

Supplementary files

Determinants in Implementing Infection Prevention and Control Practice in Nursing Homes: A Scoping Review Based on the Theoretical Domains Framework

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Summarized methods of our scoping review

We conducted this review according to the Joanna Briggs Institute scoping review manual (Peters MDJ et al., 2020).

❑ What is a scoping review?

There are several objectives for conducting a scoping review. Scoping reviews can identify the types of evidence available in a given field, identify and analyze research gaps, and identify key characteristics or factors associated with a concept (Munn et al., 2018).

❑ PCC framework for our scoping review

Population: NHs for older people and HCWs in NHs

Concept: Determinants (barriers and facilitators) to IPC practice

Context: Daily practice in NHs for older people

❑ Selection of literature

- Database search (MEDLINE and CINAHL, March 31, 2022)
- Screening and full-text check

❑ Inclusion criteria

- 1) The reports focused on HCWs' IPC practices in NHs
- 2) The reports explored the barriers and facilitators of HCWs' IPC practices in NHs

❑ Exclusion criteria

- 1) Reports of vaccination and other medications to prevent infection
Vaccination is also an essential measure of IPC, but specific determinants may influence vaccine-related practice. Therefore, we excluded reports that only addressed vaccination.
- 2) Protocol papers, guidelines, letters, commentaries, editorials, news, and pictorials
- 3) Non-English reports
We excluded non-English reports because we could not read the non-English text. We did not use a machine translation tool for these reports because we could not determine whether the translated text was accurate.

❑ Data extraction

- Characteristics data of each report
- Descriptions of barriers and facilitators of HCWs' IPC practices in NHs based on TDF

❑ Data analysis and mapping

- 1) Framework analysis based on TDF to identify the research gap(s)*
- 2) Thematic analysis within each TDF domain
Inductive generation of codes, subcategories, and themes as determinants (barriers and facilitators)
- 3) Classification of determinants based on the COM-B** model as mapping

* A "research gap" is a question or problem that has not been answered by any of the existing studies or research in a field.

**COM-B: Capability, Opportunity, and Motivation - Behavior

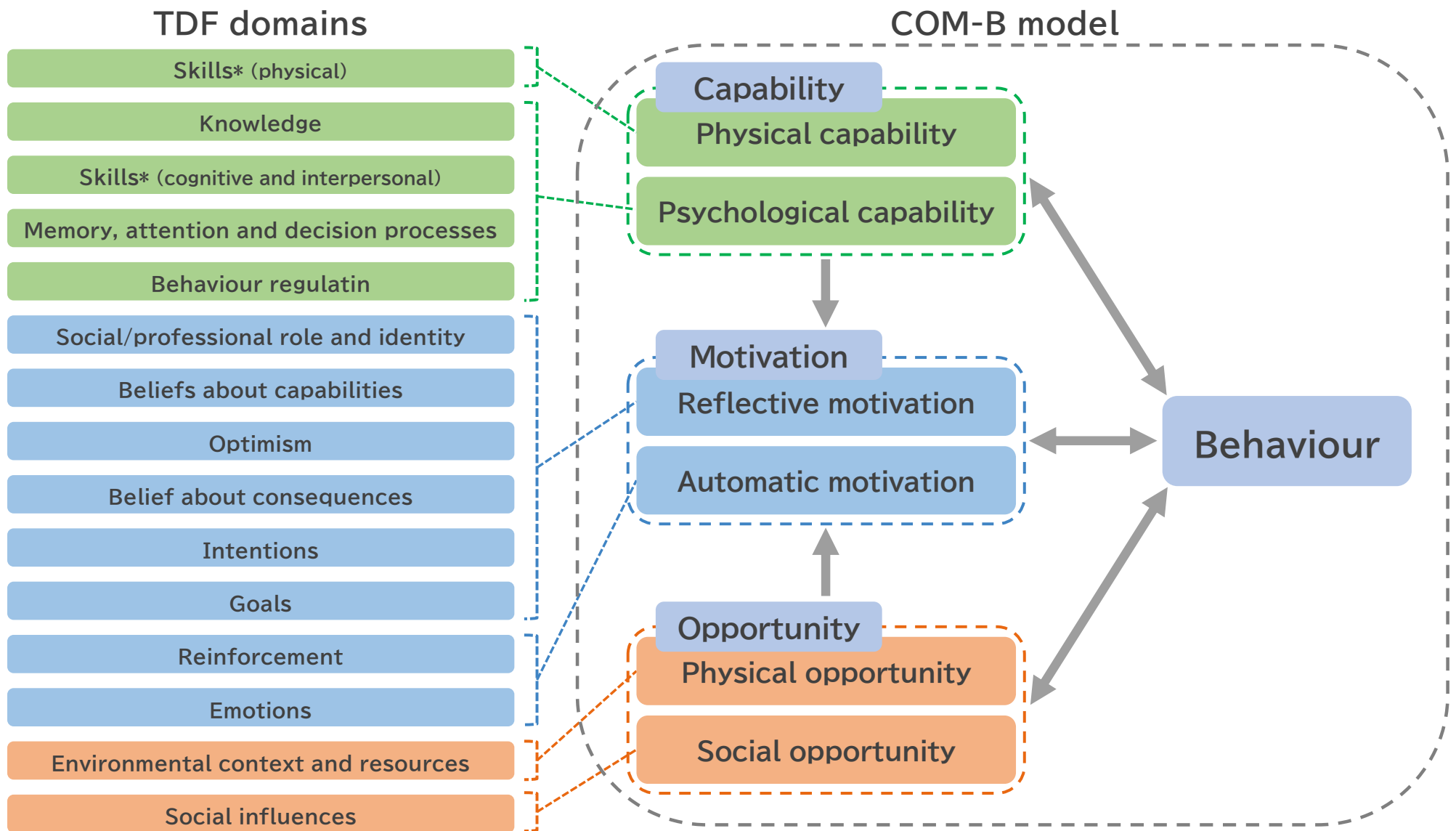


Figure S1. The Linkage between TDF and COM-B model (Modified from the figure in Chater et al., 2022)

Table S1. The definitions of TDF domains (Michie et al., 2014; Atkins et al., 2017)

TDF domain	Definition	Example of question
Knowledge	An awareness of the existence of something	Do you know about x?
Skills	An ability or proficiency acquired through practice	Do you know how to do x?
Social/Professional Role and Identity	A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting	Is doing x compatible or in conflict with professional standards/identity?
Beliefs about Capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use	How difficult or easy is it for you to do x?
Optimism	The confidence that things will happen for the best or that desired goals will be attained	How confident are you that the problem of implementing x will be solved?
Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation	What do you think will happen if you do x?
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	Are there incentives to do x?
Intention	A conscious decision to perform a behaviour or a resolve to act in a certain way	Have they made a decision to do x?
Goals	Mental representations about outcomes or end states that an individual wants to achieve	How much do they want to do x?
Memory, Attention, and Decision Processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	Is x something you usually do?
Environmental Context and Resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour	To what extent do physical or resource factors facilitate or hinder x?
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	To what extent do social influences facilitate or hinder x?
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personality significant matter or event	Does doing x evoke an emotional response?
Behavioral Regulation	Anything aimed at managing or changing objectively observed or measured actions	Do you have systems that you could use for monitoring whether or not you have carried x?

TDF: Theoretical Domains Framework

Table S2. The definitions of COM-B model components (Michie et al., 2014)

COM-B model component		Definition	TDF domains
Capability	Physical	Physical skill, strength or stamina	Skills (physical)
	Psychological	Knowledge or psychological skills, strength or stamina to engage in the necessary mental process	Knowledge, Skills* (cognitive and interpersonal), Memory, attention and decision processes, Behavioural regulation
Opportunity	Physical	Opportunity afforded by the environment involving time, resources, locations, cues, physical 'affordance'	Environmental context and resources
	Social	Opportunity afforded by interpersonal influences, social cues and cultural norms that influence the way that we think about things	Social influences
Motivation	Reflective	Reflective processes involving plans (self-conscious intentions) and evaluations (belief about what is good and bad)	Social/professional role and identity, Beliefs about capabilities, Optimism, Beliefs about consequences, Intention, Goals
	Automatic	Automatic processes involving emotional reactions, desires (wants and needs), impulses, inhibitions, drive states and reflex responses	Reinforcement, Emotion

TDF: Theoretical Domains Framework; COM-B: Capacity, Opportunity, and Motivation - Behaviour

*In the COM-B model, cognitive and interpersonal skills are classified under the psychological skills component.

Table S3. Characteristics of included reports (n=25)

Characteristics		No.
Geographical region	North America	13
	Europe	5
	Asia	5
	Oceania	2
Study design	Quantitative descriptive study	12
	Qualitative study	8
	Mixed methods study	3
	Quantitative non-randomised study	1
	Quantitative randomised controlled trial	1
Main topic	IPC practice	15
	IPC practice general	5
	MRSA precaution	4
	HAI prevention	2
	Others	4
	Hand hygiene	10
Types of participants*	Nurses**	21
	Nurse aids/assistants	12
	Care workers/assistants	7
	Other licensed healthcare professionals	8
	Other staff	13
	Facility managers/administrators	8
	Nurse managers/directors	8
	IPC specialists	6
	IPC staff	5

*Counted where applicable. Total frequency is not 25. Only participants in NH settings were counted.

**Includes all types of licensed nurses.

HAI: Healthcare associated infection; MRSA: *Methicillin-resistant Staphylococcus aureus*

Table S4. Map of extracted data from each report based on TDF and COM-B model

COM-B component		Capability			Opportunity		Motivation								
		Physical	Psychological		Physical	Social	Reflective					Automatic			
Report	TDF domain	Skills	Knowledge	Memory, Attention, and Decision Processes	Behavioural Regulation	Environmental Context and Resources	Social Influences	Social/ Professional Role and Identity	Belief about Capabilities	Optimism	Beliefs about Consequences	Intention	Goals	Reinforcement	Emotion
	1) IPC practice														
	Brumpton et al. (2004)		X	X		X	X								
	Wolf et al. (2008)					X									
	Zoutman et al. (2009)				X	X									
	Morrow et al. (2011)					X	X					X	X	X	
	McClean et al. (2012)			X		X	X	X				X			
	Bradley et al. (2012)	X	X		X	X	X								
	Freil et al. (2013)				X	X	X								
	Travers et al. (2015)	X		X		X		X							
	Cohen et al. (2015)		X	X		X					X			X	X
	Stone et al. (2015)	X			X	X	X								
	Lee et al. (2017)		X			X	X						X		
	Chi-Young et al. (2018)		X	X	X	X	X								
	Huhtinen et al. (2019)	X	X	X	X	X				X					
	Van et al. (2020)					X	X								
	Katz et al. (2020)	X	X	X	X	X	X								
2) Hand hygiene															
	Mody et al. (2003)		X	X		X					X	X			
	Smith et al. (2008)					X									
	Ashraf et al. (2010)			X	X	X	X				X				
	Takahashi & Turale (2010)		X		X	X						X			
	Ho et al. (2012)			X		X	X								
	Castle et al. (2016)			X		X			X		X				
	Hammerschmidt & Manser (2019)	X	X	X	X	X	X					X			
	Puto et al. (2020)					X									
	Jia et al. (2021)					X									
	Lescure et al. (2021)	X	X	X	X	X	X			X	X	X			X

Table S5. Map of determinants based on TDF and COM-B model: **Capability** (4 themes, 8 sub-categories, 21 codes)

COM-B model component	Theme	Subcategory	Barrier/ Facilitator	Code
Capability (physical)	TDF: Skills (physical)			
	Lack of IPC skills	Lack of training in IPC practice	Barrier	Lack of training in appropriate IPC procedures Lack of training in appropriate PPE use
		Lack of management of training as an organisation	Barrier	Lack of well-organised training Lack of training in outbreak management
	TDF: Knowledge			
Lack of IPC knowledge	Lack of understanding of IPC knowledge	Barrier	Lack of knowledge about HAI prevention Lack of understanding of IPC guidelines Lack of understanding of IPC concepts	
	Lack of knowledge of IPC practice	Barrier	Lack of knowledge about appropriate hand hygiene Lack of knowledge about appropriate PPE use	
TDF: Memory, Attention, and Decision Processes				
Failure to practice IPC	Less attention to appropriate IPC practice	Barrier	Not thinking about practicing IPC Assumptions that glove use is an alternative to hand hygiene Omitting IPC practices when deemed unnecessary	
	Busyness hinders IPC practice	Barrier	Time pressure hinders IPC Workload hinders IPC Competing priorities hinder IPC	
TDF: Behavioural Regulation				
Lack of organisational IPC	Lack of data-based assessment and feedback	Barrier	Lack of monitoring and assessment of IPC practices Lack of feedback based on data and assessment Lack of well-planned HAI surveillance Lack of root cause analysis of infection related issues	
	Lack of organisational projects to promote IPC	Barrier	Lack of established IPC improvement projects Lack of planned IPC education and training programs	

Table S6. Map of determinants based on TDF and COM-B model: **Opportunity** (4 themes, 10 subcategories, 38 codes)

COM-B model component	Theme	Subcategory	Barrier/ Facilitator	Code	
Opportunity (physical)	TDF: Environmental Context and Resources				
	NHs context complexities	Difficulties specific to care facilities for older people	Barrier	Resident's physical condition Resident's cognitive condition Resident's family preferences Resident preferences Conflict between home-like care and IPC practice	
		Complexity of HCW contexts	Barrier	Various levels of experience and education of staff High staff turnover Staff from diverse cultural backgrounds	
	Lack of resources	Lack of human resources	Barrier	Absence of a person/team responsible for outbreak management Multiple roles of the person responsible for IPC Low staffing levels Lack of time for IPC	
		Lack of material resources	Barrier	Lack of adequate facility Lack of medical resources Lack of supplies for IPC practice Lack of financial resources for IPC	
	Insufficient IPC system	Lack of collaboration	Barrier	Lack of collaboration with other institutions Lack of collaboration with other professions Lack of consulting services for IPC	
		Lack of good IPC operation	Barrier	Impractical and difficult to use guidelines Supplies placed in inconvenient locations Inadequate information sharing Unreplenished supplies Continuation of inappropriate customary practices Inappropriate management of antimicrobial resistant organisms Lack of visual cues for IPC practices	
	Opportunity (social)	TDF: Social Influences			
		IPC practice as a team	Decline in normative awareness	Barrier	Lack of staff cooperation Getting used to each other's inappropriate practices Lack of consistent leadership
			Enhanced good group norms	Facilitator	Presence of consistent leadership Empowerment of staff Existence of role models Inter-professional teamwork Positive feedback from colleagues Encouragement from IPC specialist
Lack of management support			Barrier	Lack of manager support for IPC Lack of organisational support for IPC	
Collaboration with residents and families			Both	Involvement of residents and their families in IPC	

Table S7. Map of determinants based on TDF and COM-B model: **Motivation** (8 themes, 13 sub-categories, 21 codes)

COM-B model component	Theme	Subcategory	Barrier/ Facilitator	Code
Motivation (reflective)	TDF: Social/Professional Role and Identity			
	Less IPC accountability	Lack of accountability of IPC as HCW	Barrier	Lack of accountability of IPC as HCW Lack of understanding of HCW IPC role
	TDF: Belief about Capabilities			
	Need to increase belief in IPC capability	Manager empowerment of IPC capability	Facilitator	IPC empowerment of staff by managers
		Difficulty in meeting high IPC requirements	Barrier	Difficulty in practicing frequent hand hygiene
	TDF: Optimism			
	Optimistic thoughts from HCWs	Confidence that IPC practices are effective	Facilitator	Confidence that hand hygiene reduces the risk of infection
		Low risk assumption for outbreaks	Barrier	Assumption that outbreaks are unlikely to occur
	TDF: Belief about Consequences			
	Recognition of IPC consequences	Recognition of good IPC practice reduces the risk of infection	Facilitator	Awareness that hand hygiene reduces the risk of infection Recognise that appropriate isolation reduces the risk of infection Recognise the importance of appropriate PPE use
		Recognition of the negative consequences of hand hygiene	Barrier	Recognising that hand hygiene makes hands sore
	TDF: Intention			
	Intention to practice IPC	Unwillingness to practice IPC	Barrier	Reluctance to practice hand hygiene Indifference to appropriate IPC practices
	Willingness to practice IPC	Facilitator	Willingness to practice required IPC Wanting to protect themselves from infection	
TDF: Goals				
Quality and safe care	Aiming to provide quality and safe care	Facilitator	Promoting patient health and safety Providing quality patient care	
Motivation (automatic)	TDF: Reinforcement			
	Social reinforcement	Social sanctions for inadequate IPC	Facilitator	Fines for poor IPC compliance Media and public blame and stigma
	TDF: Emotion			
Negative emotions about both infection and IPC	Fear of getting infected and dirty	Facilitator	Thinking that everything a resident touches is dirty Staff fear of infection	
	Negative feelings of residents and families towards IPC	Barrier	Fear and frustration of residents and families towards IPC	

Table S8. Search strategy on MEDLINE (searched on 31 March 2022)

#	Search Terms	Results
1	exp Residential Facilities/	56,433
2	exp Communicable Disease Control/	388,269
3	exp Cross Infection/pc	25,422
4	Catheter-Related Infections/pc	2,488
5	or/2-4	403,449
6	exp nurses/ or exp nursing staff/	157,622
7	Caregivers/	44,784
8	professional role/ or nurse's role/	57,817
9	attitude/ or "attitude of health personnel"/	179,424
10	Attitude to Health/	85,338
11	Health Knowledge, Attitudes, Practice/	122,875
12	exp Motivation/	185,227
13	exp Inservice Training/	29,889
14	exp Health Services Administration/	3,552,966
15	exp Patient Care Team/	71,937
16	(practice* or behavior* or behaviour* or attitude* or nurse*).ti.	748,771
17	or/6-16	4,430,726
18	5 and 17	68,180
19	exp Hand Hygiene/	7,844
20	Masks/ or Personal Protective Equipment/ or exp Protective Clothing/	22,133
21	Infection Control Practitioners/	735
22	or/18-21	93,587
23	22 and 1	704
24	remove duplicates from 23	702

Table S9. Search strategy on CINAHL (searched on 31 March 2022)

	Search Terms	Results
S1	(MH "Residential Facilities") OR (MH "Nursing Homes")	30,579
S2	(MH "Infection Control") OR (MH "Pest Control") OR (MH "Universal Precautions")	31,029
S3	(MH "Cross Infection+/PC")	18,925
S4	S2 or S3	43,133
S5	(MH "Nursing Manpower+") or (MH "Caregivers")	302,949
S6	(MH "Professional Role") OR (MH "Nursing Role")	106,549
S7	(MH "Attitude") OR (MH "Attitude of Health Personnel") OR (MH "Nurse Attitudes") OR (MH "Attitude to Risk") OR (MH "Attitude to Illness") OR (MH "Caregiver Attitudes")	117,576
S8	(MH "Professional Practice") OR (MH "Nursing Practice+") OR (MH "Practice Patterns") OR (MH "Scope of Practice")	108,103
S9	(MH "Motivation+")	105,090
S10	(MH "Staff Development+")	33,931
S11	(MH "Administrative Personnel") OR (MH "Health Facility Administrators") OR (MH "Nurse Administrators")	33,778
S12	(MH "Multidisciplinary Care Team")	48,504
S13	T1 practice* or behavior* or behaviour* or attitude* or nurse*	485,682
S14	S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13	1,016,860
S15	S4 and S14	9,964
S16	(MH "Handwashing")	9,390
S17	(MH "Personal Protective Equipment+")	12,762
S18	(MH "Infection Preventionists")	2,108
S19	S15 or S16 or S17 or S18	29,557
S20	S1 and S19	386
S21	(MH "Nursing Home Personnel")	4,251
S22	S4 or S16 or S17 or S18	58,319
S23	S21 and S22	129
S24	S20 or S23	459

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

