

Designing a research intervention for Health EDRM

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3.3.1 Learning objectives

To understand important factors to consider when designing an intervention for health emergency and disaster risk management (Health EDRM), including:

1. Key social and behavioural science theories, models and framework that could be used for designing interventions for the management of health risk arising from an emergency or disaster and related evaluative research.
2. Theory-derived intervention methods.
3. Methods to use for planning and developing an intervention to achieve behavioural change.

3.3.2 Introduction

A health intervention is an act or set of actions performed for, with, or on behalf of a person or population with the objective of assessing, improving, maintaining, promoting or modifying health functioning or health conditions. A wide array of approaches exists for designing and researching interventions for the health risks associated with disasters and emergencies, and this chapter discusses some of these in the context of Health EDRM.

Although the focus has long been on relief responses during and after the onset of the disasters, Health EDRM now emphasizes interventions to be applied throughout the disaster management cycle, starting with prevention and mitigation of health risks through to empowerment of communities and national capacities to provide timely and effective response and recovery. Prevention occurs at three levels: primary, secondary and tertiary. Primary prevention involves either preventing the hazard from occurring or preventing exposures to the hazard leading to injuries or diseases. Secondary prevention involves interventions such as early diagnosis and management of injuries or diseases after the exposure has occurred. Tertiary prevention attempts to avoid further complications leading to more severe injuries, disabilities or death. Interventions aiming at changes in the determinants of health behaviours and environmental

conditions during the pre-impact phase help build resilience of individuals and communities to risks, as well as their capacities to respond to and recover from the effects of emergency and disasters.

This chapter is intended to provide a framework for intervention development that can guide healthcare practitioners and policymakers involved in designing and researching effective interventions. It begins with the planning phase, which includes needs assessment, and outlines the dominant theories or models for explaining and changing behaviours and environmental settings that can be used to inform the intervention methods.

3.3.3 Needs and resources assessment

Needs and resources assessment is a prerequisite for understanding the targeted populations, the risks they face and the available resources (such as people, time, budget and political will) that will help inform the design of any intervention. Assessment involves the researchers' collection of epidemiological, social, environmental and health service information that could describe the existing situation (see also Chapter 3.1). During this stage, researchers responsible for designing an intervention also need to determine the prevalence and incidence of the problem as a whole and among sub-populations, as well as identify audiences of the health intervention in order to achieve maximum outcomes (Chapters 2.1 to 2.4).

The PRECEDE-PROCEED model (1) provides a useful example for this. The PRECEDE part of the model provides a framework for understanding the causation of health problems at multiple levels and the consideration of multiple determinants of health-related behaviour and social and physical environment. Phases 1 to 4 of PRECEDE explain the various perspectives to be assessed:

Phase 1: Social assessment: determine the problems and needs of a targeted population and identify desired results.

Phase 2: Epidemiological, behavioural and environmental assessment: identify the health determinants of the identified problems and set priorities and goals.

Phase 3: Ecological assessment: analyse behavioural and environmental determinants that predispose, reinforce and enable the behaviours and lifestyles.

Phase 4: Administrative and policy assessment: identify administrative and policy factors that influence implementation and choose appropriate interventions that lead to desired and expected changes.

The targeted populations and stakeholders should be involved in all aspects of the PRECEDE model. They may suggest issues that need to be analysed in detail. Despite the importance of primary data, secondary data from reports or studies conducted by other agencies should also be examined.

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3.3.4 Understanding theory and approach

Improving the implementation of Health EDRM practices depends on achieving changes in behaviours and environmental settings. The prevention and control of communicable and noncommunicable diseases, as well as climate change-induced risks, require behavioural change. Deaths, injuries, diseases, disabilities, psychosocial problems and other health impacts brought about by emergencies and disasters could be reduced or avoided through effective interventions that initiate, promote and sustain behavioural changes at individual, interpersonal and community levels.

Behaviour change interventions are implemented to change behaviours that are associated or causally linked to mortality and morbidity. They are designed based on behaviour change theories or models, which are a combination of approaches, methods and strategies drawn from social and health sciences, such as psychology. Behaviour change theories guide an understanding of people's behaviours as individuals or groups (interpersonal, organizational, community and societal) and play a critical role during the various stages of an intervention, such as when identifying what information is required to develop an intervention strategy that will be effective (2). Systematic reviews have indicated that using behavioural theory or models in the selection, planning, implementation and evaluation of interventions can lead to more positive effects than interventions designed without the support of any theory or model (3).

Although a multitude of health behaviour theories or models for the development of interventions exist, criticisms prevail about the lack of research into the choice of theories (4) and the description of interventions (5). This chapter therefore discusses some of the most widely used theories or models for understanding behavioural changes, including the kinds of changes needed to enhance emergency and disaster risk management (6).

Human behaviours happen in a complex ecological system. A health problem could therefore be understood in an ecological way (Figure 3.3.1), which includes behavioural and environmental determinants, for making an informed choice as to the levels of intervention (7). Changing health behaviours involves altering an individual's attitude and motivation, which may be influenced by a range of people (such as family members, teachers and colleagues) and conveyed in a variety of settings (such as home, school and workplace). The settings enable the interaction of the environmental, organizational and personal factors to affect health and well-being (8).

Figure 3.3.1 Logic Model for Methods, Determinants, Behaviours, Environmental Conditions and Health (7)



3.3.5 The health belief model

The health belief model (9–12) is among the most popular conceptual frameworks in health behaviour research and provides a guide to frame interventions to change health behaviour (Table 3.3.1). The health belief model provides a useful, simple, actionable model and is commonly used for prevention and detection (such as vaccination against influenza, injury prevention and hazard preparedness) (6, 13–15). However, its efficacy, effectiveness and impact remain limited.

Therefore, many researchers have extended the original health belief model or identified other variables to be incorporated into it, which could enhance its predictive capacity – to such an extent that the model no longer only comprises the key constructs (16). Moreover, for most effective use, the health belief model should be integrated with other models that account for the environmental context and suggest strategies for change (17–18).

Table 3.3.1 Key constructs and definitions of the health belief model (9–12)

Construct	Definition	Application
Perceived susceptibility	Belief about the probability of experiencing a risk or suffering from a disease	Identify populations at risk and assess their risk levels; Define the risk based on an individual's characteristics, behaviour or experience.
Perceived severity	Belief about how serious the situation is and its consequences	Specify the consequences, which could be multi-dimensional (such as physical illness, mental health deterioration and relationship issues).
Perceived benefits	Belief in the potential benefits of the action	Define the action to be taken (such as what, where, when and how). Describe the positive effects.
Perceived barriers	Belief about the potential barriers carrying out the action	Identify and tackle the barriers such as costs, loss of opportunities through reassurance, incentive, etc.
Cues to action	Strategies to activate behaviour change	Provide information and reminders.
Self-efficacy	Confidence in the ability to take action	Training and guidance to strengthen one's confidence in taking the recommended action. Goal setting and reinforcement.

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3.3.6 Theories of reasoned action

Although theories of reasoned action do not suggest methods for changing health behaviours, theories of reasoned action have their significance in understanding health risk behaviours among people who are aware of the negative outcomes associated with behaviour. These started with the Theory of Reasoned Action (19), then the Theory of Planned Behaviour (20). Later, these authors co-developed the Reasoned Action Approach (21–22). While the Theory of Planned Behaviour emphasizes that behaviour intention is determined by some conceptually independent elements, such as one's attitude towards the behaviour, subjective norm and perceived behaviour control, the Reasoned Action Approach includes subcomponents of attitude (experiential/instrumental), perceived norm (injunctive/descriptive) and perceived behavioural control (capacity/autonomy) as well as environmental constraints to predict intention and behaviour (23). The Theory of Planned Behaviour provides a useful, multi-factorial, actionable model, but empirically its prediction for actual behaviours, beyond the mere intention, has remained modest – and especially so for generic and complex behaviours. The SMART specifications required to achieve high prediction can become ludicrously precise. The Theory of Planned Behaviour remains a good model for articulating the cognitive factors (beliefs and knowledge) with the social pressure and the enabling environment (control, competencies, skills, power and so on).

These theories of reasoned action have captured the belief and the intention to change. The stronger the intention to engage in behaviour, the more likely it is that it will be performed. In previous studies, the Theory of Planned Behaviour has predicted an individual's intention to engage in certain behaviours, such as the use of helmets while cycling, the prevention of sexually transmitted diseases through human papilloma virus (HPV) vaccination and adaptation or mitigation of climate change (24–26). The Reasoned Action Approach has also been applied in multiple contexts, such as smoking cessation, HIV prevention, health promotion and changing multiple behaviours (27).

3.3.7 Stage theories: The transtheoretical or stages of change model

Stage theories suggest that people in different stages require different methods to help them cope with the stage they are in, and so finally change (28). The transtheoretical model (the stages of change model) (29) is not a direct behaviour change theory but rather a time perspective on the deployment of behaviour change development and unrolling. It reveals that behaviour change unfolds through a series of stages (30).

The transtheoretical model focuses on the decision-making of the individual and is a model of change. It assumes behaviour change does not happen quickly and decisively, but rather that the process of change occurs continuously and can relapse at any time. Unlike other theories or models where behavioural change is regarded as an individual event, the transtheoretical model postulates that such change is a process that needs to progress through a series of five stages for behavioural change (Figure 3.3.2 and Table 3.3.2). The stages include pre-contemplation,

contemplation, preparation, action and maintenance. For each stage of change, different intervention strategies will be applied to move the person to the subsequent stage of change until they reach the maintenance stage to accomplish the behavioural change.

Figure 3.3.2 The Transtheoretical Model and Stages of Change (28-30)

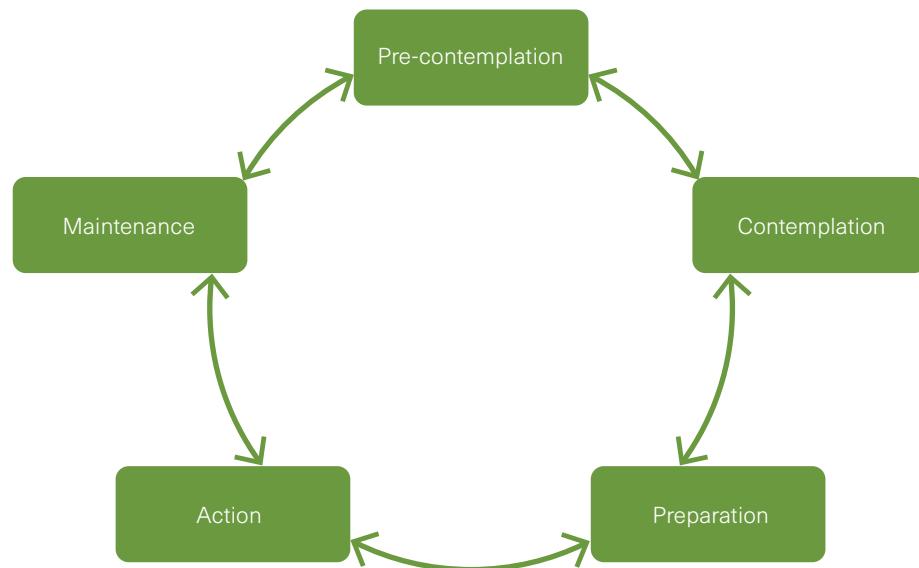


Table 3.3.2 Stages of Change in the Transtheoretical Model (28-30)

Stage	Description	Intervention Strategy
Pre-contemplation	Do not intend to take any action in the near term, usually within six months	Raise the awareness of the need for change; personalize the information about risks and benefits.
Contemplation	Be thinking about the behavioural change, but has not made a commitment to take action	Motivate the individual, encourage or support them to make action plans.
Preparation	Is prepared to take action within 30 days and has taken some preliminary steps	Help the individual to develop a specific, measurable action plan as well as goals.
Action	Have made significant modifications in lifestyle over the past six months	Provide them with feedback, support and reinforcement.
Maintenance	Behavioural change has lasted for at least six months; individual is working to maintain the change and prevent relapse	Give them reminders to avoid relapse.

The majority of transtheoretical model-related interventions focus on cessation of addictive behaviours and there is ongoing debate as to the validity of the transtheoretical model, such as its negligence of independent variables (31). Some have also commented that effective

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longer-term health promotion requires longer-lasting interventions that may need to go beyond health education and incorporate environmental change strategies (32). In view of these concerns, the precaution adoption process model (33) is also worthy of consideration for Health EDRM interventions and research, such as infection control and hazard risk management. The precaution adoption process model identifies seven stages along the path from lack of awareness to action and tailors potential designs of individual and organizational-level interventions throughout the process (34). It raises consciousness among individuals and the community, specifies consequences of the risk and uses step-by-step process to provide information of those risks.

3.3.8 Social cognitive theory

Social cognitive theory is an interpersonal theory which proposes that learning happens in a context that is dynamic and with reciprocal interaction of the person, environment and behaviour (35). The behaviours of an individual are influenced by their experiences and by observing the actions of people around them, taking into account the benefits of those actions. Reciprocally, the people themselves also exert influence on their surroundings. Social cognitive theory interventions are based on active learning that promotes performance during the entire process composed of the following six constructs:

- i) Reciprocal determinism: the core concept of social cognitive theory, the dynamic and reciprocal interaction of person, environment and behaviour.
- ii) Behaviour capability: an individual's ability to behave through necessary knowledge and skills, as well as knowing what to do and how to do it.
- iii) Observational learning: individual observes a behaviour conducted by others and then replicates those actions.
- iv) Reinforcements: the internal and external response to a person's behaviour. It will affect the likelihood of continuing or discontinuing the behaviour. Internal reinforcement refers to self-reward; external reinforcement refers to whether the environment encourages or discourages the enforcement of the behaviour.
- v) Expectations or anticipated outcomes of the behaviour: one anticipates the outcomes before adopting the behaviour and this influences the successful completion of the behaviour.
- vi) Self-efficacy: the level of one's self-knowledge or confidence that one can succeed in adopting the behaviour.

Social cognitive theory considers many determinants of the social ecological model (36–37) in explaining the behavioural change of individuals. Methods derived include modelling and reinforcement. It has been applied to behaviours that are complex and require much behaviour capacity, for instance, in the promotion of physical activity and disaster preparedness (38).

3.3.9 The setting approach

Aside from theories or models informing interventions to promote behaviour changes, the setting approach, where setting is defined as “the place or social context in which people engage in daily activities in which environmental, organizational and personal factors interact to affect health and wellbeing”, was laid out in the 1986 Ottawa Charter for Health Promotion. This holistic and multifaceted approach has been developed into intervention programmes such as Healthy Cities (one of the most widely recognized examples of the settings approach), Safe Hospital Initiatives (39) as highlighted in the Sendai Framework (40), and Health Promoting Schools. These highlight community participation and empowerment, inter-sectoral partnerships and participant equity for health promotion (41).

While research on epidemiological and environmental risk transitions reveals that environmental risks might be responsible for 25% to 40% of the global burden of disease (42) (see also Chapter 2.3), the healthy environment or settings approach (43) have become prominent for health promotion. Meanwhile, in consideration of problems with the setting approach (44–45), it has been “revitalized” with the advance to the supersetting approach. The supersetting approach is an ecological approach (46) emphasizing that health promotion interventions may be optimized through the integrated efforts of a variety of stakeholders such as private, public and voluntary sectors and civil society. The principles of integration, participation, empowerment, context-sensitive and knowledge-based development have guided the variety of stakeholders to carry out coordinated activities within the supersetting (school, hospital, home, workplace, and so on) to achieve a sustainable impact on community health promotion. Evidence has demonstrated that the supersetting approach is a useful conceptual framework for developing and implementing a complex multicomponent health promotion intervention. Still, more research on its sustainability may be required. For instance, “ownership” of the development and implementation of the activities has been identified as a motivational factor to foster sustainability of the intervention (47).

In summary, the setting approach is a useful framework for developing intervention-based initiatives or enhancing the effectiveness of interventions. It emphasizes that coordinated and integrated health promotion activities that are implemented together with multiple stakeholders and across multiple settings are powerful in bringing about change. Similarly, in the promotion of individual and interpersonal behavioural change, a single theory could not explain all aspects or determinants of a health problem. A multi-theories approach should always be adopted when designing or tailoring interventions.

3.3.10 Techniques employed in intervention designs

The following techniques can be employed to design interventions that could resolve a health problem. Again, there is no single method dominating intervention development and intervention research. The various methods could be applied in combination and with consideration to feasibility, efficacy and cost:

- **Chunking:** this enhances the performance of memorizing and learning outcomes, facilitating comprehension and fluency by using thought units (48).
- **Cues:** these are a technique to retrieve information. The use of cue reminders may increase the effectiveness of interventions that aim to prevent health-risk behaviours (49) especially when presented at the time of encoding and retrieval. For instance, by printing the oral rehydration solution formula on a teaspoon, it reinforces the behaviour of making and using the solution when having diarrhoea.
- **Elaboration:** unlike chunking, elaboration is for an audience with the ability to process the information and are motivated to do so. Techniques to effective elaboration include rehearsal such as disaster preparedness drills, where more information could be gathered and consolidated among the audience.
- **Fear:** arousal of fear has long been used as a method to raise awareness of risk behaviour and promote change (50). However, it only motivates individuals who have high outcome and self-efficacy expectations. Fear has been adopted in NCD prevention and intervention.
- **Nudging:** these interventions are broadly defined as a rearrangement of a choice context that gently suggests a specific choice, with some applications in domains such as health (51). Further research in nudging is needed to help improve understanding of applied nudging interventions (52).
- **Social marketing:** this is a behavioural change approach that adapts commercial marketing techniques to achieve specific behavioural goals for a social good. Research shows that despite its small effect by clinical standards, it can have a large impact on population health (53).

Among the different types of intervention that might be used, researchers and practitioners should examine the effectiveness and feasibility of each before finalizing their choice. Furthermore, an approach of multiple interventions targeting different layers of stakeholders (such as the general public, patients, practitioners, regulators and decision-makers) might prove more effective (54).

The effectiveness of an intervention refers to how well it reduces the burden of a disease (Chapter 2.3), as well as its efficacy and cost. This may require knowledge of the epidemiology of the disease (55). In disasters or emergency situations where infectious diseases can be life-threatening, interventions have to be effective at multiple points in the chain of transmission (that is between the vector, the host and the environment). Cost is important not just for healthcare practitioners but for researchers

too. The intervention must be provided within the budget allocated. Moreover, although primary prevention is always the most cost-effective prevention level, for policy-makers, prevention is not always sufficiently visible and palpable, with the result that rescue or curative actions might be more attractive and perceived to be more impactful. Convincingly documenting the gains from prevention intervention is critical. Lastly, the effectiveness of an intervention also depends on the cultural and social beliefs of the audience.

Feasibility describes how easy it is to implement the intervention and its related research. Complex interventions are more challenging to implement (56). The feasibility of an intervention depends not just on organizational factors, but also on gender, cultural and political factors (55). There should be an assessment of how acceptable the intervention is to the community and its stakeholders. Researchers may need to consider whether the intervention requires a high degree of community involvement and whether the expected outcome is possible.

Table 3.3.3 presents examples of intervention strategies that can be used in relation to Health EDRM; Case Studies 3.3.1, 3.3.2 and 3.3.3 provide detailed descriptions of interventions to prevent influenza and Ebola virus disease, as well as for disaster prevention and preparedness.

Table 3.3.3 Examples of Health EDRM intervention strategies for emergencies and crises

Health risk related to health emergency and disaster	Topical focus	Strategies or interventions used
Epidemic	Interventions to combat a cholera outbreak.	WASH intervention techniques (57) Modelling: Reinforcing cholera intervention through prediction-aided prevention (58)
Pandemic	Interventions to be used during 2009 A/H1N1 influenza pandemic.	Use of antiviral drugs together with social distancing (such as extended school closure) may substantially slow the rate of influenza epidemic development in the initial stage (59). Risk communication strategies used during the pandemic included “speaking with one voice”, involving academic experts and government officials in the effort, and targeting core groups of at-risk populations. Activities included awareness campaigns, advocacy, call centres, online response capacity and multi-ministerial, nongovernmental and private sector partnerships (60).
Dead body management	Interventions for safe and dignified burials after disasters or during outbreaks of infectious disease.	Policy or guidelines enforcing the better management of dead bodies have been released, including “Management of dead bodies after disasters: A field manual for first responders” which provides practical and easy-to-follow guidelines on the recovery, documentation and storage of the remains of individuals who have died in disasters (61). Another WHO guideline outlines the steps for the safe and dignified management of patients who have died from suspected or confirmed Ebola virus disease (62). These guidelines have helped promote community engagement, awareness raising on the contagious Ebola virus disease as well as respect towards the cultural practices and beliefs (Case Study 3.3.2).
Basic sanitation	Health education and communication strategies to reduce faecal-oral transmission of disease and exposure to disease-bearing vectors.	Awareness raising and adoption of practices in personal or household hygiene such as handwashing, improved water and sanitation through health education and demonstration of health practices such as handwashing have been achieved (Case Study 3.3.3).

Case Study 3.3.1**Non-pharmaceutical interventions for the prevention of pandemic influenza**

An influenza pandemic is an ever-loomng threat. Non-pharmaceutical interventions, also known as community mitigation strategies, are a critical tool as the first line of defence for limiting the transmission and spread of influenza. Non-pharmaceutical interventions demonstrate the ecological approach to health promotion. They include personal and interpersonal levels of prevention such as better handwashing (63), the use of facemasks and covering the mouth when coughing. Most interventions have been done at the community level, such as introducing checklists stating specific actions to help public health professionals and administrators of schools, workplaces and mass gatherings for the implementation of non-pharmaceutical interventions (64-65). These checklists address the concerns or issues from the "planning", "take action" to "follow-up" phases for administrators of various settings to tackle. It should be noted that workplace emergency planning efforts occur with a recognition of, and in concert with, other levels mentioned in the ecological model, especially at the level of families and schools (such as working parents struggling to send their sick children to schools (66)).

Since the 2009 influenza pandemic, several countries have geared non-pharmaceutical interventions into their national influenza pandemic preparedness plans and there have been an increasing number of studies assessing the effectiveness of non-pharmaceutical interventions (67). Furthermore, the importance of educating policymakers about the benefits of promoting an effective national influenza prevention and control strategies has been further reiterated. The WHO Global Influenza Strategy 2019-2030 (68) also highlights the expansion of seasonal influenza prevention and control policies and programmes using non-pharmaceutical interventions.

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Case Study 3.3.2

Importance of health interventions for coping with the highly contagious Ebola virus disease in the Republic of Côte d'Ivoire

The 2014-2016 Ebola virus disease outbreak in West Africa was one of the largest Ebola outbreaks in history. It was first reported in March 2014 and officially declared over by WHO on 10 June 2016. The impact this epidemic had in West Africa, particularly in the Republic of Guinea, the Republic of Sierra Leone, and the Republic of Liberia is significant. Despite its proximity to these three countries, no cases had been reported in Côte d'Ivoire (69).

A series of interventions were carried out in Côte d'Ivoire to prevent the spread of Ebola virus disease. First, a team of community health workers, community leaders and religious leaders was formed, which played a crucial role in delivering information about risks associated with Ebola virus disease. The Ebola-related health risks were also disseminated through major mass communication channels, such as television. Citizens who recalled thinking Ebola was a rumour during the initial disease outbreak later perceived the susceptibility to and the severity of the disease through news updates on the television.

Ebola virus disease is highly contagious. The priority in infection control is to avoid physical contact with the sick or deceased person, including their body fluids and the objects they have used. This highlights the challenge of dead body management. WHO, in partnership with the International Federation of Red Cross and Red Crescent Societies and faith-based organizations, developed a protocol outlining the step-by-step processes for safe and dignified burials (62). The protocol highlights the consideration of cultural practices and inclusion of family in the planning, preparation and implementation of the burial, especially for Christians and Muslims, who have different burial rituals and constituted the majority of the populations being affected.

The Government of Côte d'Ivoire also implemented other prevention measures. It banned bush meat and promoted regular handwashing. It was suggested that people should raise their arms as a way of greeting instead of hugging and shaking hands. These interventions have been effective in controlling the transmission of the disease (70).

Case Study 3.3.3**Health education intervention in a rural Chinese, earthquake-prone transitional village**

CCOUC conducted disaster preparedness interventions, including face-to-face health education in 2009 and 2011, and an intervention evaluation research in 2018, in the earthquake- and flood-prone Dai and Yi ethnic minority-based community in Sichuan Province, China (71). These interventions examined how the villagers' experiences and beliefs interact with the external social context (environment) to make certain behavioural changes. The research showed that awareness raising and adoption of practices in personal or household hygiene, such as handwashing, food and nutrition, and water and sanitation were retained. This suggests that the interventions not only improved the immediate knowledge of the participants, but also achieved temporal stability, as observed in 2018, seven years after the original intervention. However, the intervention to promote preparation of a disaster preparedness kit was found to be unsustainable because villagers' intention to prepare a disaster preparedness kit decreased over time.

Conceptualizing disaster preparedness as a social cognitive process may contribute to understanding of the improvement in the uptake of related health behaviours. The social context such as the improvement in socioeconomic conditions, the increased access to media and internet technologies as well as the knowledge transfer from the migrant populations may have contributed to the positive intervention outcomes. It should be noted that disaster response is regarded in China as a Government-initiated and organized activity rather than a personal or family-related responsibility (72). This may explain the low intention of action. Meanwhile, the active promotion of disaster preparedness kit preparation through a bottom-up approach should be reinforced, with repeated educational efforts to enhance the improvement of self-efficacy in case of emergency.

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3.3.11 Conclusions

This Chapter has discussed theories, models and settings to help researchers understand and review health problems, and so design effective interventions and related evaluations. One of the biggest challenges for researchers is to conduct translational research in which the knowledge gained from research is applied in the implementation of interventions that address critical needs and risks. The classical approach to translation of basic research findings into interventions typically takes some time (73) and further investigations are needed to shorten this time lag (74-75). This would improve identification, evaluation and implementation of effective interventions in Health EDRM, and improve the outcomes of the research in the long-run.

3.3.12 Key messages

- o **Developing effective interventions in Health EDRM requires review of the most relevant and applicable theories or models, as well as understanding of relevant approaches.**
- o **The theories on which the intervention design is to be based should be chosen on the basis of the health risk or problem as well as an understanding of the targeted populations and their health risk factors.**
- o **Changeable factors and the mechanism for change should be identified.**
- o **Translational research is needed to show sufficient evidence of effectiveness to justify implementing the intervention.**

3.3.13 Further reading

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