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Title:

Health promotion interventions to prevent early childhood human influenza at the household level: a realist review to identify implications for programmes in Hong Kong.

Abstract

Aim. To identify factors affecting the delivery of health promotion interventions to prevent early childhood human influenza at the household level.

Background. Yearly influenza epidemics seriously affect all age groups, particularly those with weakened immune systems, including children. Influenza is transmitted easily from person to person through droplet and direct contact. Maintaining personal hygiene, avoiding close contact with the infected person and proper hand washing are recommended as the most effective means of preventing the transmission of influenza. However, it is not clear what programme-related mechanisms and contexts are crucial to the successful delivery of interventions in the home. This paper systematically reviewed published research studies to identify factors influencing the effective delivery of health promotion programmes targeting influenza in a household.

Design. Realist review

Methods. A realist review methodology was selected to examine what interventions are effective in preventing and managing influenza at the household level and in what circumstances. A structured search of the peer-reviewed primary research literature was undertaken using a defined search protocol.

Results. Eight studies were retrieved for analysis. Mechanisms impacting on intervention delivery were identified, including: timing of implementation, programme reach, organizational and healthcare worker involvement, mode and place of delivery, contact with infected person, health practice compliance, and sustainability at home.

Conclusion. These findings suggest contextual factors that could be identified through ecological approaches to health promotion that are crucial for policy makers to consider when designing interventions.

Relevance to clinical practice. The active involvement of community nurses through an integrated household visiting programme may help to better deliver family-based health promotion interventions to prevent illnesses such as influenza in children.

Key words: child, influenza, health promotion, review

- Contextual factors related to successful programme delivery should be considered.
- Interventions to prevent influenza infection at family level should be implemented using a health promotion approach, rather than a disease prevention approach.
- Family health promotion initiatives for child health at the household level should be promoted in the community.

Introduction

An individual's health is affected by multiple inter-related physical and psychological factors, as well as their relationship to environmental attributions (Lohrmann 2010, Lee 2011, Chan 2011). Yearly influenza epidemics can seriously affect all age groups, including those with developing and weakened immune systems such as: young children, elderly people and those with chronic illness (WHO 2009a). Human influenza is caused by the influenza viruses A, B or C. Influenza A viruses can further be sub-typed and Influenza A (H1N1) is one of the examples. In Hong Kong, these viruses are common from January to March and from July to August (Centre of Health Protection 2012). As a result of these seasonal fluctuations, Hong Kong residents are at risk of contracting influenza twice a year for three-month periods (Centre of Health Protection, 2012). The virus is transmitted easily from person to person through droplet and direct contact (Centre of Health Protection 2012, WHO 2009a), particularly in overcrowded environments.

Hong Kong is a small geographical area densely populated with seven million people (Hong Kong Census and Statistics 2012). Living space in Hong Kong is limited, with restricted internal floor area per person, especially for those living in public estates (Jayantha & Lau 2008). It is usual for a family of four to share around 50 square metres, which translates to 12.5 square metres per person. This living area is considerably smaller than the median living space in the United States, where it has been calculated at around 67.5 square metres per person (Department of Housing and Urban Development 2007). Under such circumstances, the risk of being infected by the influenza virus is comparably higher. High rates of infection in confined spaces are supported by studies of Baker *at el.* (2000) and Fullilove and Fullilove (2000) who found that communities with overcrowding and higher levels of population density experience greater rates of respiratory disease, chronic illness and other health issues. A realist review methodology has been selected to identify contextual factors that facilitate the successful delivery of interventions at the household level This will provide important insights to enable policy makers in Hong Kong and other high-risk countries to not only prevent routine influenza transmission and other common infectious diseases, but to reduce the likelihood and severity of possible epidemics.

Background

In the last century, three pandemics of human influenza have affected the world population in 1918, 1957 and 1968 respectively. The most deadly pandemic was the "Spanish Flu", which is

thought to have killed at least 40 million people during the 1918-1919 period (WHO 2003). Two other influenza A pandemics have occurred: the Asian influenza pandemic in 1957 and the Hong Kong influenza pandemic in 1968. Both not only had devastating consequences for the economy but also resulted in significant global morbidity and mortality (WHO 2003).

More recently, an Influenza A (H1N1) virus emerged to cause illness in humans, resulting in a pandemic in mid 2009 (WHO 2010). After early outbreaks in North America in April 2009, the new influenza virus spread rapidly around the world. A total of 74 countries and territories were affected. Unlike typical seasonal flu patterns, this new influenza virus led to patterns of death and illness not normally identified as resulting from influenza infections. Most of the deaths caused by this influenza pandemic occurred among younger people, including those who were otherwise healthy. Pregnant women, younger children and people of any age with chronic medical conditions appeared to be at higher risk of illness-related complications (WHO 2010).

In recent years, antiviral drugs used to treat influenza have been an effective treatment. Vaccination is suggested as one of the most effective ways to prevent the disease or severe outcomes from the illness (WHO 2009a). However, drug therapeutic intervention may cause complications such as fever or drug allergy. In addition, new sub-type variants of influenza appear from time to time and at irregular intervals (Centre of Health Protection 2012). People are not always immune to new variants of the virus. Even people who are vaccinated may still become infected because of the constant changing of influenza viruses (WHO 2003). These variants may then cause epidemics (WHO 2009a).

Crucially, many diseases can be prevented or their impact on health minimized through health promotion and preventative measures (Centre of Health Protection 2012, National Scientific Council on the Developing Child 2010, WHO 2003). Maintaining high levels of personal hygiene, avoiding close contact with infected persons and proper hand washing are recommended as the most effective means of preventing transmission and arresting the spread of influenza (Centre of Health Protection 2012, WHO 2009a and 2009b). The family is one of the immediate primary sources and providers of children's health education and information (Hopper *et al.* 1992). Nurses are well placed to support parents, as the nurse's role is not only to take care of the sick but also to promote overall health and prevent the onset of illness within the community (Royal College of Nursing 2007). However, it is not clear what programme-related mechanisms are important at the household level to ensure the efficient and effective

implementation of health promotion interventions promoting health behaviours that prevent influenza transmission. This paper systematically reviews published primary research concerning health interventions to decrease influenza at the household level. To our knowledge, we are the first to apply a realist inquiry approach to the study of factors affecting the delivery of interventions targeting influenza within households. The present review aimed to identify interventions that have been found to prevent and manage influenza among young children in the home and to examine programmatic elements and contextual factors related to their successful delivery. We aimed to develop insights for community nursing and recommendations to guide the development of health promotion interventions.

Methods

Community interventions are complex and involve multiple components that interact in a non-linear way. Recently, there has been an increasing emphasis on measuring the effectiveness of programmes. However, due to variability in programme implementation and policy contexts, the reasons that determine a programme's success and adoption in the community setting are not always clear (Saunders *et al.* 2005). A programme's success could be ascribed to any programme-related reasons comprising programme design, implementation, and/or ability to reach the target population (Saunders *et al.* 2005), the mode of intervention delivery and the way in which healthcare workers are involved. In addition to programme contextual factors, organizational support, socio-economic, cultural and the political environment including stakeholder involvement, their interests and convictions regarding change are also vital to the success of a programme.

Realist inquiry is useful for examining the relationship between the context into which interventions are delivered and their outcomes. Such inquiry aims to determine: "what is it about this programme that works for who in what circumstances" (Pawson 2002, Wong *et al.* 2013) Realist reviews can help to identify how interventions produce certain outcomes by exploring what processes are used, what outcomes are triggered by the various components of the intervention, how change is brought about, and which contextual factors are critical for success or failure (Pawson 2002, Wong *et al.* 2013). The method emphasises an understanding of causation and how causal mechanisms are formed and constrained by social context. Realist

reviews are particularly suitable for understanding complex social programmes involving human decisions and actions (Wong *et al.* 2013). A realist approach was therefore chosen for this review as it provides a rationale and tools for synthesizing complex and, at times, difficult to interpret evidence from community-based programmes (Wong *et al.* 2013).

[Insert Figure 1]

Figure 1 provides a flow chart of the process of identifying, including and excluding papers for the review. Research articles published in English from 2003 to 2013 were included. Six electronic databases and Google scholar, 502 were searched to identify quantitative and qualitative studies. Duplicate articles were identified and excluded. Searches were undertaken using the key words: health promotion, health education, children, influenza, and infectious disease. Inclusion criteria for retrieved articles were developed, based upon a checklist derived from this review's aims, a study population involving parents or families with children at the household level, the study's issue of interest, details of the research design and the outcome of the interventions. The articles were assessed and selected by screening records and examining the full-text versions according to predefined inclusion criteria. Fifty articles were selected for further examination, with the final total of 8 retrieved quantitative research studies used for analysis. Studies with diverse methodologies were included to extract rich data from a variety of countries and settings in order to provide a comprehensive picture of intervention implementation.

The papers were read, re-read, and discussed. A matrix was constructed using an Excel spreadsheet to collate information for each research study:

- Study country and setting
- Any theories or mechanisms assumed by the research authors to explain the success or failure of the programme
- Nature of the experimental and control interventions, including intensity and timing
- Study design, sample size and outcome data
- Process detail such as delivery mode, use of a training package, healthcare worker training and involvement, equipment and products provided

We systematically assessed the outcome, context and mechanisms through which the interventions produced their outcomes. Relevant data were considered trial by trial in terms of the interaction between context, mechanism and outcome, and then across the different trials to

detect patterns and heterogeneity. We discussed preliminary conclusions and synthesized key findings using a narrative and interpretive approach (Greenhalgh *et al.* 2007).

Results

A total of eight quantitative studies formed the basis of the review. See Table 1 for a summary of the articles.

[Insert Table 1]

The findings of four studies were found to be statistically significant. Two papers focused on acute respiratory infection, namely human influenza (Rosen *et al.* 2005, Holloway *et al.* 2009). These studies were conducted in Israel and Nepal respectively and examined school health education on personal hygiene or hand washing as the preventive interventions. Two studies solved three health issues together, such as gastrointestinal, respiratory and skin infections, using the one intervention (Luby *et al.* 2005, Cole *et al.* 2012). This research was carried out in Pakistan and South Africa and adopted hand hygiene with the use of a hygiene product (e.g. plain soap or antibacterial soap) as an intervention.

Four studies reported that there were no significant differences in the prevalence of influenza resulting from the delivery of household-level interventions. These studies focused on interventions to address influenza specifically (Cowling *et al.* 2009, MacIntyre *et al.* 2009, Simmerman *et al.* 2011, Suess *et al.* 2012). These four studies were conducted in Hong Kong, Australia, Thailand and Germany respectively. Hand washing with a hygiene product and use of face masks were the bases of the interventions.

The analysis identified various features across all studies included in the review that were found to impact upon the implementation of influenza prevention programmes at a household level (Figure 2). These factors are described below, with examples from the pertinent studies.

[Insert Figure 2]

Timing of programme implementation

Before disease onset

Among the eight studies included in the review, four papers involved the delivery of a health promotion intervention before disease onset (Rosen *et al.* 2005, Holloway *et al.* 2009, Luby *et al.* 2005, Cole *et al.* 2012). In these studies, all families with children within the relevant communities were invited to join the programmes. Once they were recruited to the programmes,

preventive primary interventions were taught and participants applied these interventions in their homes. Primary intervention was defined as an intervention applied before the disease developed or pre-pathogenesis (Gordis 2009). Even though the interventions used (hand washing with a provided hygiene product and health education on personal hygiene or on hand washing) were delivered differently in these four studies, they achieved the same statistically significant result in preventing infectious disease transmission.

Post-influenza onset

Four studies in the review focused on the delivery of an intervention within one to two days after the onset of influenza to prevent secondary infection (Cowling *et al.* 2009, MacIntyre *et al.* 2009, Simmerman *et al.* 2011, Suess *et al.* 2012). Preventive measures used to control acute respiratory transmission included hand washing and mask wearing. The outcome measures in these studies included the secondary attack rate of the influenza virus, adherence to hand washing and mask wearing (Cowling *et al.* 2009, MacIntyre *et al.* 2009, Simmerman *et al.* 2011, Suess *et al.* 2012). However, all of the results showed that there were no significant differences between the control and intervention groups in these four studies.

Prompt implementation of personal hygiene practice within 36 hours

The study by Cowling *et al.* (2009) reported that there were no significant differences in secondary attack rate between the control using hand hygiene only and the intervention group, who used face masks and hand hygiene. The secondary attack rate is defined as the probability that infection will occur among susceptible people within a reasonable incubation period following known contact with an infectious person or an infectious source (Halloran 2005). However, the report found that there was a decrease in the secondary attack rate among intervention group participants if health promotion interventions were delivered within 36 hours of flu symptom onset in the index patients, who were described as the first people to become infected in the households. The study of Suess *et al.* (2012) also demonstrated that household transmission of influenza could be reduced significantly by using face masks and hand hygiene, when implemented within 36 hours after symptom onset of the first infected case.

Mechanisms that lead to programme success in the prevention of household influenza were triggered by an increase in participants' knowledge, skills and awareness of disease prevention, and their being empowered to implement preventive measures before or at the time of disease onset.

Programme reach

Enhancement of programme success was triggered by health service accessibility to the community. Two studies (Rosen *et al.* 2005, Holloway *et al.* 2009) attributed the success of their studies to the exposure of all people within the community to the health intervention. They employed a primary care approach to avoid infectious disease transmission at home. This broader and more comprehensive approach involved strategies such as public regulations (e.g. proper use of antibiotics and seeking medical advice when sick); instruction to drug retailers; and training for community leaders, school teachers, healthcare workers and parents with children.

Unlike these two studies, the four studies with non-significant results (Cowling *et al.* 2009, MacIntyre *et al.* 2009, Simmerman *et al.* 2011, Suess *et al.* 2012) only recruited infected participants and affected families. These studies concentrated on the provision of hygiene products such as face masks, soap or hand rubs, and the involvement of healthcare workers in delivering health education to families.

Organizational and healthcare worker involvement in programme delivery

Mechanisms for programme success were explored in two studies. The analysis found that the two programmes where significant differences were identified between intervention and control arms not only invited families with their children, but also included different important community partners (Rosen *et al.* 2005, Holloway *et al.* 2009) to participate. School teachers, healthcare workers, drug retailers and community leaders were encouraged to support implementation of the preventive measures (Rosen *et al.* 2005, Holloway *et al.* 2009). The above findings supported wider involvement of community partners as a crucial contextual factor leading to health professional consultation availability for participants. The studies that did not find any difference between the intervention and control groups involved healthcare workers, parents and their children in the intervention implementation (Cowling *et al.* 2009, MacIntyre *et al.* 2009, Simmerman *et al.* 2011, Suess *et al.* 2012).

Mode and place of programme delivery

Two studies that outlined programmes where significant findings were noted involved the dissemination of health interventions by healthcare workers, parents with their children, child-to-child and school teachers (Rosen *et al.* 2005, Holloway *et al.* 2009). They adopted multiple

modes to implement the interventions (Rosen *et al.* 2005, Holloway *et al.* 2009). Key messages regarding prevention of infection transmission in households were conveyed to programme participants through different channels such as school, posters, street theatre and peers. This delivery approach triggered more opportunities for community participation, while research papers describing the delivery of programmes that did not find significant differences between the intervention and control only delivered the health programme through family members and healthcare workers at the household level (Cowling *et al.* 2009, MacIntyre *et al.* 2009, Simmerman *et al.* 2011, Suess *et al.* 2012).

Contact with infected persons

In a Thai study, Simmerman *et al.* (2011) demonstrated that influenza transmission was not reduced by hand washing and face mask use. The authors concluded that this may have been due to the poor face mask compliance of infected patients and shared sleeping arrangements. Based on the analysis, close contact between individuals and longer time spent with infected patients were strong predictors for secondary influenza viral infection. It was recommended that a careful analysis be completed regarding the socio-cultural perspective for future health promotion studies in human influenza.

Compliance and sustainability of health practice at home

The studies by Simmerman *et al.* (2011) and MacIntyre *et al.* (2009) identified that poor face mask compliance was one of the contextual factors affecting the success of preventive health interventions. Simmerman *et al.* (2011)'s Thai study also concluded that the non-significant results may be triggered by the poor face mask compliance of infected children and their young siblings. Similar comments are also noted in MacIntyre *et al.* (2009)'s study that identified that less than 50% of participants wore masks most of the time, while other participants wore face masks rarely or never. Participants reported three reasons for not wearing face masks: discomfort, children refusing to wear the mask, and children forgetting to wear the mask. Further research is needed to examine how to sustain the wearing of face masks.

Discussion

Process evaluation provides a useful conceptual framework for understanding the crucial factors and mechanisms affecting the success of the interventions detailed in the papers identified in this

review. Process evaluation is a set of activities directed towards assessing progress in programme implementation (Nutbeam *et al.* 2010, Green & Kreuter 2005). Process evaluation includes a broad range of methods and measures, but the most common elements are: participants' exposure and participation in the programmes, relevant stakeholders' and partners' engagement, programme delivery method, and intervention context such as changes to physical environment and assessment of intervention impact (Nutbeam *et al.* 2010).

Using the concept of process evaluation, the findings of this realistic review demonstrate that studies where influenza had been prevented were found to have a wider community reach and engage not only families but health workers, teachers, drug retailers and community leaders. Multiple strategies were also employed, including education, street theatre, posters in the community and peer sharing before the onset of influenza symptoms. In addition, interventions that demonstrated success in preventing influenza involved family compliance with healthcare behaviours in the home. Contact time and physical distance from the infected person were found to be vital to the effectiveness of health prevention interventions for seasonal influenza.

These process evaluation factors have been incorporated in the design of a framework for the development of a nurse-led health promotion visiting programme that can be employed to better facilitate the delivery of health promotion programmes in Hong Kong that can be seen at Figure 3. This framework summarizes the relationship between programme factors (left ovals) in enhancing (arrows) family health promotion initiatives (middle oval) so as to improve healthy behaviours and family health (right oval) in a household.

[Insert Figure 3]

The framework for delivering nurse-led health promotion interventions is underpinned by the PRECEDE-PROCEED (PP) model of health promotion programme planning, using structure, process, and outcome measures (Green & Kreuter 2005, Gielen *et al.* 2008). The PP model is most aligned with ecological models in health promotion, where human behaviour is viewed as being determined by both individual, social and environmental factors (Hancock 1985 & 1993). The PRECEDE model is based on the premise that an education diagnosis should precede an intervention (Green & Kreuter 2005, Mirtz *et al.* 2005).

The PP model guides the development of an intervention using a systematic process involving nine phases, with the first five involving the identification of health problems and their

determinants through a series of diagnostic steps (Mirtz *et al.* 2005, Gielen *et al.* 2008). The last four steps involve programme application and various forms of evaluation. Phase I focuses on the identification and evaluation of possible social problems, followed by an epidemiological diagnosis. The primary task in this phase is to determine which health problems pose the greatest threat to a given target population. Planners use epidemiological data to identify and rank the health problems. Phase III focuses on the systematic identification of behavioural health practices and environmental factors that appear to be linked to the identified health problem. Phase IV covers educational/ecological assessment including predisposing, reinforcing and enabling perspectives. Phase V takes into consideration the administration and policy aspects. This phase focuses on the administrative and organizational concerns that must be addressed prior to programme implementation. Phase VI is the implementation of the intervention, and process evaluation takes place in Phase VII. The Phase VIII impact evaluation measures the programme's effectiveness in terms of objectives and changes in predisposing, enabling, and reinforcing factors. Phase IX is the outcome evaluation (Green & Kreuter 2005).

Among these nine phases, the educational/ecological assessment phase is the most pertinent to this discussion because it focuses on the identification of factors that are necessary to initiate and sustain behavioural change (Green & Kreuter 2005). This phase is a composite of three important areas: predisposing factors, enabling factors, and reinforcing factors. Based on these three perspectives, these findings of the review can be better understood and used to inform the planning and design of health promotion for influenza. Community health nurses need to consider predisposing factors, including family knowledge, attitudes, beliefs, personal preferences, existing skills, and self-efficacy toward the desired behaviour change (Green & Kreuter 2005).

Reinforcing factors include causes that reward or reinforce the desired behaviour changes. This can involve conducting indirect health education through social support networks and involving health professionals in consultation or healthcare worker training, e.g. train the trainer programmes to enable children to share their health practice with their peers in school (Reamy & Slakey 2001). Family participation, role modelling and reinforcement of children's behaviour practice in daily interactions has been found to impact upon maintaining children's healthy

behaviour (Schor & American Academy of Pediatrics Task Force On The Family 2003, Gussy *et al.* 2008, Beets *et al.* 2010). However, this can only be achieved by building children's and parents' awareness of healthy practices and enhancing mutual support within families, such as reminding each other to wash hands on arriving home in order to initiate changes in health practices and thereby prevent seasonal influenza (McConnell *et al.* 2013).

Enabling factors are direct or indirect environmental factors facilitating health behaviour changes (Green & Kreuter 2005). These include the context of programmes/services and resources necessary for achieving an intervention outcome. For instance, the availability of hand hygiene products (contextual factor) might influence the effectiveness of hand hygiene practices (outcome) because of encouragement in adequate health promotion practices (mechanisms). The timing of intervention implementation is important. Prompt preventive measures and health promotion interventions taken (contextual factor) lead to increased community awareness and competence (mechanism) to prevent and manage influenza in the community (outcome).

Implications for programme development

Applying a health promotion approach

These findings confirmed that health promotion interventions are important for mitigation of a pandemic influenza (Cowling *et al.* 2009). Based on analysis of the papers in this review, interventions to prevent influenza infection at a household level should be implemented using a health promotion approach, rather than a disease prevention approach. The studies show that health interventions delivered before disease onset demonstrated significant results in the prevention of infection transmission (Luby *et al.* 2005, Rosen *et al.* 2005, Holloway *et al.* 2009, Cole *et al.* 2012). The provision of adequate protection before disease onset highlights the importance of primary prevention measures (Gordis 2009). When designing and implementing health promotion activities, the message of early implementation of personal hygiene practices should be emphasized, but these require integration with other messages including those regarding healthy lifestyle, to assist immune systems and vaccination programmes.

According to the Royal College of Nursing (2007), nurses should incorporate health promotion services and health education activities into their professional roles. It was acknowledged that

community nurses play a major role in shifting the health system away from a predominant focus on illness and cure, and toward increased attention to health promotion and disease prevention (International Council of Nurses 1996). It may be necessary to review existing nursing practice and strategies in order to redirect nursing practice from being disease-orientated towards a health promotion ideology (Mcilfattrick 2004).

Family health promotion initiatives in child health

Apart from educational institutes, the family is one of the immediate primary sources and providers of children's health education and information (Hopper *et al.* 1992). Children will be less vulnerable to influenza if sufficient support is provided by their family or community health network (Stevenson *et al.* 2009). In order to minimise the risk, family involvement in and support for health education and health promotion are necessary to enhance the success of interventions (Baranowski *et al.* 2000, Trevino *et al.* 2005, Ferguson *et al.* 2006). Health practice initiation and sustainability requires a family to provide an appropriate environment for children to learn and practice health-related behaviours, with parents providing regular reminders. This daily contact can also be transformed into a cost-effective way of fostering and sustaining their children's health-related practices (Perry *et al.* 1987, Schor & American Academy of Pediatrics Task Force on the Family, 2003).

Under such circumstances, it is worthwhile for nursing professionals to increase their efforts in collaborating with families and communities to sustain health promotion interventions that include targeting health behaviours and preventative measures to address infectious diseases such as influenza.

Integrated and comprehensive nurse-led family-based health promotion

This review has identified the directions for future family nursing practice in the prevention of human influenza, particularly during seasonal human influenza or pandemic influenza episodes. The findings of two studies in this review provide evidence that basic, simple and cost-effective interventions such as hand washing with a hygiene product effectively prevent not only human influenza infection transmission but also other infectious diseases with similar transmission routes, like gastrointestinal and skin infections (Luby *et al.* 2005, Cole *et al.* 2012). This highlights the importance of not using multiple strategies, as in the case of education and social

marketing interventions, but also an integrated approach to health promotion to address multiple health issues that can be understood within the framework of an ecological model of health promotion (Lee *et al.* 2007). The study by Schellenberg *et al.* (2004) identified that integrated child health management contributed to reducing infant mortality and morbidity. Nurse-led health clinics are a feature of healthcare delivery in countries such as Australia, the USA, Canada and the UK (Pulcinin *et al.* 2010, Shui *et al.* 2011), and have been adopted in Hong Kong since the 1990s (Shui *et al.* 2011). Evaluations consistently show that various nurse-led interventions have resulted in improved clinical outcomes and added value to the quality of care (Shiu *et al.* 2011, Larsson *et al.* 2012). The home setting is an optimal place for health promotion and education, especially for children and their families as learning takes place within an everyday context. In a study by Li *et al.* (2009), home nursing services were identified as feasible in addressing childhood health risk factors through early intervention.

Based on the findings of this review, there is a service gap in the provision of integrated and comprehensive nurse-led family-based health promotion service to children and their families. The refocusing or enhancement of child and family health service is a potential gap that needs to be addressed by local health policy makers.

Socio-cultural factors affect the health practices of families and their children (Evans *et al.* 2011, MacIntyre *et al.* 2009). These family practices can directly influence their children's health status (Lopez-Dicastillo *et al.* 2010, Yung *et al.* 2010). An American study found that ethnicity, household income, parent education level and acculturation affected different child feeding practices and concerns. Spanish-speaking Hispanics and African-American parents were more likely than English-speaking Hispanics to use food as an incentive to calm the child (Evans *et al.* 2011) Sharing a bed with children who could be infected is a daily practice in some countries like Thailand (Simmerman *et al.* 2011). These factors signal the need for attention to the socio-cultural context during the programme design and implementation to ensure that all opportunities for health promotion and education can be harnessed (Lopez-Dicastillo *et al.* 2010).

Complex, community-based interventions inevitably operate at multiple levels, and must be interpreted in their appropriate cultural and policy context. This review has highlighted the importance of delivering socio-culturally appropriate multi-faceted interventions that engage families and community members in building healthy practices within the home. The individual exists within a family that plays a vital role in establishing health value, attitudes and habits, and

continuously influences the health of its members (Hancock 1985 & 1993). The family is not merely an incorporated component of the ecological system. Instead, it should be viewed as the entry point of initiation and the focus of primary health promotion intervention. The family is the principal unit of a socio-cultural system in which behaviour patterns are learned, adapted, or altered (Novilla *et al.* 2005). Therefore, the family and its influence on health should not be neglected (Schor & Menaghan 1995) as a primary valuable resource and setting for enhancing and protecting health at both individual and community levels.

The community health nurse has a significant role to play in family health, in Hong Kong as in other countries. The time has come to re-examine the service scope of community nurses, particularly when working with families with children. There is a need to review existing family nursing practice and strategies about how to include integrated and comprehensive home-based health promotion in routine practice (Mcilfattrick 2004).

An effective hand washing approach with a hygiene product was found to be the most effective disease prevention and control method in the household. However, there was no mention of cough etiquette, which has been emphasized as a pivotal component in the management of influenza (Centre of Health Protection 2012, WHO 2009a). This personal health hygiene practice poses a challenge to researchers as they might have underestimated its significance as a preventive intervention.

Conclusion

These findings suggest that interventions conducted using a primary care approach were important for the mitigation of acute respiratory infections at the household level. Hand washing with a hygiene product was also vital to prevent household transmission of the influenza virus when it was implemented within 36 hours of patient symptom onset. However, the sustainability of health practices creates a serious concern requiring further exploration. If health practices cannot be sustained, there will be frequent recurrences of infectious diseases such as influenza. Hence, there is a need for the establishment of family health promotion interventions at a household level to maintain health practice and improve family health.

Relevance for clinical practice

The current body of evidence suggests that nurse-led family health promotion interventions should consider using an integrated and comprehensive approach, as these have been shown to ensure quality healthcare service outcomes. Future research will provide health professionals with increased insight into how structured nurse-led health promotion interventions may be effectively implemented and thereby benefit family health services.

Strength and limitations of the review

This review includes only published peer-reviewed studies and is thus susceptible to publication bias. The studies were completed in Australia, Germany, Hong Kong, Israel, Nepal, Pakistan, South Africa and Thailand. Although these diverse contexts make it difficult to generalize, it strengthens the analysis of different health promotion intervention contexts, providing policy-makers with a more complete picture of the issue during the strategy planning and decision-making processes.

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Contributions

Study design: LW, DA, FC; data collection and analysis: LW, DA, FC; and manuscript preparation: LW, DA, FC.

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Figure1. Identification of papers for inclusion in the review.

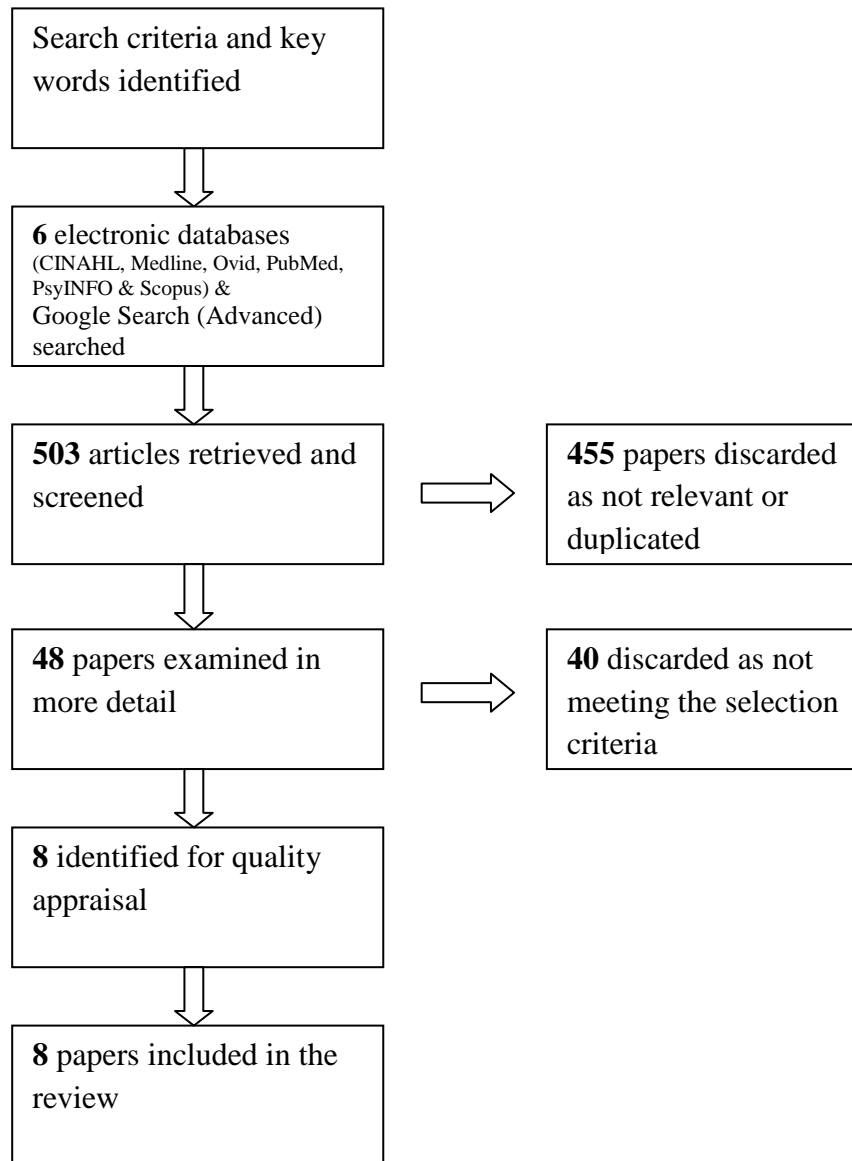


Table 1: Summary of eight studies included in the review

Reference	Aim/objectives/purpose	Context	Sample criteria and size	Method/data gathering	Findings
Luby <i>et al.</i> (2005)	To examine the effect of hand washing promotion with soap on the incidence of acute respiratory infection, impetigo, and diarrhea.	Karachi , Pakista n.	At least 2 children younger than 15 years old; at least one of whom was less than 5 years old; Children (n=4691) in 906 households from 36 settlements Control: 306 households from 11 neighbourhoods Intervention: 600 households from 25 neighbourhoods	Cluster randomized controlled trial: 1 year project Control: stationary for children’s learning Intervention: education, meeting and use of plain soap Intervention: education, meeting and use of antibacterial soap Data collected by weekly record symptoms of all household members for 1 year and weight children aged under 5 years at baseline and every 4 month.	1) Incident rate of disease differed significantly between control and intervention group. 2) Incident rate of disease did not differ significantly between use of plain and antibacterial soap
Cowling, <i>et al.</i> (2009)	To investigate the effect of hand hygiene and use of face masks on prevention of household transmission of influenza.	Hong Kong	People (n=407) from 259 families diagnosed with influenza A or B virus from 45 outpatient clinics; among 259 families, 794 families members aged from less than 5 to more than 50 year old.	Cluster randomized controlled trial: 7 days intervention and 1 st home visit scheduled within 2 days; 2nd home visit at 3rd or 6th day after 1 st home visit. Control: education on healthy lifestyle and symptom alleviation Intervention: Hand hygiene group: education on proper hand washing with liquid hand soap, hand rub provided. Intervention: Facemask group (pus hand washing): education on surgical facemask use with surgical mask provided. Data collected by self-reported diaries, interview on adherence to intervention, no. of masks and amount of soap/hand rub used and secondary attack rate confirmed by laboratory.	1) No significant difference between control and intervention group. 2) Hand hygiene plus facemasks seemed to prevent household transmission of influenza virus when implemented within 36 hours of index patient symptom onset 3) Adherence to intervention varied. Intervention group reported higher adherence than control group.
Holloway	To evaluate the	Nepal	Children (n=3654) under 5 in 2719	1 year quantitative pre and post intervention study	1) Health clinic attendance rose by 13% in

<i>et al.</i> (2009)	community education intervention on treatment of acute respiratory infection (ARI).		households from 4 hill districts randomly assigned to receive the intervention.	using questionnaire for data collection. The surveys included symptoms of acute respiratory illness, drug use, percentages of cases attending health facilities and receiving antibiotics.	child under-fives with severe ARI and fell by 9% in child under-5 with mild ARI. 2) Use of prescribed antibiotics increased 21% in child under-5 with severe ARI but only 1% in under-fives with mild ARI. 3) Irrespective of ARI severity, the use of non-prescribed antibiotics dropped by 5%. 4) consultation with community health volunteers and use of safe home remedies increased by 6.7% and 5.7% respectively
Macintyre <i>et al.</i> (2009)	To examine the effect of face mask use on control of respiratory virus transmission in households	Sydney, Australia	Children (n= 401) age 0-15 children with fever and either cough or sore throat; living in the families containing more than 2 adults and both were age above 16 years old.	Cluster randomized controlled trial: 14 days intervention with daily follow up. Control: no masks Intervention: surgical masks for 2 adults, to be worn at all times when in the same room as the infected child. Intervention: P2 masks for 2 adults, to be worn at all times when in the same room as the infected child Data collected by self reported, observation during follow up and exit interview.	1) No significant differences were noted between control and interventions. 2) Less than 50% of participants wore masks most of the time. 3) Household use of face masks was associated with low adherence and was ineffective for controlling seasonal respiratory disease.

Table 1: (continued)

Reference	Aim/objectives/purpose	Context	Sample criteria and size	Method/data gathering	Findings
Rosen <i>et al.</i> (2009)	To examine the effects of health education intervention regarding hand washing and communicable pediatric disease such as diarrhea or respiratory infection.	Jerusalem, Israel	Preschool children (n=1029) and 80 teachers from 40 preschool	Cluster randomized controlled trial: 5 months intervention. Control: no health education Intervention: education programme to the teacher Data collected by observation on change of hand washing behaviour from teachers' and their assistance and illness absenteeism.	Intervention group scored higher in every individual item of the scale.
Simmerman, <i>et al.</i> (2011)	To examine the effect of hand washing and wearing mask in household on reduction of influenza transmission from sick child to parents	Bangkok, Thailand	Children (n=442) with influenza and fever in 1147 households. Among those children, 221 (50%) were aged under 6.	Cluster randomized controlled trial: 4 week intervention and 1 st home visit within 24 hours, then subsequent home visit on 3rd, 7th and 21th day. Control: receiving education on hand washing Intervention: receiving education on hand washing as well as wearing paper face mask Data collected by self daily record of symptoms and secondary attack rate confirmed by nasal and throat swabs as well as serum test.	1) Influenza transmission was not reduced by interventions 2) Influenza secondary attack rate was 21.5%.56 out of 345 secondary cases were asymptomatic. 3) 397 (89.8%) households reported that the index patient slept in the parents' bedroom. 4) Health practice adherence was poor, especially among index case and their younger sibling.
Cole <i>et al.</i> (2012)	To examine the effect of family hygiene education programme with hygiene products provided on reduction of 3 diseases (gastrointestinal and respiratory illness and	Cape Town, South Africa	Families (n=685) from 2 regions with at least one child aged under 5 years old. Divided into 2 groups: each group consisted of people living in government housing and informal housing: 307 households:	Controlled trial: two year intervention with weekly home visit Control: education solely Intervention: education plus hand hygiene product Baseline illness data collected in both groups one year before intervention. Post intervention data collected during follow up and home visit by Sunday Family	1) Both control and intervention groups got significant reductions in 3 diseases. 2) Intervention group had greater reductions.

	skin infection) of children aged under 5		(control 177; intervention 182) 378 households: (control 130; intervention 196)	Health Chart, Burden of Illness of three disease, record on behaviour change and amount of soap/ antiseptic usage.	
Suess, <i>et al.</i> (2012)	To investigate efficacy, acceptability and tolerability of non-pharmaceuticals intervention in households with influenza index patients	Berlin, Germany	Patients (n=218) aged under 14 years old from 84 households, having flu symptom within 2 days and confirmed flu by laboratory.	Cluster randomized controlled trial: 8 days intervention Control: education Intervention: Mask group– surgical mask provided with information given. Intervention: Mask/Hand washing group–surgical mask and alcohol based hand-rub provided with information on the correct use of it given. Data collected by self-report daily record, questionnaire on adherence of masks use and secondary attack rate confirmed by nasal swab.	1) Intervention implemented within 36hours after symptom onset of index case, influenza secondary attack rate of M and MH groups was significantly lower than control group. 2) There was no statistically significant effect of the M and MH interventions on secondary infections 3) Household members who spent at least 18hours each day at home were significantly more likely to develop laboratory confirmed influenza infection.

Figure 2: Concept map on identified features

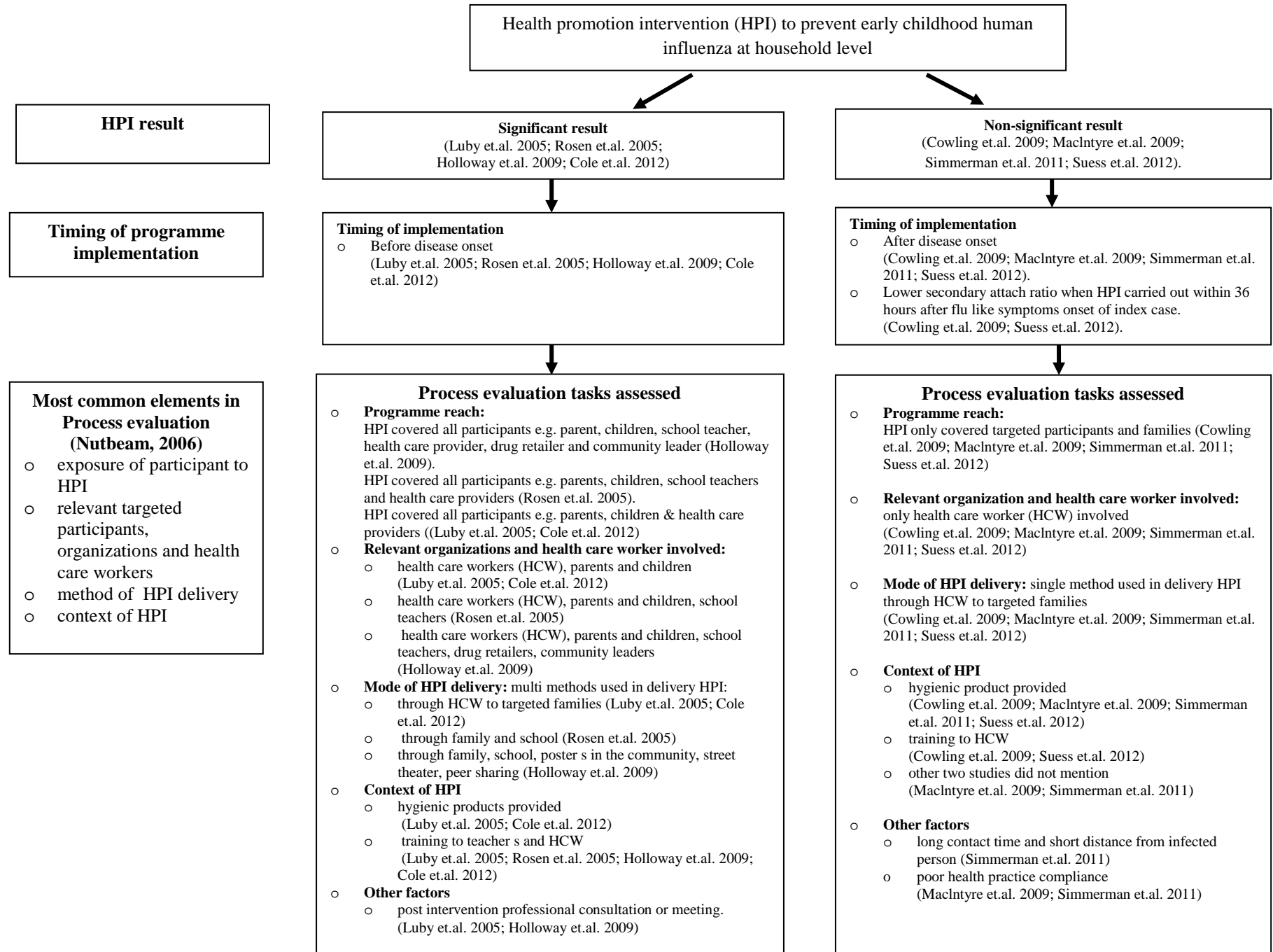


Figure 3: Conceptual framework for the development of nurse-led health promotion visiting programme and family health

