

# Using Behaviour Change Theories to Understand Pediatric Emergency Discharge Communication Interventions

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## Research

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# Abstract

## Background

Interventions to improve discharge communication in emergency practice settings are inherently complex and incorporate multiple strategies aimed at patient, caregiver and healthcare provider behaviours. Behaviour change theories, including the capability-opportunity-motivation-behaviour (COM-B) model and Behaviour Change Technique Taxonomy version 1 (BCTTv1), provide consistent language for identifying and evaluating the active components of interventions. The objectives of this study were to: (1) identify common barriers and enablers to discharge communication interventions and (2) describe behaviour change techniques (BCTs) present in pediatric emergency discharge communication interventions aimed at patients, caregivers and health care providers.

## Methods

We conducted a secondary analysis of 35 experimental and quasi-experimental studies included in a narrative synthesis of discharge communication interventions in pediatric emergency care. Included studies were reviewed to identify reported barriers and enablers to implementation and intervention effectiveness, which were then mapped to the COM-B model. Trained BCT coders independently coded intervention descriptions using the BCTTv1 as a coding framework. Consensus was used to resolve any discrepancies. BCTs were analyzed using descriptive statistics to determine the frequency of the 93 individual BCTs and 16 BCT categories for patient/caregiver and health care provider interventions.

## Results

Barriers and enablers were identified at the patient/caregiver, health care provider, intervention and health system levels. *Psychological capability* was the most frequently coded COM-B component. Of the 33 studies that included BCTs, 29 interventions targeted patients or caregivers. A total of 20 different individual BCTs were identified across the interventions in the 33 studies. The number of BCTs identified in each study ranged from 1–9 BCTs, with most (n = 14, 42%) interventions containing one BCT. Reporting deficiencies were noted related to adequate details of intervention components and implementation fidelity.

## Conclusions

The COM-B model and BCTTv1 proved to be useful tools to provide a foundational understanding of the common mechanisms used in pediatric discharge communication interventions. With only a fraction of the available BCTs were used in the included studies, future research is needed to explore the utility of

other BCTs to address common implementation barriers and improve the effectiveness of discharge communication interventions.

## Contributions To The Literature

- Discharge communication interventions in pediatric emergency care require strategies aimed at health care provider, caregiver and patient behaviours. While a number of barriers were identified at the health care provider and intervention level, the majority of BCTs in this review targeted caregivers.
- Instructions on how to perform the behaviour was the most common BCT targeting parents. Techniques targeting healthcare providers' discharge communication behaviours were rare.
- Behaviour change theories can assist with identifying active components of pediatric discharge communication interventions. Our findings contribute to the limited body of knowledge regarding theory-based interventions in pediatric emergency care.

## Background

Interventions in health care are often complex and involve a number of components, targets, behaviours, and outcomes [1]. Understanding the components that comprise a successful intervention can provide important information for the development of future interventions and can result in more efficient use of health care resources [2]. A number of intervention classification frameworks have been developed over recent years, including the Effective Practice and Organization of Care (EPOC) classification system [3] and the Template for Intervention Description and Replication (TIDiER)[4], that aim to standardize intervention descriptions [5]. While these classification systems allow for improved comprehensiveness of intervention reporting, there is also evidence to suggest that using systematic, theoretically-derived classification systems improve the replicability of health behaviour interventions [1, 6].

The capability-opportunity-motivation-behaviour (COM-B) model is a behaviour change framework which suggests that behaviours are the result of interactions within capabilities, opportunities and motivations [7]. The COM-B model is further differentiated into six components; physical capability, psychological capability, physical opportunity, social opportunity, reflective motivation, and automatic motivation [7] and has been used to understand barriers and enablers across a range of health contexts[8, 9]. Combining both intervention classification and health behaviour theory, the Behaviour Change Technique Taxonomy version 1 (BCTTv1) provides consistent language for identifying and evaluating the active components of interventions [10]. A behaviour change technique (BCT) is defined as an “observable, replicable and irreducible component of an intervention designed to alter or redirect causal processes that regulate behaviour”[10]. As such, they are often referred to as the ‘active ingredients’ of an intervention’s design. The BCTTv1 includes 93 individual techniques with labels and definitions organized into 16 BCT categories [10]. The BCTTv1 has been used to evaluate and design a number of health care interventions in varying clinical settings, including medication adherence [11], weight management [12], physical activity [13, 14], antimicrobial resistance [15], and diabetes care [16, 17]. Previous research has found the

BCTTv1 to be a useful tool for classifying intervention components and standardizing intervention language [15–18].

Pediatric emergency department (ED) settings can be noisy and chaotic and the discharge process can be a stressful for patients and families. Interventions to improve discharge communication are often complex and can incorporate multiple strategies aimed at health care provider, caregiver and patient behaviours [19, 20]. Effective discharge communication interventions include standardizing content delivered through both verbal and written modes, and ensuring patient comprehension and recall through strategies such as demonstration of the behaviour, prompts, and social support [21, 22]. Findings from a recent systematic review and narrative synthesis of pediatric discharge communication found that the majority of interventions across both acute and chronic illness presentations were aimed at improving caregiver comprehension of health information [23]. Further, many of these discharge communication interventions include multiple intervention components (e.g., education, reminders) and targets (e.g., patient and family, health care provider and system), making it difficult to discern which intervention components, or interaction of multiple components, resulted in the measured outcome [2, 23, 24].

To date, behaviour change frameworks have yet to be used to identify the barriers, enablers and active ingredients in emergency discharge communication interventions. Using the results from a recent systematic review and narrative synthesis of pediatric emergency discharge communication, the objectives of this study were to: (1) map identified intervention barriers and enablers identified by authors in the experimental and quasi-experimental studies to the COM-B model, and (2) describe common BCTs included ED discharge communication interventions.

## Methods

We conducted a secondary analysis of 35 experimental and quasi-experimental studies included in a systematic review and narrative synthesis of discharge communication in pediatric emergency care to gain a better understanding of the behaviours related to discharge communication and the characteristics of existing interventions [23]. A full description of the narrative synthesis protocol [25] and findings [23] can be found elsewhere. Coders were blinded to the intervention function classification completed during the narrative synthesis.

### *Identifying and mapping intervention barriers and enablers*

All included studies were analyzed by two reviewers (JAC and AJG). First, the full text articles were imported into NVivo 11 qualitative software [27], and the study reports were reviewed to identify barriers and enablers to intervention implementation and effectiveness as reported by the study authors. The reviewers met after coding every 5-7 studies to compare consistency and discuss any discrepancies. Once barriers and enablers were identified they were mapped onto relevant domains within the COM-B model. The two reviewers independently mapped the barriers and enablers to the components of the

COM-B model and then met to compare findings of the mapping exercise. Discrepancies in mapping were resolved through discussion.

### *BCTTv1 coding*

Similar to other research [16], we developed rules a priori to guide BCT coding and reviewer consensus. The first rule was to code only those intervention components with sufficient detail to clearly identify a BCT. This prevented over-coding of interventions by limiting coder assumptions that a BCT could be present but poorly described. The second rule was specific to education interventions, which are common in discharge communication. We assumed that components of education intervention included at a minimum *instruction on how to perform the behavior*. Other BCTs were coded in education interventions only when sufficient details were provided.

Textual data from study reports were managed using NVivo 11[27]. All reviewers completed the online BCTTv1 training course [28] and received a copy of the 93 individual BCT definitions and examples from the BCTTv1[7, 10] prior to coding. Four reviewers (AJG, AB, JE, CC) independently coded the intervention descriptions in all included studies. The study objectives were reviewed first to obtain a sense of the intervention target and outcomes of interest. The methods sections were then read in their entirety and analyzed to identify BCTs in the interventions. BCTs were only identified in content related to the intervention groups, as the control groups received either no intervention or standardized care.

Following independent coding, a consensus meeting was held to compare coding and resolve discrepancies. Coding discrepancies were discussed as a team and resolutions were achieved by consensus. When coding discrepancies could not be resolved, a fifth team member (JAC) was included in the discussion to help achieve consensus. We chose to reach consensus rather than use inter-coder reliability statistics as inter-coder agreement has not been well established in the literature [29]. All coding resolutions were then noted in the NVivo file. Descriptive statistics were used to determine the frequency of the 93 individual BCTs and 16 BCT categories for patient, caregiver and health care provider interventions. Our study report adheres to the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ; [26]) checklist (see additional file 1).

## **Results**

### *Barriers and enablers*

Barriers and enablers were identified across patient/caregiver, health care provider, intervention and health system levels. All six domains of the COM-B model were identified across the barriers and enablers, with *psychological capability* being the most commonly identified domain across levels. The full list of barriers and enablers and identified COM-B domains are outlined in Table 1.

Patient/caregiver barriers ranged from low health literacy levels, feelings of anxiety and stress, and poor understanding of discharge instructions. Health care provider barriers included resistance to change and

poor relationships with patients/caregivers. Complex interventions that required a substantial allotment of resources to implement was also identified as a key barrier. Finally, two important health system barriers included the chaotic nature of the ED context and limited access to primary care providers.

Enablers were also identified across studies. Enablers included providing caregivers with information early in the ED visit, having health care providers use pre-formatted discharge communication templates as part of the intervention, establishing links between the ED and primary care providers, and personalizing intervention content to the patient's needs.

### *BCT Coding*

Two [60, 61] of the 35 experimental studies did not include identifiable BCTs as components of the interventions and were therefore not included in the analysis. These interventions either did not target behaviour change or did not provide enough detail in the methods sections to identify potential BCTs. Table 2 provides an overview of study characteristics and identified BCTs from the remaining 33 studies.

### *Patient/Caregiver targeted interventions*

Of the 33 studies that included BCTs, 29 interventions targeted patients/caregivers. A total of 20 out of the 93 individual BCTs, from 12 of the 16 BCT categories, were identified in the interventions (Figure 1). The number of BCTs identified in each study ranged from 1-9 BCTs, with a mode of 1 BCT per intervention. The three most commonly coded BCTs in patient/caregiver interventions were:

*4.1- Instruction on how to perform the behaviour.* Fourteen studies included this component as part of their interventions [30–34, 37, 38, 42, 43, 47, 50, 53, 55, 62]. Interventions that included this BCT were most often aimed at asthma, fever, and gastroenteritis illness presentations.

e.g., “the video discusses methods for taking a temperature, outlines indications for contacting a physician, refutes common parental misconceptions about fever, and identifies methods to comfort a febrile child”[37].

*5.1- Information about health consequences:* Eleven interventions included information about health consequences [30, 33, 39, 47, 48, 50, 55–57, 63, 64]. This BCT was identified across numerous studies, including interventions aimed at pain management, mental health, and wound care.

e.g., “the instructions were legible, were written to be understood by a patient with a seventh-grade education, and included information concerning suture removal, wound care, signs of infection, and methods to reduce scarring”[30].

*3.2- Social support (practical):* Ten studies used practical social support in their interventions [33, 40, 43, 47, 48, 50, 58, 59, 62, 63]. In one study [62], this BCT was used in two components of the intervention. Six of these interventions were aimed at asthma or mental health presentations [43, 47, 50, 58, 62, 63].

e.g., “the educator also asked about and reinforced use of the asthma action plan, provided a referral for any identified obstacles, tried to help the family set goals to assure follow-up, and addressed any new concerns or questions as appropriate”[43].

### *Health care provider targeted interventions*

Only eight of the 33 studies that included BCTs targeted health care provider behaviours. Four interventions solely targeted health care providers [35, 41, 44, 51], while the other four interventions primarily targeted caregivers but also included health care providers [42, 48–50]. Four of the potential 93 individual BCTs were identified from these eight interventions across four BCT categories: *shaping knowledge, natural consequences, associations, and repetition and substitution* (Figure 1). The four identified BCTs in health care provider interventions were:

*4.1- Instruction on how to perform the behaviour.* Four studies included this BCT as a component of their interventions [44, 49–51]. Two of the interventions were focused on asthma, one on mental health and one otitis media illness presentations. Further, one study [44] used this BCT at two different points in the intervention.

e.g., “...all nurses and Respiratory Care Practitioners (RCP) were instructed on the use of the plan to ensure that all healthcare providers delivered the same messages to the patients and parents” [51].

*7.1- Prompts/Cues:* This BCT was also identified in four interventions [41, 42, 44, 48]. Two of these interventions targeted asthma, one targeted otitis media illness presentations, and the final intervention used *prompts/cues* to encourage families to purchase and use helmets.

e.g., “physicians were provided, during orientation sessions, with a small plasticized pocket cue card outlining a number of points to serve as the basis for counseling the family about the risks of cycling and the benefits of helmets”[48].

*5.1-Information about health consequences:* Two studies included this BCT [35, 50]. One of the studies targeted asthma and the other targeted fever.

e.g., “each ED was introduced to the protocols through educational sessions outlining the importance of compliance with asthma care guidelines”[50].

*8.1- Behaviour practice/rehearsal:* Only one intervention included this BCT [49]. This intervention targeted mental health presentations and also included numerous intervention components targeted at caregivers and patients to increase use of outpatient mental health services and to decrease suicide attempts.

e.g., “clinicians with graduate mental health training received didactic training with role playing, observed intervention sessions, and were observed until a senior clinician certified them as proficient” [49].

## **Discussion**

The application of the BCTTv1 was useful for identifying the active ingredients present in pediatric emergency discharge communication interventions targeting caregivers and health care providers. We identified 20 out of a possible 93 BCTs across all studies, indicating that less than a quarter of the available BCTs are commonly used in interventions to improve ED discharge communication. This low percentage of identified BCTs is consistent with other reviews of BCTs in diabetes care [17, 66] and medication adherence literature [67].

### *Changing patient/caregiver behaviours*

The majority of ED discharge communication interventions from our analysis solely targeted caregivers. *Instruction on how to perform the behaviour* was the most commonly identified BCT in interventions across all illness presentations that aimed to improve caregiver compliance, comprehension, or recall of discharge instructions. This is not surprising as discharge communication is meant to instruct patients and caregivers on how to perform behaviours specific to managing care of their child at home. This finding is also consistent with BCTs identified in the diabetes [17, 66], cardiovascular disease [68], and physical activity [69] literature. Interestingly, many of the common BCTs used to address other health behaviours, including *action planning* [67], *goal setting* [66, 68, 70], *self-monitoring of behaviours* [67, 69–71], *problem solving* [70, 72] and *reducing negative emotions* [68, 70] have not been widely used in discharge communication interventions to date. While education is a commonly employed behaviour change strategy, without the addition of BCTs like *action planning* and/or *goal setting*, it is unlikely to lead to changes in behavior [73, 74]. There is further evidence to suggest that interventions that incorporate barrier mitigation and problem solving along with action planning can be even more efficacious [75, 76]. As such, there is an opportunity to leverage the strengths of these BCTs to examine their utility in conjunction with educational interventions for ED discharge communication.

We identified a subset of studies which incorporated *practical social support* as the only BCT [40, 58], or combined with other BCTs [33, 43, 47, 48, 50, 59, 62, 63] to increase follow-up care after discharge from the ED to reduce inappropriate return visits. This is consistent with other studies which found that *practical social support* techniques such as phone call reminders and customized asthma care plans, can improve the likelihood of follow-up care with primary care providers [77]. Including social support in health-related interventions has been associated with long-term positive outcomes, especially in behaviour change studies [78, 79], as well as having an overall positive impact on health [80]. However, no significant impacts on system level outcomes, such as ED return rates or unscheduled care, have been found [77].

Finally, interventions targeting chronic illness presentations, like asthma and mental health, were more likely to include multiple BCTs compared to acute illness presentations. Of the 13 asthma interventions targeting patients/caregivers, five interventions included at least three BCTs [36, 42, 43, 50, 62]. Each of the three mental health interventions included between four and nine BCTs targeting patients/caregivers, significantly higher than the mode of one BCT per intervention in the majority of other studies [47, 49, 63].

As chronic disease often involves multiple interacting risk factors, management of these conditions may require more multi-component, complex interventions.

The identified barriers to effective ED discharge communication provides some guidance on which BCTs should be prioritized and evaluated moving forward [81]. BCTs associated with increasing familiarity and confidence in performing behaviours following ED discharge, such as *demonstration of the behaviour* and *behavioural practice/rehearsal*, may help to overcome barriers associated with improved teaching and demonstration. Future research should consider the possibility of a wider range of important patient and caregiver level barriers to effective discharge communication when designing intervention strategies

### *Changing health care provider behaviours*

Few interventions in our analysis targeted ED health care provider behaviour. This is concerning given that effective discharge communication requires an interactive process between health care providers and patients/caregivers that includes assessment of comprehension [21]. By primarily focusing interventions on patients/caregivers, half of the discharge communication equation is missing.

Coding the barriers and enablers to intervention effectiveness allowed us to identify factors at the health care provider level that may affect uptake of the intervention. Some of the barriers identified at this level could be addressed by incorporating BCTs specifically targeting health care providers into the interventions. For example, health care providers' resistance to intervention uptake could be addressed by including *habit forming*, *habit reversal*, or *restructuring the physical environment* components in the intervention. These BCTs may help facilitate the uptake of new clinical behaviours. Additionally, health care providers' rapport with caregivers could be addressed by use of *prompts/cues*, which could support providing more consistent and comprehensive discharge communication. Other studies detailing health care provider-focused interventions have also identified *prompts/cues* and *instruction on how to perform the behaviour* as commonly coded BCTs [66]. Reminders have also been shown to be an effective strategy to change health care provider behaviours across health care settings [82], although factors such as patient preference may ultimately override their decision-making processes [83]. As only four studies in our analysis included BCTs targeting both caregivers and health care providers, greater evaluation of health care provider-focused behavioural interventions are needed.

### *Intervention content descriptions*

While the majority of interventions in our analysis included education components, education content and delivery were rarely reported in enough detail to identify additional BCTs that might have been present. Our findings suggest there is a critical need for improvement in study reporting, particularly regarding details about intervention components and implementation strategies, clearly explicating assumptions about how the intervention is expected to work. This has been identified as an important factor to advance the science of behaviour change and improve replicability [84, 85]. Articles included in our analysis did not use a checklist, such as the TIDiER checklist, which has been widely available since 2014 [4]. Further, none of the included articles specified a taxonomy or classification system, like the

BCTTv1, to describe individual intervention components. Use of a reporting guideline to guide intervention descriptions would greatly strengthen not only the findings generated from the evaluation of pediatric ED interventions, but also lead to greater ability to replicate studies and synthesize resulting evidence. Intervention fidelity not only assesses whether the intervention was delivered as planned, but provides important insight into how implementation varied and important barriers and facilitators to consider in future research [86].

### *COM-B Intervention barriers and enablers*

To our knowledge, this is the first instance of using the COM-B model to describe barriers and enablers of discharge communication interventions. Applying this model to analyze barriers and enablers has been completed in other research areas, including a systematic review regarding testing for sexual transmitted infections [9]. Our analysis mapped intervention barriers and enablers to all six domains in the COM-B model, with most categorized under the *psychological capability* domain. *Instruction on how to perform the behaviour* and *information about health consequences* were two of the most commonly identified BCTs in patient, caregiver and health care provider interventions. While these frequently used BCTs may address some of the barriers in the *psychological capabilities* domain, clearly they provide insufficient coverage to address all existing barriers within this domain.

### *Limitations*

Deficiencies in the reporting of implementation strategies and intervention descriptions made it challenging to identify all behaviour change content. It is possible that we may have missed some relevant intervention content during coding. While we developed coding rules to help prevent under or over-coding of BCTs, it is possible there were more behaviour change techniques associated with pediatric discharge communication interventions that we were unable to identify.

## **Conclusions**

There is limited research identifying the active components of pediatric ED discharge communication interventions. The COM-B model and BCTTv1 provided a useful to analyse the barriers, enablers and common mechanisms used in these interventions. With only a fraction of the available BCTs used in the included studies, future research is needed to explore the utility of other BCTs to improve the effectiveness of discharge communication interventions. Further, the BCW presents an opportunity to prospectively design effective discharge communication interventions that incorporate prioritized BCTs using a systematic, theoretical approach. At a minimum, it is critical that intervention descriptions be standardized to ensure consistency in reporting, the ability to discern and evaluate successful intervention components, and to improve replicability moving forward.

## **Abbreviations**

BCT

Behaviour Change Technique  
BCTTv1  
Behaviour Change Technique Taxonomy version 1  
COM-B  
Capability, Opportunity, Motivation- Behaviour  
ED  
Emergency Department  
ENTREQ  
Enhancing Transparency in Reporting the Synthesis of Qualitative Research  
EPOC  
Effective Practice and Organization of Care  
MDIS  
Metered Dose Inhaler with Spacer  
NAEPP  
National Asthma Education and Prevention Program  
PCP  
Primary Care Provider  
RCP  
Respiratory Care Practitioners  
TDF  
Theoretical Domains Framework  
TIDiER  
Template for Intervention Description and Replication

## **Declarations**

*Ethics approval and consent to participate*

Not applicable.

*Consent for publication*

Not applicable.

*Availability of data and material*

Not applicable.

*Competing interests*

The authors declare that they have no competing interests.

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### *Authors' contributions*

JAC conceived of the research question and method for this project. All authors participated in coding the BCTs, and JAC and AJG conducted coding of the barriers and enablers. AB and AJG prepared the first draft of the manuscript with input from CC, JE and JAC. All authors have made substantive contributions to revising the manuscript and have approved the final version.

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## Tables

Table 1. Intervention barriers and enablers with identified COM-B domains

	Theme	Barrier or Enabler	Example(s)	Identified COM-B domain(s)
Caregiver level	Difficulty understanding discharge communication [30-36]	Barrier	<p>“if caregivers encountered difficulty with using the instructions, he or she was then unable to effectively manage his or her child’s condition in terms of restricting activity, seeking follow-up care, administering medications, and so on [34].”</p> <p>“patients may not even realize the deficits in their own knowledge and therefore do not pursue further clarification of instructions [31].”</p>	Psychological capability
	Caregiver stress/anxiety [35-40]	Barrier	<p>“Often, these parents are quite anxious upon arrival to the busy ED setting, where they have been dealing with the ill effects of fever and an uncomfortable child for the past several hours at home [39].”</p> <p>“parents are not receptive to advice when stressed or distracted [36]”</p>	Psychological capability
Health care provider level	Rapport between health care providers and caregivers [30, 32, 38, 40, 41]	Barrier and enabler	<p>“It is possible that the families enrolled in our study did not have a strong, trusting relationship with their PCP and were uncomfortable calling him or her with questions rather than returning to the PED [38].”</p> <p>“Because many children receive episodic health care in ED settings, the effectiveness of doctor-parent communication in this setting is of great concern [30].”</p>	Psychological capability
	Poor uptake of intervention by health care provider [41-43]	Barrier	“...a minority of plans that were generated by the kiosk were acted on by providers. A mismatch between an activated patient and a less-than-proactive provider may have widened a gap in partnership that the kiosk was meant to narrow [41].”	Social opportunity
	Providing relevant discharge information early or throughout the ED visit [35, 44-46]	Enabler	“Anecdotal feedback from nursing staff was that many parents read the material while waiting for medical assessment and once admitted to a cubicle area, the majority of parents asked questions or sought clarification of information contained in the handout [35].”	Psychological capabilities
	Training of healthcare providers [35, 47]	Enabler	“increasing staff training and skills to cope with suicidal youth, the ER experience assisted in setting accurate, positive expectations for the family’s outpatient therapeutic experience [47].”	Psychological capability
Intervention level	Intervention complexity [34, 41, 48, 49]	Barrier	“Our intervention did not provide resources for time or additional personnel to support the improvement effort [41].”	Physical opportunity
	Tailoring interventions to patient needs [33, 42, 43, 50-52]	Enabler	“provided caregivers with detailed instructions to help them care for their child with asthma and improve the child’s symptoms [50].”	Social opportunity and psychological capability
	Reinforcement of discharge communication [32, 39, 42, 44]	Enabler	“... providing educational materials in different formats (i.e., verbal, written, and visual) offers an increased likelihood for comprehension levels collectively [32].”	Physical opportunity
	Simple, low cost interventions [40, 53, 54]	Enabler	“The low resource requirements for this intervention...support its potential utility in clinical practice [53].”	Physical opportunity

	Discharge information available in a variety of formats [30, 31, 39, 41, 45, 50, 51, 53-57]	Enabler	“Video discharge instructions have the potential to substantially mitigate factors such as illiteracy, limited physician time, and variability in communication skills among health care professionals, which may affect comprehension, without adding a lot of extra time to the patient’s total ED visit. [31].”	Psychological capability
Health care system level	Appropriate use of primary care [36, 40, 51, 58]	Barrier	“...infrequent use of primary care may greatly affect morbidity among economically disadvantaged children. [51].”	Physical opportunity and social opportunity
	ED context [32, 33, 35, 39, 41, 49, 50]	Barrier	“In addition, the bustling ED setting adds additional stress to the parents because of the long wait and the loud and chaotic nature of the environment [39].”	Physical opportunity
	Knowledge exchange between ED care and primary care provider (PCP) [49, 50, 58, 59]	Enabler	“In an effort to enhance communication between the patient and his or her PCP, ED visit information was faxed to the PCP. Such communication is important in linking care between health care providers, because asthma is a chronic disease that requires continuous care, monitoring, and reinforcement of education [50].”	Reflective motivation and physical opportunity

COM-B= Capability, opportunity, motivation- behaviour model; ED= emergency department; PCP= primary care provider; PED= pediatrics emergency department

Table 2. Summary of included studies and identified BCTs.

Author and Year	Illness Presentation(s)	Study Objective(s)	BCTs Identified Targeted at Patients/Caregivers	BCTs Identified Targeted at Health Care Providers
Asarnow et al., 2011[49]	Mental health	To evaluate a suicide prevention intervention to improve use of outpatient care and decrease suicide attempts	1.4- action planning 3.1- social support (unspecified) 3.3- social support (emotional) 7.1- prompts/cues 12.1- restructuring the physical environment 12.5- adding objects to the environment 13.2- framing/reframing	4.1- instruction on how to perform the behaviour 8.1- behaviour practice/ rehearsal
Baker et al., 2009 [37]	Fever	To determine if an educational video of home management of fevers could reduce return ED visits	4.1- instruction on how to perform the behaviour	
Bloch & Bloch, 2013 [31]	Asthma, fever, vomiting, or diarrhea	To determine if a video providing discharge information would improve home management of a child's illness	4.1- instruction on how to perform the behaviour	
Boychuk et al., 2006 [50]	Asthma	To develop and implement an asthma education program based on National Asthma Education and Prevention Program (NAEPP) guidelines	1.4- action planning 3.2- social support (practical) 4.1- instruction on how to perform the behaviour 5.1-information about health consequences 6.1- demonstration of the behaviour 7.1-prompts/cues	4.1- instruction on how to perform the behaviour 5.1-information about health consequences

			9.1-credible source	
Brooks et al., 2017 [34]	Concussion	To determine the usability of symptom-guided discharge instruction intervention	4.1- instruction on how to perform the behaviour	
Chande et al., 1996 [38]	Minor illnesses	To determine if educating caregivers could reduce unnecessary return ED visits	4.1- instruction on how to perform the behaviour	
Considine & Brennan, 2007 [35]	Fever	To examine the effect of a staff educational intervention on discharge advice provided to caregivers leaving the ED		5.1-information about health consequences
Cushman et al., 1991 [48]	Head injury	To encourage the purchase of helmets following a visit to the ED with a child with a bike injury	3.1- social support (unspecified) 3.2- social support (practical) 5.1- information about health consequences 9.1- credible source	7.1- prompts/ cues
Delp and Jones, 1996 [30]	Lacerations	To improve caregiver comprehension with the use of illustrated discharge information	4.1-instruction on how to perform the behaviour 5.1-information about health consequences	
Ducharme et al., 2011 [42]	Asthma	To determine if providing written discharge information and a prescription improved compliance with asthma discharge information	2.1- monitoring of behaviours by others without feedback 4.1- instruction on how to perform the behaviour 12.5- adding objects to environment	7.1- prompts/ cues
Gorelick et al., 2006 [62]	Asthma	To compare asthma interventions in the ED on return visits	1.4- action planning 3.2- social support (practical) 4.1- instruction on how to perform the behaviour	
Hart et al, 2015 [56]	Fever	To improve caregivers' knowledge of fever with an interactive online education resource	5.1-information about health consequences	

Hussain-Rizvi et al., 2009 [45]	Asthma	To improve caregiver compliance with asthma home management by providing metered dose inhaler with spacers  (MDIS) with physician supervision	8.1- behaviour practice/rehearsal  9.1- credible source	
Isaacman et al., 1992 [44]	Otitis media	To determine if offering verbal or verbal and written discharge information would improve information recall		4.1- instruction on how to perform the behaviour  7.1- prompts/ cues
Ismail et al., 2016 [32]	Fever and closed head injury	To improve caregiver recall and comprehension by providing video discharge information	4.1- instruction on how to perform the behaviour	
Jones et al., 1989 [40]	Otitis media	To use nursing interventions to increase compliance with follow up care	3.2- social support (practical)	
Komoroski et al., 1996 [59]	Acute infections or non-urgent ED presentation	To determine the effectiveness of interventions aimed at improving rates of follow up care	3.1- social support (unspecified)  3.2- social support (practical)  7.1- prompts/cues  12.5- adding objects to the environment	
Kruesi et al., 1999 [63]	Mental health	To examine if injury prevention education could reduce access to lethal means	1.2- problem solving  3.2-social support (practical)  5.1- information about health consequences  12.1- restructuring the physical environment	
Le May et al., 2010 [64]	Various injuries	To test an education intervention about pediatric pain 24 hours following ED discharge	5.1- information about health consequences	
O'Neill-Murphy et al., 2001 [39]	Fever	To test a fever education intervention to reduce caregiver anxiety and improve home management of fevers	5.1- information about health consequences  6.1- demonstration of the behaviour	
Patel et al., 2009 [33]	Gastroenteritis	To improve caregiver recall of verbal discharge information with the use of a bilingual discharge facilitator	3.1- social support (unspecified)  3.2- social support (practical)	

			4.1- instruction on how to perform the behaviour  5.1- information about health consequences	
Petersen et al., 1999 [51]	Asthma	To determine if creating an asthma education tool improved rates of follow up care		4.1- instruction on how to perform the behaviour
Porter et al., 2006 [41]	Asthma	To determine the effectiveness of an asthma information kiosk on caregiver satisfaction, and clinician use of the kiosk information		7.1- prompts/ cues
Rotheram-Borus et al., 2000 [47]	Mental health	To decrease suicidal behaviours with outpatient therapy compliance	1.2- problem solving  1.4- action planning  3.2- social support (practical)  3.3- social support (emotional)  4.1- instruction on how to perform the behaviour  5.1- information about health consequences  6.1- demonstration of the behaviour  8.1- behaviour practice/rehearsal  13.3- valued self-identity	
Scarfi et al., 2009 [54]	Asthma	To determine if allergen skin testing for asthma during an ED visit would improve follow up rates at an asthma clinic	2.6- biofeedback  10.8- incentive (outcome)	
Smith et al., 2006 [36]	Asthma	To determine if providing asthma coaching and incentives would improve rates of follow up care with a primary care provider	1.2- problem solving  3.1- social support (unspecified)	

			10.2- material reward (behaviour)	
Sockrider et al., 2006 [43]	Asthma	To test a tailored asthma management intervention to improve caregiver confidence and reduce return ED visits	1 . goal setting 3.2- social support(practical) 4.1- instruction on how to perform the behaviour 7.1- prompts/cues 9.1- credible source	
Stevens et al., 2012 [65]	Pediatric pain	To determine the effect of a pain management video on caregivers' knowledge and pain medication use following ED discharge	4.1- instruction on how to perform the behaviour 5.1- information about health consequences	
To et al., 2010 [46]	Asthma	To determine if an asthma information card would improve asthma management in the ED	7.1- prompts/cues	
Wood et al., 2017 [57]	Various Illnesses	To determine the impact of video discharge instructions compared to written/verbal instructions on caregiver knowledge	5.1-information about health consequences	
Yin et al., 2008 [53]	Various illnesses	To determine if the use of illustrated health literacy interventions helped decrease liquid medication dosing errors	4.1- instruction on how to perform the behaviour 6.1- demonstration of the behaviour 8.1- behaviour practice/rehearsal 12.5- adding objects to environment	
Zorc et al., 2003 [58]	Asthma	To determine the effectiveness of scheduling follow-up appointments to help manage asthma cases	3.2- social support (practical)	
Zorc et al., 2009[52]	Asthma	To develop and test a three part asthma intervention to improve rates of follow up care	7.1- prompts/cues 9.1- credible source	

BCT = behavior change technique, ED= emergency department, MDIS= metered dose inhaler with spacer, NAEPP= National Asthma Education and Prevention Program

## Figures

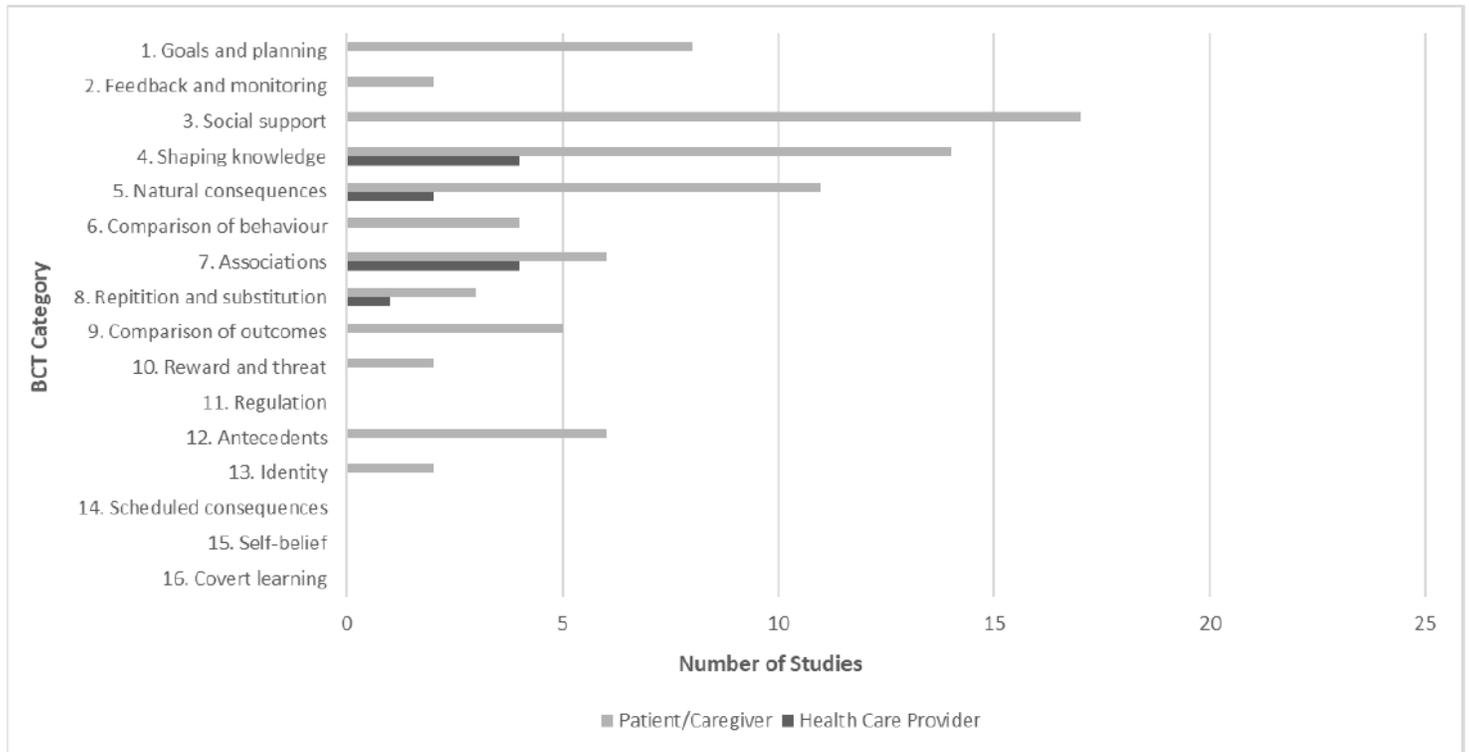


Figure 2

BCT category coding frequency by intervention target

## Supplementary Files

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