding the use of gloves in different care activities.	Nursing assistants, nursing technicians, nurses (n = 74)
Primary research Cross sectional study - survey	[24] **Floyd and Meyer 2007** New Zealand (HC)	**Intramuscular injections–what's best practice?** To explore the gap between what is taught in nursing schools about the best technique for intramuscular injections and what happens in practice.	**General practice, prisons and mental health settings** Registered Nurses (n = 173)
Primary research Cross sectional study – survey	[25] ***Giard et al., 2016** France (HC)	**Compliance with standard precautions: Results of a French national audit** To assess institutional policies for standard precautions promotion, available resources for implementation, and education of health care workers and their compliance.	**Healthcare facilities (multiple sites) – medical and surgical wards** Nurses, physicians, midwives, physicians, allied health, cleaning personnel (n = 203,840)
Primary research Cross sectional study - survey	[26] **Legrand et al. 2019** France (HC)	**Nurses' practices in the preparation and administration of intramuscular injections in mental health: A cross-sectional study** To assess the practices associated with intramuscular injections in mental health.	**Psychiatric hospital (single-centre)** Nurses (n = 128)
Primary research Cross sectional study - survey and observation	[27] **^Romualdo dos Santos et al. 2013** Brazil (UMI)	**The use of gloves by nursing staff: from protection to transmission risk** To evaluate the use of gloves by nursing staff in a small hospital.	**Hospital (single site) - emergency, adult and paediatric inpatient wards** Nurses and nursing technicians (n = 33)
Primary research Cross sectional study - survey	[28] **Roseira et al. 2020** Brazil (UMI)	**Injectable medications: self-reported practices of nursing professionals**	**Various sites and settings (majority hospital 57.5%)**

		To describe self-reported injectable medications practice of nursing professionals.	Nurses, nursing technicians, nursing assistants (n = 1295)
Primary research Cross sectional study – survey Retrospective incidence study – sharps injuries/biological exposures	[29] **^Stefanati et al. 2015** Italy (HC)	**A survey on injuries among nurses and nursing students: a descriptive epidemiologic analysis between 2002 and 2012 at a University Hospital** To evaluate the incidence of injuries related to biological risk in nurses and nursing students at the University Hospital of Ferrara, how they occur, knowledge on the topic, and behaviour during department activities.	**Hospital (single site) – emergency and inpatient wards** Nurses and nursing students (n = 132)
Primary research Mixed-methods cross-sectional observation study with subsequent qualitative interview	[30] **Theofanidis 2017** Greece (HC)	**In-Hospital Administration of Insulin by Nurses in Northern Greece: An Observational Study** To explore current practice regarding insulin administration by nurses in a Greek public hospital.	**Hospital (single site) – two medical wards** Nurses (n = 20)
Primary research Cross sectional study - survey (audit prior to IPC education)	[31] **Trim et al. 2003** United Kingdom (HC)	**Healthcare workers' knowledge of inoculation injuries and glove use** To evaluate the level of staff knowledge and the efficacy of current training and education programmes on universal precautions and inoculation injury management.	**Hospital (single site)** Nurses, doctors, phlebotomists, surgical staff, healthcare assistants (n = 200)
Primary research Cross sectional study - survey	[10] **Wilson et al. 2017** United Kingdom (HC)	**Public perceptions of the use of gloves by healthcare workers and comparison with perceptions of student nurses** To determine attitudes of student nurses and members of the public to the use of non-sterile clinical gloves.	**University (single site)** Student nurses at practical class and members of public (n = 67 students, 142 members of public)
Secondary research Systematic review of nursing texts	[32] **Svenšek et al. 2024** Slovenia (HC)	**Assessing the incorporation of the 'Five Moments for Hand Hygiene' into nursing procedure textbooks**	NA

		To conduct a thorough comparison between the hand hygiene information included in international nursing textbooks and the Slovenian nursing textbook's equivalent content as it relates to nursing procedures.	
Guideline	[33] **Hutin et al. 2003** Global	**Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections** To outline evidence-based guidelines for safe injection practice.	NA
Guideline	[34] ***Occupational Safety and Health Administration 2001** United States (HC)	**Enforcement Procedures for the Occupational Exposure to Bloodborne Pathogens** To establish policies and provides clarification to ensure uniform inspection procedures are followed when conducting inspections to enforce the Occupational Exposure to Bloodborne Pathogens Standard.	NA
Guideline	[35] ***Royal College of Nursing 2022** United Kingdom (HC)	**Tools of the Trade: Guidance for health care staff on glove use and the prevention of work-related dermatitis** To provide guidance on the maintaining skin health and early recognition and management of work-related dermatitis.	NA
Guideline	[9] ***World Health Organization 2010** Global	**WHO best practices for injections and related procedures toolkit** To provide guidance on rational and safe use of injections globally, and better injection safety practices.	NA
Educational resource	[36] **Chadwick and Withnell 2015** United Kingdom (HC)	**How to administer intramuscular injections** To help nurses to administer intramuscular injections in a safe, effective and patient-centred manner.	NA
Educational resource	[37] ***Dougherty et al. 2015**	**The Royal Marsden Manual of Clinical Nursing Procedures: Student Edition**	NA

	United Kingdom (HC)	To support learning in clinical practice.	
Educational resource	[38] **Ernstmeyer and Christman 2023** Not reported	**Chapter 18. Administration of Parenteral Medications (in Nursing Skills. 2nd edition)** To educate nurses on the administration of parental medications.	NA
Educational resource	[39] **Gordon 2021** United Kingdom (HC)	**COVID-19 vaccination: intramuscular injection technique** To educate about administering the COVID-19 vaccine via intramuscular injection	NA
Educational resource	[40] **Hunter 2008a** United Kingdom (HC)	**Subcutaneous injection technique** To outline the procedure for administering subcutaneous injections, including site selection and prevention of complications.	NA
Educational resource	[41] **Hunter 2008b** United Kingdom (HC)	**Intramuscular injection techniques** To educate about the administration of intramuscular injections as a part of medication management, including how to perform a skilled injection technique to reduce pain and avoid unnecessary complications.	NA
Educational resource	[42] **Shepherd 2018** United Kingdom (HC)	**Injection technique 1: administering drugs via the intramuscular route** To provide guidance on intramuscular injection technique to minimise complications.	NA
Educational resource	[43] **Workman 2000** United Kingdom (HC)	**Safe injection techniques** To provide guidance on the correct technique for safe intradermal, subcutaneous, and intramuscular injections.	NA
Editorial	[44] **Alexander 2000**	**Editorial...needlestick injury prevention**	NA

	Not reported	Share opinion on injection-related glove use practices	
Editorial	[45] ***Brown and Nickalls 2021** United Kingdom (HC)	**Rollout of the COVID-19 vaccination programme** Share opinion on the COVID-19 vaccination programme implementation and administration.	NA
Letter	[46] **Baller 2004** United States (HC)	**More on injection technique** Share opinion on the Centers for Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA) recommendations against glove-use during immunization.	NA
Letter	[47] **Goldrick 2004** United States (HC)	**More on injection technique** Share opinion on the Centers for Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA) recommendations against glove-use during immunization.	NA

Table Footnote: Articles are ordered by type and then alphabetically by first author. ^Non-English language articles; *identified from reference list screening. **Acronyms**: HC: Higher Income; IPC: infection prevention and control; LMIC: Lower-Middle Income; NA: not applicable; UMI: Upper-Middle Income; WBIG: World Bank Income Group.

3.2 Characteristics of included articles

The 31 articles included in this scoping review were published between 2000 and 2024. Research articles were the most common source type (n = 15), followed by educational resources (n = 8), guidelines (n = 4), and editorials/letters (n = 4). Articles were from nine countries and included high income countries (n = 22), upper-middle income countries (n = 4), and low-middle-income countries (n = 1).

Most were published in English (28/31, 90.3%). Three primary research articles were translated: Ferreira, Bertolo [23] and Romualdo dos Santos, Roseira [27] from Portuguese, and Stefanati et al. Stefanati, Boschetto [29] from Italian. Most articles included nurses as study participants or as the intended target population for guidelines. Only one article specified the inclusion of midwives [25].

3.3 Research articles

Most of the 15 research articles were primary research studies, 14 (14/15, 93.3%). These studies were conducted across a range of clinical settings, most commonly hospitals (9/14, 64.3%) however two were in community settings [22, 24]. Injection practice was the focus of six studies. Remaining studies examined broader IPC and healthcare worker safety issues including adherence to standard precautions [21, 25], hand hygiene education [32] and occupational injury [20, 29]. Study participants included nurses, registered nurses, nursing technicians, nursing assistants, nursing students and midwives. Several studies also included other healthcare professionals such as medical, allied health, and technical support services, or members of the public.

Most studies employed cross-sectional survey designs (12/15, 80.0%) including two with an educational intervention [20, 31]. Observational methods were used in three studies to assess clinical practice directly [19, 21, 30]. One study combined a retrospective incidence review of biological exposures (including sharps injuries) with a survey component [29]. One article was a systematic review that compared nursing textbooks related to hand hygiene during procedures, including for administration of SC injections [32].

3.4 Guidelines

All four of the included guidelines explicitly stated that routine NSG use was unnecessary when administering IM/SC injections [9, 33–35].

The United States Occupational Safety and Health Administration [34] guideline *Enforcement Procedures for the Occupational Exposure to Bloodborne Pathogens* stated that NSG are "usually not necessary when administering intramuscular or subcutaneous injections as long as bleeding that could result in hand contact with blood or OPIM [Other Potentially Infectious Materials] is not anticipated (page 33)." Similarly, a 2003 World Health Organization guideline *Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections* stated that NSG were only indicated if excessive bleeding is anticipated [33].

A further WHO guideline published in 2010, *WHO best practices for injections and related procedures toolkit*, expanded on the use of NSG in the context of IM/SC injections [9]. This guideline stated that NSG are unnecessary for routine IM/SC injections when the health worker and patient's skin is intact. They further explained that gloves they do not protect against needle-stick injuries. The guideline was later referenced in the United Kingdom's Royal College of Nursing [35] *Guidance for health care staff on glove use and the prevention of work-related dermatitis*. It considers glove use from a holistic perspective, highlighting infection prevention principles, risk of glove-related dermatitis, and environmental sustainability themes.

3.5 Educational resources

A total of eight educational resources were included in the review including six educational articles and two nursing texts. A total of four (50.0%) presented NSG as necessary for IM/SC injections [36, 37, 40,

41]. A further two (25.0%) stated that NSG use was not routinely required and should instead be guided by risk assessment [39, 42]. The final two (25.0%) presented an unclear position on NSG use [38, 43].

Two educational resources on IM/SC injection techniques by the same author [40, 41] explicitly describe that NSG must be worn for injections which they deemed invasive procedures. The authors provide a rationale that gloves help to prevent cross infection but acknowledge that gloves do not protect the nurse from needlestick injuries. The nursing student text authored by Dougherty et al. [37] also states NSG are required for IM/SC, providing a rationale that they are needed to prevent contamination of medication and equipment. The educational article on intramuscular injections by Chadwick and Withnell [36] implies that gloves should be worn but defers to local policy guidelines.

In contrast, the educational article on IM injections by Shepherd [42] advises that, “If gloves are considered necessary, following the risk assessment, these should be applied (p.24)”. Similarly, an education article on COVID-19 vaccination by the intramuscular route by Gordon [39] explicitly stated that NSG are not required unless there is a risk of exposure to blood or body fluids.

The nursing skills text by Ernstmeyer and Christman [38] and the educational article on safe injection techniques by Workman [43] presented mixed messages without clear recommendations to support decision making. Notably, these articles also included images depicting injection practice both with and without NSG use.

3.6 Editorials and letters

Two editorials [44, 45] and two letters [46, 47] were identified. Of these four sources, Alexander [44] and Baller [46] suggested that NSG were necessary. In contrast, Goldrick [47] and Brown and Nickalls [45], argued that NSG were not necessary.

3.7 Practices and attitudes of nurses and midwives

Of the primary research studies, 14 supported an examination of injection-related NSG use practices among participant groups that included nurses and midwives (Table 2). Of these, two employed observational methods [19, 30], while the remaining studies captured self-reported NSG use practice via participant survey.

Table 2
Glove Use Practices for Intramuscular and Subcutaneous Injections

Article Author and Year of Publication **Country**	**Setting** **Participant Group/s**	**Gloves Worn for IM Injections**	**Wear Gloves for SC Injections**	**Gloves Worn for IM/SC Injections (combined)**
[19] **Al-Rawajfah and Tubishat 2017** Jordan	**Hospital (multiple sites) – nine hospitals** Nurses	20.5% (23/112) observed events	50.0% (15/30) observed events	NR
[30] **Theofanidis 2017** Greece	**Hospital (single site) – two medical wards** Nurses	70.0% (77/110) observed events	NR	NR
[31] **Trim et al. 2003** United Kingdom	**Hospital (single site)** Nurses, doctors, phlebotomists, surgical staff, healthcare assistants	61.0% (98/161)	NR	NR
[23] **^Ferreira 2009** Brazil	**Hospital (single site)** Nursing assistants, nursing technicians, nurses	68.9% (51/74)	58.1% (43/74)	NR
[24] **Floyd and Meyer 2007** New Zealand	**General practice, prisons and mental health settings** Registered Nurses	4.0% Always 42.5% Sometimes 53.4% Never **N = 73 participants	NR	NR
[20] **Bergamini et al. 2009** Italy	**Single university (various healthcare facilities)** Nursing students	**Start of course** 77.7% Always 15.3% Sometimes 7.6% Never **N = 85 participants	NR	NR

Table Footnote: ^non-English language articles; *cited from reference list screening; **N is included as the number of participants where raw data was not reported. **Acronyms**: IM: intramuscular; NR: not reported; NSG: non-sterile gloves; SC: subcutaneous

Article Author and Year of Publication Country	Setting Participant Group/s	Gloves Worn for IM Injections	Wear Gloves for SC Injections	Gloves Worn for IM/SC Injections (combined)
		End of course 71.3% Always 21.3% Sometimes 7.5% Never **N = 80 participants		
[29] **^Stefanati et al. 2015** Italy	**Hospital (single site) – emergency and inpatient wards** Nurses and nursing students	72.0% (95/132) Always 19.7% (26/132) Sometimes 8.4% (11/132) Never	NR	NR
[26] **Legrand et al. 2019** France	**Psychiatric hospital (single-centre)** Nurses	**Planned situation** 74.8% (77) Always 9.7% (10) Often 5.8% (6) Sometimes 9.7% (10) Never/No **Emergency situation** 60.8% (59) Always 15.5% (15) Often 15.5% (15) Sometimes	NR	NR

Table Footnote: ^non-English language articles; *cited from reference list screening; **N is included as the number of participants where raw data was not reported. **Acronyms**: IM: intramuscular; NR: not reported; NSG: non-sterile gloves; SC: subcutaneous

Article Author and Year of Publication Country	Setting Participant Group/s	Gloves Worn for IM Injections	Wear Gloves for SC Injections	Gloves Worn for IM/SC Injections (combined)
		8.3% (8) Never/No		
[28] **Roseira et al. 2020** Brazil	**Various sites and settings (majority hospital 57.5%)** Nurses, nursing technicians, nursing assistants	65.4% Always 7.5% Almost always 9.3% Sometimes 9.0% Almost Never 8.8% Never	59.5% Always 7.8% Almost always 8.7% Sometimes 11.6% Almost Never 12.4% Never	NR
[22] **Fekonja et al. 2021** Slovenia	**Community and primary care settings** Nurses and nursing assistants	**Nurses** 31.3% (42/134) Always 43.3% (58/134) Rarely 25.3% (34/134) Never **Nursing assistants** 18.5% (12/65) Always 58.5% (38/65) Rarely 23.1% (15/65) Never	NR	NR
[27] **^Romualdo dos Santos et al. 2013** Brazil	**Hospital (single site) - emergency, adult and paediatric inpatient wards** Nurses and nursing technicians	NR	NR	26.9% (14/52)

Table Footnote: ^non-English language articles; *cited from reference list screening; **N is included as the number of participants where raw data was not reported. **Acronyms**: IM: intramuscular; NR: not reported; NSG: non-sterile gloves; SC: subcutaneous

Article Author and Year of Publication Country	Setting Participant Group/s	Gloves Worn for IM Injections	Wear Gloves for SC Injections	Gloves Worn for IM/SC Injections (combined)
[10] **Wilson et al. 2017** United Kingdom	**University (single site)** Student nurses and members of public	NR	NR	76.1% (51/67)
[21] **Brunelli, Gonçalves de Faria et al. 2019** Brazil	**Hospital (single site) – intensive and critical care units** Nurses	NR	NR	67.5% (27/40) Always 15.0% (6/40) Frequently 15.0% (6/40) Sometimes 2.5% (1/40) Rarely 0.0% (0/40) Never
[25] ***Giard et al., 2016** France	**Healthcare facilities (multiple sites) – medical and surgical wards** Nurses, physicians, midwives, physicians, allied health, cleaning personnel	NR	NR	35.4% Always 17.5% Often 48.1% Never/sometimes **N = 98,401 participants

Table Footnote: ^non-English language articles; *cited from reference list screening; **N is included as the number of participants where raw data was not reported. **Acronyms**: IM: intramuscular; NR: not reported; NSG: non-sterile gloves; SC: subcutaneous

Most studies reported high levels of NSG use during injections with some variation across settings and countries. In observational studies, NSG were worn in 20.5% to 70.0% of injection events [19, 30]. Among survey-based studies, most (8/12) found that greater than half of participants self-reported using NSG for injections.

Lower rates of NSG use were reported in some studies. Only 4.0% of Registered Nurses in New Zealand working across general practice, prisons and mental health settings reported *always* wearing NSG for injections [24]. Fewer than one third of nurses in Slovenia working in community and primary care reported *always* wearing gloves [22]. Fewer than one third of nurses and nursing technicians working in a Brazilian hospital reported wearing gloves [27]. Some studies compared practices across contexts and professional groups, finding that NSG use was higher in routine compared to emergency situations [26] and higher among nurses compared to nursing assistants [22].

No study explored nurse and midwife attitudes as a primary outcome; however, the included articles provide insight into professional attitudes on whether NSG should be routinely worn during injections. Perspectives varied considerably across the included sources, with evidence of strongly held and opposing professional attitudes on best practice.

3.8 Behavioural drivers of injection-related glove use

The behavioural drivers influencing NSG use during injections can be understood through the COM-B model which identifies capability, opportunity, and motivation as core determinants of behaviour [18]. Key themes were identified and mapped to the COM-B model and these are presented in Fig. 2, The findings from this review suggest injection-related NSG behaviours are shaped by knowledge, understanding and ability to apply IPC principles (capability), social and professional contexts (opportunity), and by deeply held beliefs and habits relating to safety, self-protection, and routine practice (motivation).

Figure 2. Behavioural Drivers of Non-Sterile Glove Use for Injections Among Nurses and Midwives

Figure Footnote: Behavioural drivers influencing non-sterile glove use during intramuscular and subcutaneous injections were identified and mapped to the COM-B model. **Acronyms** IPC: infection prevention and control

3.81 Psychological and physical capability

Psychological capability refers to knowledge and understanding needed for the behaviour to occur, while physical capability includes practical factors [18]. Knowledge, understanding and the ability to apply infection prevention and control (IPC) principles emerged as a key driver of selective rather than routine NSG use. The use of risk assessment to guide NSG decision making was a common theme and is illustrated by a participant in Floyd and Meyer's [24] study who reported that NSG were worn “Only when giving injections to known infective patients (p. 22)” or “only if obvious blood or bleeding around (p. 22)”.

The theme of cross-contamination was another key IPC principle that emerged from the literature. Theofanidis (2017) observed that gloves were sometimes not changed between patients or for non-injection tasks, indicating that misuse may reflect gaps in knowledge relating to cross-contamination. Other sources suggested that gloves prevent cross-contamination or cross-infection as a rationale for their use, however, did not explain exactly how this was achieved [31, 41].

Knowledge, understanding and application of hand hygiene before and after the injection procedure may also influence NSG use behaviour. Two observational studies found that hand hygiene moments were often missed when gloves were worn for injections [19, 30]. Further highlighting a potential underappreciation of hand hygiene for self and patient protection during injection administration, a systematic review of nursing texts by Svenšek [32] found that hand hygiene was often omitted from injection related procedural guidelines.

Conversely, capability factors of hand hygiene and physical dexterity may drive avoidance of NSG as illustrated by one participant who said “I always wash my hands first but can manage the injection with better control with no gloves (p. 22)” [24]. This was reflected in the study by Ferreira et al. [23] who found that some nurses reported decreased tactile sensation as a barrier to glove use.

3.82 Social and physical opportunity

Opportunity within the COM-B model, refers to the physical and social conditions that enable a behaviour to occur [18]. Social opportunity and professional context emerged as key drivers of NSG use attitudes and practices. Variation in best practice recommendations across sources highlights a powerful social and professional context which may limit the opportunity for sustainable injection-related NSG use guided by risk assessment, rather than as routine practice.

Generational differences in professional education are also likely to influence NSG behaviours. Floyd and Meyer [24] found that the newer generation of nurses had been taught to wear NSG for IM injections. However, the authors also hypothesised that the practices of younger nurses were influenced by older nurses who did not routinely wear NSG for injections.

Public expectations is a further social opportunity factor which may contribute to glove use behaviours. Interestingly, Wilson, Bak [10] found that 65.5% (93/142) of members of the public preferred nursing staff to wear gloves when administering injections.

Physical opportunity factors influencing glove use may include a lack of time or resources. [20], identified lack of time as a factor contributing to poor hand hygiene, which was also hypothesised to contribute to inappropriate NSG use. Similarly, Theofanidis [30] suggested that poor NSG practices may be influenced by inadequate hand hygiene infrastructure, and staff time pressures.

3.83 Reflective and automatic Motivation

Motivation within the COM-B model is described as reflective or automatic. Reflective motivation involves conscious thought processes and evaluation, while automatic motivation relates to emotions, habits and instincts [18]. Injection-related glove use was frequently associated with a motivation for self-protection. This was illustrated in the study by Al-Rawajfah and Tubaishat [19] who observed that many injection events were performed with gloves but without prior hand hygiene. This finding was reflected the study by Theofanidis [30] who observed a lack of hand hygiene before donning gloves and failure to change gloves between patients and tasks. Automatic motivation is illustrated in a study by Ferreira et al. [23] who described how nurses appeared to use gloves indiscriminately driven by a false sense of security.

Environmental sustainability may represent a newer but important reflective motivation to reduce unnecessary NSG use. However, only one article included in this review identified environmental sustainability as a rationale for risk-based rather than routine glove use for injections [35].

4 Discussion

This scoping review found substantial variation in the practices and attitudes of nurses and midwives regarding injection-related glove use. Empirical evidence demonstrates practice variation exists and may be driven by a misalignment between guidelines, educational resources, professional attitudes and local practice culture. Guidelines included in this review explicitly state that routine NSG use for injections is unnecessary because the risk of exposure to blood and body fluids is low, and additionally that gloves do not prevent sharps injuries. Included educational resources presented mixed text and visual messages, which may contribute to practitioner confusion and practice variation. Editorials and letters further highlighted divergent professional norms that shape injection-related NSG use.

Primary research studies demonstrated wide differences in NSG-use practices. However, the overall small number of studies, small sample sizes, and diverse settings limits generalisability. Most studies relied on self-reported practice collected through surveys, which are vulnerable to social desirability bias and may lead to over- or under-reporting of NSG use. Concealed observational studies by Al-Rawajfah and Tubaishat [19], Theofanidis [30] offer more reliable estimates of practice, and both found variable NSG practice among hospital-based nurses in a low and high-income setting respectively. Only one included study specifically identified midwives as participants highlighting an important evidence gap for this professional group.

There was limited qualitative research exploring attitudes and behavioural drivers of NSG use during IM/SC injections. Theofanidis [30] conducted interviews with eight nurses following observation of practice which provides some insight into the decision-making process for injection-related NSG use. However, additional qualitative research is needed to provide contextually appropriate insights that can support strategies to improve the sustainability of injection-related glove while maintaining safety.

4.1 Misalignment between guidelines, education and local practice culture

This review uncovered a misalignment between global guidelines, local policies and educational resources regarding NSG use for injections. Several studies included in this review highlighted discrepancies between guidelines and local practice culture. For example, Fekonja, Fekonja [22], reported frequent NSG use in Slovenia despite WHO guidance indicating gloves are not required. In the United Kingdom, Trim et al. [31] similarly acknowledged that their recommendations diverged from guidelines. In Brazil, Roseira et al. [28] identified a lack of consensus for glove use during injections.

Further confusion may arise from ambiguous terminology such as the requirement for NSG for all invasive procedures which underpinned a rationale for NSG use in some sources [29, 40, 41]. On the other hand, many sources emphasised risk assessment rather than routine NSG use, however interpretations of risk varied widely. Differences in health professional education and training across settings, countries and over time may also influence glove use practice [24].

4.2 Evidence of risks and benefits

Few studies provided evidence of the risks and benefits associated with injection-related glove use, however two studies observed that NSG use was associated with reduced hand hygiene adherence and increased cross-contamination events, posing potential risks to both patients and clinicians [19, 30]. This is an important healthcare safety finding which is reflected in literature examining the overuse and misuse of NSG for a broader range of clinical procedures [48, 49].

Potential benefits of NSG use for injections may include perceived safety, and alignment with patient expectation [10]. Glove use for injections as a measure of self-protection emerged as a strong theme in this review, also reflecting the broader literature [48, 49]. However, indiscriminate and habitual NSG use risks providing healthcare workers with a false sense of safety and security, while proven interventions, such as hand hygiene, could be neglected. Given the recognised harms of reduced hand hygiene adherence, cross-contamination, and contribution to healthcare waste and emissions, the benefit of 'perceived safety' requires careful reflection.

Several sources clearly state that NSG do not provide protection against needle stick injuries. However, evidence regarding the actual risk of blood or body fluid exposure during IM/SC injections remains limited and warrants future research. A Cochrane review demonstrated that double gloving reduces blood and body fluid exposures for operating theatre staff during surgery [50], however this is not translatable to IM/SC injection administration. In any case, NSG are not an effective measure to prevent needle stick injury, and other more effective interventions should be instead emphasised. This includes safe sharps management and disposal practices supported by education, policy and procedures, and the introduction of safer injection devices such as auto-disable syringes [9]. Additionally, hepatitis B vaccination, recommended by WHO for all healthcare workers, is an essential intervention to protect patients and healthcare professionals in the case of exposure [51].

4.3 Recommendations for policy and practice

The promotion of sustainable glove use for injections requires clear and consistent messaging that is evidence-based and reflects local context. The behavioural insights uncovered in this review can support the development of targeted interventions that address capability, opportunity and motivation for sustainable glove use while maintaining IPC principles and meeting clinician expectations [8, 18].

Knowledge, understanding and application of IPC principles was emphasised as a key behavioural driver of glove use for injections and this reflects the broader literature examining NSG use for other procedures [48, 49]. This finding highlights the need for foundational and continuous professional education and training, including competency assessment, to explicitly include risk assessment, the avoidance of cross-contamination, and hand hygiene adherence during injection administration. Such approaches have demonstrated effectiveness in improving sustainable NSG practice and healthcare safety for a broader range of clinical procedures [6, 7]. However, for more technically nuanced procedures, such as IM/SC injections and administration of antimicrobials [52], additional attention is

needed. Perceived safety beliefs and habitual glove use also emerged as important behavioural drivers and these require targeted education to build clinician competence and address falsely held beliefs.

Environmental sustainability as a motivator for more sustainable NSG practice may present a new and powerful behavioural driver for practice change. The broader shift towards more sustainable healthcare has created opportunities to incorporate sustainability principles into health professional education and practice [53]. Only one of the included texts referred to environmental sustainability [35] so it cannot be inferred that this currently plays a substantial role in clinicians decision to wear NSG for injections. However, the growing recognition of the environmental impacts of personal protective equipment, including NSG, supports this as an important consideration for the delivery of safe and sustainable healthcare [2, 6–8].

4.4 Strengths and limitations

Our scoping review followed recognised methods [13, 14] and included two large databases alongside Google Scholar and an extensive grey literature search to support an understanding of contemporary nurse and midwife practices and attitudes regarding NSG for injections. Despite these strengths, it is possible that relevant evidence was missed. Firstly, we excluded articles where nurses and midwives were not explicitly specified. Secondly, the grey literature search focused on global and national evidence, and it is acknowledged that relevant local guidelines may exist and these warrant review within specific organisational, specialty and regional contexts. Lastly, it is notable that other health professionals administer IM/SC injections, and their specific context and perspectives should be considered in future studies.

5 Conclusions

Key guidelines state that NSG are not routinely required for IM/SC injections, however, substantial variation in practice exists and may be driven by the misalignment between guidelines, educational resources, professional attitudes and local practice culture. The findings from this scoping review highlight the need for improved alignment between guidelines, educational curricula, competency assessments, and local policies to ensure consistent messaging regarding risk assessment, hand hygiene, and sustainable glove use during injection administration. Targeted qualitative and quantitative research is needed to better understand local, context-specific behavioural drivers of injection-related NSG practices to inform improvement strategies in specific settings.

Declarations

Conflict of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could be perceived to influence the work reported in this paper.

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CRediT Author Statement

Flora Feng: Conceptualisation, methodology, investigation, data curation, formal analysis, writing - original draft, writing – review and editing.

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Figures

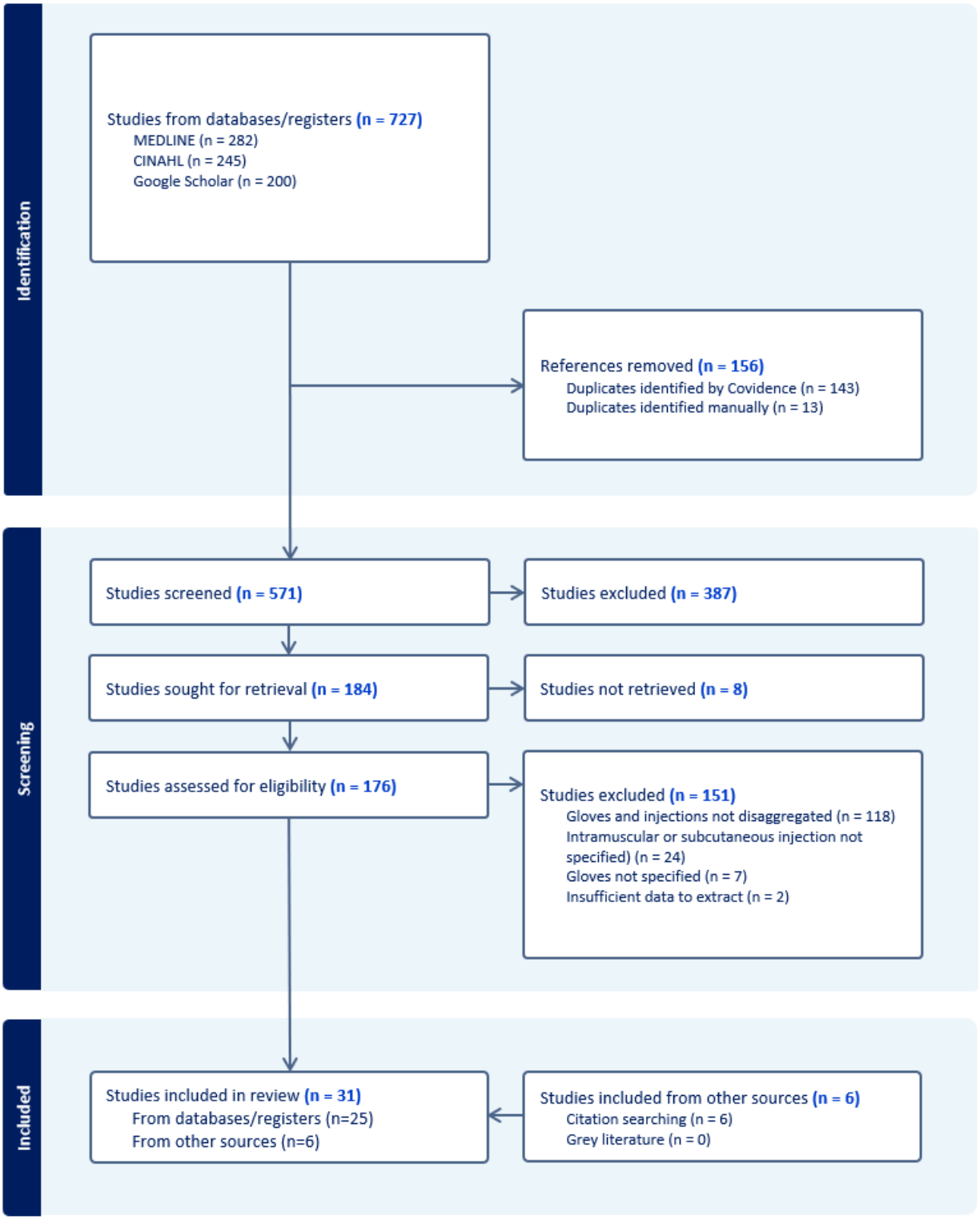


Figure 1

PRISMA Flow Diagram

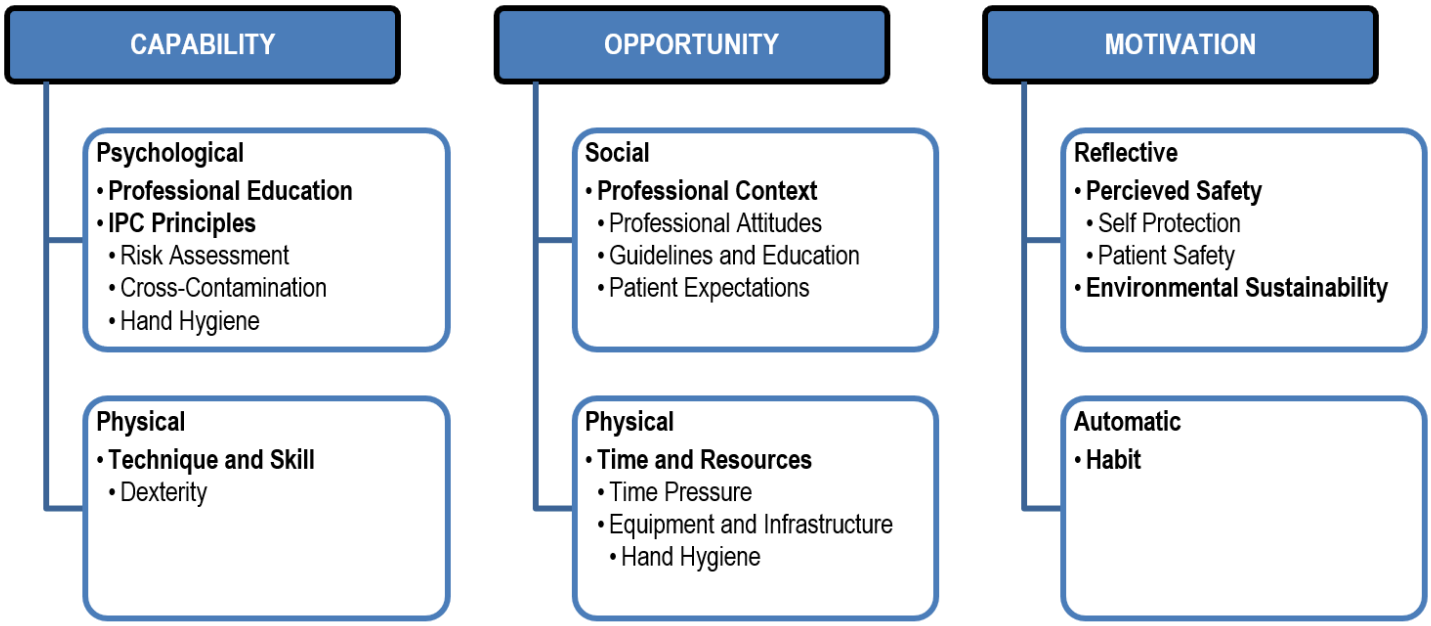


Figure 2

Behavioural Drivers of Non-Sterile Glove Use for Injections Among Nurses and Midwives

Figure Footnote: Behavioural drivers influencing non-sterile glove use during intramuscular and subcutaneous injections were identified and mapped to the COM-B model**. Acronyms** IPC: infection prevention and control

Supplementary Files

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