DEVELOPMENT AND VALIDATION OF KNOWLEDGE, PERCEPTION AND PRACTICE QUESTIONNAIRE ON RESPIRATORY TRACT INFECTION PROTECTIVE MEASURES AMONG MALAYSIAN HAJJ PILGRIMS 2012

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LIST OF ABBREVIATIONS

AIC	Aikaike Information Criterion
AVE	Average Variance Extracted
CA	Cronbach's alpha
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CR	Construct Validity
df	Degrees of Freedom
ECVI	Expected Cross-Validation Index
EFA	Exploratory Factor Analysis
KPP	Knowledge, Perception and Practice
KPP-PMQ	Knowledge, Perception and Practice-Protective Measures Questionnaire
n	number
PAF	Principal Axis Factoring
PIMM	Perception Initial Measurement Model
PFMM	Perception Final Measurement Model
PM	Protective Measures
RMSEA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean Square Residual
SV	Shared Variance
TFI	Tucker-Lewis Fit Index
USM	University Sains Malaysia

PEMBINAAN DAN KEBOLEHPERCAYAAN SOAL SELIDIK BERDASARKAN PENGETAHUAN, TANGGAPAN DAN AMALAN TERHADAP PENCEGAHAN JANGKITAN SALURAN PERNAFASAN DALAM KALANGAN JEMAAH HAJI MALAYSIA 2012.

Abstrak

Pengenalan: Jangkitan saluran pernafasan adalah jangkitan yang kerap dalam kalangan jemaah Haji. Kaji selidik sangat berpotensi bagi membantu mencegah jangkitan semasa mengerjakan haji.

Objektif: Untuk menetukan kesahan dan kebolehpercayaan soal selidik pengetahuan, tanggapan dan amalan yang baru dibentuk terhadap pencegahan jangkitan pernafasan dalam kalangan jemaah haji Malaysia.

Metod: Setelah kandungan terperinci dan kesahihan muka, soal selidik yang ditadbir sendiri dengan 74 item telah dibina yang dinilai tahap KPP ke arah langkah-langkah perlindungan saluran jangkitan pernafasan. Data dikumpul daripada sejumlah 303 jemaah pada musim Haji 2012. Analisis faktor penerokaan (EFA) sebagai pengurangan data untuk pengetahuan dan domain tanggapan telah dilakukan. Peringkat kesahihan selanjutnya telah dilakukan ke atas domain tanggapan oleh Analisis faktor pengesahan (CFA). Ketiga-tiga domain termasuk domain amalan diperiksa konsisten dalamannya.

Hasil: Purata (sisihan piawai) umur peserta kajian ini ialah 55.27 (10.32) tahun. Hampir semua adalah dari kaum Melayu dan mereka juga terdiri daripada 184 orang lelaki dan 119 orang perempuan. Kebanyakannya sudah berkahwin (87.8%). Hanya 76 orang peserta bekerja dengan kerajaan dan tahap pendidikan tertinggi adalah dari sekolah menengah (41.4%). Terdapat tiga komponen yang diambil untuk setiap domain pengetahuan dan persepsi dalam EFA. Domain persepsi menunjukkan model lengkap kerana indeks kecergasan adalah memuaskan dalam CFA di mana Chisquare(df),p-value=17.62(11), 0.091; AIC=51.62; ECVI=0.256; TLI/CFI= 0.977/0.988; RMSEA=0.055; SRMR=0.04; Chi-square/(df)=1.60. Konsisten dalaman (Cronbach's alpha) bagi KPP adalah masing-masing 0.51, 0.78 dan 0.78. Walaubagaimanapun, CFA tidak dilakukan terhadap domain pengetahuan disebabkan model domain tersebut tidak dapat dikenalpasti oleh perisian Amos. Sebaliknya, ia boleh dianggap kandungan telah disahihkan sebagai sebuah pembinaan sahaja. Sebanyak tiga puluh enam item telah dikekalkan dalam penyelesaian akhir pengesahan soal selidik.

Penutup: KPP adalah sah tetapi kurang dipercayai hanya pada domain pengetahuan. Oleh itu, penambahbaikan perlu diteruskan untuk meningkatkan kesahan dan kebolehpercayaan soal selidik.

Kata kunci: *pengetahuan, tanggapan, amalan, jemaah Haji, validasi, analisis faktor*

DEVELOPMENT AND VALIDATION OF KNOWLEDGE, PERCEPTION AND PRACTICE (KPP) QUESTIONNAIRE ON RESPIRATORY TRACT INFECTION PROTECTIVE MEASURES AMONG MALAYSIAN HAJJ PILGRIMS 2012.

Abstract

Introduction: Respiratory tract infection is a common infection among pilgrims during Hajj pilgrimage. A survey may provide information in preventing highly potential infections during Hajj pilgrimage.

Objective: To validate a newly developed knowledge, perception and practice (KPP) questionnaire on respiratory tract infection protective measures among Malaysian Hajj pilgrims.

Methods: After a detailed content and face validity evaluation, a self-administered questionnaire with 74 items was developed which assessed level of KPP towards respiratory tract infection protective measures. Data was collected from 303 pilgrims in 2012. Exploratory factor analysis (EFA) as data reduction for knowledge and perception domains was done using IBM SPSS 20.0. Further construct validity was evaluated on perception domain by Confirmatory Factor Analysis (CFA) using AMOS 18.0. All three domains including practice were checked for internal consistency.

Results: The mean (SD) of age of the respondents was 55.27 (10.32) years old. Majority of them were Malay (98.0%) and there were a total of 184 of male and 119 female Hajj pilgrims. Most of them were already married (87.8%). Only 76 respondents were worked with government and the highest level of education background was from

secondary school (41.3%). There were three components extracted for each knowledge and perception domains in EFA. The perception domain performed model fit since fitness indeces were satisfactory in CFA as Chisquare(df),p-value=17.62(11), 0.091; AIC=51.62; ECVI=0.256; TLI/CFI= 0.977/0.988; RMSEA=0.055; SRMR=0.04; Chisquare/(df)=1.60. Internal consistency (Cronbach's alpha) for KPP were 0.51, 0.78 and 0.78, respectively. However, the CFA for knowledge domain was not performed due to unidentified problem of the model. Otherwise, it was considered content validated under a single construct. A total of thirty-six items were retained in the final questionnaire.

Conclusion: The KPP was valid but less reliable only on knowledge domain. Thus, further, improvement should be performed to increase the validity and reliability of questionnaire.

Keywords: *knowledge, perception, practice, Hajj pilgrims, validation, factor analysis*

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Hajj pilgrimage is the largest annual gathering in the world which starts on eighth until thirteenth Dhul Hijjah, the last month of the Islamic Calendar. Hajj is performed in Mecca by all adults Muslims who are physically and financially capable. It is a religious obligation to adults Muslims to perform the pilgrimage at least once in their lifetime. According to Saudi Foreign Embassy, the total number of pilgrims in 2012 is approximately 3.16 million. Meanwhile, nearly 28, 000 hajj pilgrims came from Malaysia and 65% of them were at the age of 50 years above and mostly are female.

Every year, the pilgrims from different countries travel and start arriving at various times in Mecca about several weeks before the Hajj season. They were usually in groups led by accredited tour operators. Malaysian pilgrim groups are mostly led by Tabung Haji. Tabung Haji is the established and designated government related agency who is responsible to handle Hajj management for Malaysians. It usually manages welfare of Malaysians registered under the agency during pilgrimage in Mecca and Medina.

Hajj pilgrimage involves several activities. First of all, the pilgrims are required to walk around the *Ka'aba* (the building Muslims consider the house of God) in the Grand Mosque for seven times and this is called as *Tawaf.* Later, the pilgrims leave for Arafat which is a few miles east of Mecca. They would make overnight stops in Mina while travelling to Arafat and in *Muzdaliffah* on return. In returning back to Mina, the pilgrims stop at *Jamarat* to stone the pillars that are effigies of Satan. A pilgrim who

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has completed Hajj is called as *Hajjee* then makes an animal sacrifice as thanks for an accepted Hajj. At last, the pilgrims did a farewell *Tawaf* and leave Mecca. Each of pilgrims struggles to get a Hajj *Mabrur* (an accepted Hajj) by strictly following the activities and usually they took at least twelve days to complete the hajj.

The hajj pilgrims were highly at risk to any kind of potential diseases in this massive gathering. One of the common infections during hajj is the respiratory tract infections (Rashid *et al.*, 2008a; Alzeer, 2009). Communicable diseases including respiratory tract infection resulting from this intense crowding were well reported (Ahmed *et al.*, 2006). Mandourah *et al.* (2012) stated that the pilgrims during Hajj had endured a high population density and physical exertion due to a whole migration from site to site and extreme temperatures. In addition, they were restricted provision of usual personal items, including space for rest. The population is frequently older and many have possible medical comorbidities.

Lowe respiratory tract infection (LRTI) was the most common cause of admission to hospital during Hajj (Al-Ghamdi *et al.,* 2003). While Balkhy *et al.* (2004) discovered about 50% of hajj pilgrims developed upper respiratory tract infections (URTI) during the first week of pilgrimage. Alborzi *et al.* (2009) reported that acute respiratory diseases have been the most common cause of illness among Iranian pilgrims and influenza virus was the most common virus identified. According to Deris *et al.*, (2009), the prevalence of Malaysian hajj pilgrims with triad of cough, subjective fever and sore throat were quite high compared to other symptoms.

In order to increase the infection prevention, control policies are established every year based on knowledge of current global outbreaks, epidemiology of specific contagions and best practices for prevention and control (Memish, 2010). Balaban *et al.* (2012)

identified three protective behaviours were associated with reduced risk of respiratory illness; social distancing, hand hygiene and contact avoidance. Additionally, contact avoidance may reduce the duration of respiratory illness. Memish and his friends (2012a) found that the prevalence of respiratory virus infection was lower among pilgrims who received H1N1 vaccine compared to those who did not receive the vaccine. However, Gautret *et al.* (2010) suggested that vaccination against influenza and the use of surgical facemasks were not efficient against respiratory infections in the French pilgrims participating in the Hajj of 2009.

A survey can be established to evaluate the extent of preventive measures applied by the pilgrims to prevent themselves from being infected by respiratory diseases during pilgrimage. Furthermore, it may suggest ways to prevent highly potential infectious disease during Hajj pilgrimage. Questionnaire is an important tool used by the researchers in many disciplines to obtain information to answer a research question especially in health and medical science field. Distribution of questionnaire is one of the survey methods in measuring people thoughts on how well they care about their health (McDonald *et al.*, 2003; Gumucio *et al.*, 2011). It is also can be designed to measure knowledge, perception and practice regarding respiratory tract infection protective measures. After developing the items in the questionnaire, it is needed to be validated. Validation study is conducted to assess the validity and reliability of the questionnaire. Validated questionnaire ensures the accuracy of the information on the topic assessed (Streiner and Norman, 2008). Otherwise, reliability of a questionnaire ensures the consistency of the questionnaire (Kline, 2011). Factor analysis is part of validation questionnaire and comprised a collection of methods to examine how underlying constructs influence the responses on a number of measured variables

(Trochim, 2006; Brown, 2006). There are basically two types of factor analysis; exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

This study used self-administered questionnaire with three domains which are knowledge, perception and practice of Hajj pilgrims towards preventive of respiratory tract infection. The validation of questionnaire based on these domains was discussed in this study.

1.2 Rationale of study

The respiratory tract infections are the most common reason for interference with the performance of Hajj ritual activities, as well as affecting individual's daily activities, and can lead to respiratory tract complications (Al-Ghamdi *et al.,* 2003; Balkhy *et al.*, 2004; Deris *et al.*, 2009).

Since the infection is easily spread from person to person, or even to the larger community, these diseases are difficult to be prevented. Health authorities in countries of origin are supposed to provide information to pilgrims on respiratory infection symptoms, methods of transmission, complications and means of prevention. Thus, a study examining respiratory tract infections among Hajj pilgrims is needed as well as to estimate the protective measures practiced by them. There is still no report available on Malaysian hajj pilgrims towards protective practice on respiratory tract infection during pilgrimage.

This study also attempted to develop a comprehensive KPP-PMQ (Knowledge, Perception and Practice-Protective Measures Questionnaire) from a larger perspective i.e. mechanical protective measure, health supplement taken, habits, physical fitness,

psychological aspect and spiritual. Therefore, this tool could be used to assess role of KPP-PMQ in respiratory tract infections which offer understanding on level of knowledge, perception and practice of local population and information for better preventive strategies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Respiratory tract infections and the protective measures

Respiratory tract infections (RTI) accounts for the majority of acute respiratory illness at all ages worldwide with a large proportion of which are viral (Shek and Lee, 2003; Steffen and Connor, 2005). Respiratory illness may be defined into few kinds of acute respiratory disease intensity (WHO, 2009). Acute Respiratory Illness (ARI) or so called acute febrile respiratory illness comprises of fever more than 38°C with spectrum of disease from influenza-like illness to pneumonia. Influenza-like Illness (ILI) is defined as person with sudden onset of ever > 38°C and cough or sore throat in the absence of other diagnosis. Other researchers also had defined ILI as "triad of cough or sore throat with subjective fever" at the Hajj or other mass gatherings (Thursky *et al.*, 2003; Babcock *et al.*, 2006; Rashid *et al.*, 2006). Severe Acute Respiratory Illness (SARI) meets ILI case definition with additional shortness of breath or difficulty breathing or/and requiring hospital admission (Rashid *et al.*, 2006). Epidemiological differences exist for RTI between tropical and temperate regions and results in obvious seasonal pattern to influenza infections (Stephenson and Zambon, 2002).

Johnson and his friends (2009) had conducted an assessment on the efficacy of surgical and N95 masks to filter influenza virus in patients with laboratory-confirmed acute influenza infection. They found that both masks were equally effective when used in short period to prevent the spread of infection. An intervention study done by Ailleo *et al.* (2010) to examine whether use of face masks and hand hygiene reduce the influenza-like illness (ILI) or not. He found that there was a reduction of the

transmission of ILI during winter season and-substantial effects among individuals who share crowded living conditions were demonstrated by using face masks and hand sanitizer more often. Those travelers who had taken influenza vaccines were at lesser risk to be infected by influenza virus during travelling (Stephen and Connor, 2005). Thomson *et al.* (2003) found that influenza associated deaths have increased substantially from the 1976-1977 through 1998-1999 seasons in the United States. Besides, the deaths associated with viral respiratory infections also have increased substantially during the past decade and it appears that they will continue to increase as the population continues to age.

2.1.1 Respiratory tract infections and the protective measures among hajj pilgrims

Acute respiratory infection in previous studies was defined as a Hajj pilgrim who developed at least one of the following local symptoms (runny nose, sneezing, sore throat, cough with/without sputum, and difficulty in breathing) as well as at least one of the constitutional symptoms (fever, headache, and myalgia) after reaching Makkah (Al-Mudameigh *et al.*, 2003; Choudhry *et al.,* 2006). In order to accomplish Hajj, pilgrims start Hajj by visiting the sacred Ka'aba and then on subsequent days, they move to different holy places including Mina, Arafah and Muzdalifa. They usually stay in tent-type housing which is 50 to 100 persons share domestic facilities and move around by buses or on foot. The risk of exposure to respiratory tract infection during travel depends on time of the year, type of travel, destination and duration. Thus, crowding, fatigue and the extreme climatic conditions during pilgrimage are important factors for transmitting air- and droplet-borne infections (Ahmed et al., 2006; Alzeer, 2009).

During the Hajj season, crowded condition was the most potential factor accelerating to the spread of the infections. A study performed by Rashid et al. (2006) demonstrated increased respiratory infections caused by influenza and other viruses among United Kingdom (UK) Hajj pilgrims during winter season. Close contact among pilgrims during periods of intense congestion, their shared sleeping accommodations and the dense of air pollution increased the risk of airborne respiratory disease transmission (Memish, 2010).

Respiratory diseases are a common illness among hajj pilgrims and respiratory tract infections are the commonest cause of hospital admission during Hajj season (Al-Ghamdi *et al.*, 2003; Ahmed *et al.*, 2006; Mandourah *et al.*, 2012). An estimated of 24,000 pilgrims suffered from influenza each year (Balkhy *et al.*, 2004; El Bashir *et al.*, 2004; Gatrad *et al.*, 2006). Pneumonia was the highest cases diagnosed (39.4%) among patients who were admitted to Al-Mashear hospitals in Saudi Arabia during the Hajj (Al-Ghamdhi *et al.*, 2003). An incidence of 40.0% out of 1027 pilgrims from Riyadh were suffered from acute respiratory infections found in a study done by Choudry and other researchers (2006) conducted in 2002 Hajj season. Cough and sore throat were the most common symptoms of acute respiratory infection among Iranian pilgrims (Alborzi *et al.*, 2006). Meanwhile, 58.9% of Malaysian hajj pilgrims suffered from acute respiratory infections (fever and other respiratory symptoms) in 2007 hajj season (Deris *et al.*, 2010). The most common asthma symptoms among patients during the Hajj were shortness of breath (91.4%) and cough (89.7%) with varying levels of asthma severity which were referred to hospital for emergency reasons (Mirza *et al.*, 2011).

The overall prevalence of any respiratory virus detected was 14.5% among arriving and departing hajj pilgrims at the King Abdulaziz International Airport, Jeddah (Memish *et*

al., 2012b) where the main viruses detected were rhino-enteroviruses, coronaviruses, respiratory syncytial virus and influenza A virus. Rashid *et al.* (2008a) confirmed that influenza and respiratory syncytial virus (RSV) cause acute respiratory infections in British hajj pilgrims. Cough is one of the most viral respiratory infections experienced by many pilgrims at the Hajj (Gautret *et al.*, 2009; NaTHNaC, 2012). Pertussis (defined as prolonged cough and a 14-fold increase in the level of immunoglobulin G to whole-cell pertussis antigen) was another of respiratory infection of concern where 57.0% of Singaporean pilgrims complained of having prolonged cough during Hajj (Wilder-Smith *et al.*, 2003).

The risk of respiratory infection may be minimized by offering pre-travel advice and appropriate immunizations. The Saudi Ministry of Health recommends influenza vaccination to pilgrims before arrival, especially to those with underlying pre-existing conditions such as the elderly, people with chronic chest or cardiac, hepatic or renal disease (Ahmed *et al.*, 2006; Memish, 2010). Even all the healthcare workers working in the Hajj premises and internal pilgrims with pre-existing conditions are also recommended to take influenza vaccination. A case-control study done by Mustafa *et al.* (2003) reported vaccine was effective in preventing clinic visits for ILI among Malaysian pilgrims attending the 2000 Hajj, plus, prevent from the dispensing of over-the-counter medications and antibiotics. They recommended that governments together with significant numbers of Hajj staff should provide programs about influenza immunization and its effects in minimizing the incidence and risk of influenza among pilgrims before they go to Makkah. In contrast, Rashid *et al.* (2008b) observed no significant difference between vaccinated and unvaccinated groups. Based on blood tests for influenza among Hajj pilgrims before departure and after they returned from the Hajj, the rate of influenza attack was found to be 38% among UK pilgrims and only

30% of the pilgrims who had been vaccinated. They suggested that all pilgrims should be vaccinated against influenza before traveling to the Hajj. Other than that, few pilgrims had poor knowledge of influenza vaccine existence which resulted in a very low vaccination was received in 2003 Hajj season (Balkhy *et al.*, 2004).

The US Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) had issued behavior recommendations to mitigate the impact of influenza A (H1N1) among pilgrims including washing hands often, use of hand sanitizer, wearing a facemask, covering one's cough or sneeze, staying away from sick people and not touching objects touched by sick people (CDC, 2009; WHO, 2010). Reduced risk of respiratory illness was associated with practicing social distancing, hand hygiene, and contact avoidance. Pilgrims who reported practicing recommended protective measures during the Hajj were reported either less occurrence or shorter duration of respiratory illness (Balaban *et al.*, 2012). In addition, practicing contact avoidance was also associated with shorter duration of respiratory illness. According to study done by Gautret *et al.* (2010), only a slight significant ($p<0.005$) findings on protective measures among French hajj pilgrims was found. Sputum and myalgia were less frequently reported in individuals using hand disinfectant and disposable handkerchiefs and less fever in those vaccinated against pneumococcal infections. However, their results suggested that influenza vaccination and use of surgical face mask were not efficient against respiratory illness during 2009 Hajj pilgrimage. These results supported by an earlier study reporting similar findings among Malaysian hajj pilgrims attending the 2007 Hajj season (Deris *et al.*, 2009). The group of researchers also estimated that the usage of facemasks by men was highly protective against acute respiratory infection (Choudry *et al.*, 2006). Barrier masks could reduce the effects of pollution and dense smoke, which are mainly occurred in overcrowded places such as

Hajj. Health authorities in countries of origin are required to provide information to pilgrims on respiratory infection symptoms, methods of transmission, complications and means of prevention.

2.2 Knowledge, Attitude or Perception and Practice Questionnaire on respiratory diseases and protective measures

Studies examining knowledge, attitude, and practices (KAP) have been conducted in related to respiratory disease and among different types of people, such as among US travelers (Yanni *et al.*, 2010), poultry workers in Nepal (Neupane *et al.*, 2012), European travelers (Pfeil *et al.*, 2010), travelers in Singapore (Wilder-Smith *et al.*, 2007), travelers in Qatar (Bener & Al-Khal, 2004), Hungarian family physicians (Rurik *et al.*, 2011), parents in Malaysia (Naina & Bahari, 2004), French pilgrims at the Hajj (Gautret *et al.*, 2010) and US pilgrims at the Hajj (Balaban *et al.*, 2012).

A pre-travel and post-travel questionnaire knowledge, attitudes and practices (KAP) was distributed to traveler who had stop at four international airports New York, Chicago, Los Angeles and Sans Francisco regarding seasonal influenza and H5N1 avian influenza prevention measures (Yanni *et al.,* 2010). Of 41% reported receiving the vaccine during the previous session, majority were aware of influenza prevention measures. 65% believed they were susceptible to influenza but 75% were not worried about acquiring influenza during travel to Asia. They suggested continuing education in the basics of health advice should be available at provider conferences and at all levels of medical training. Otherwise another study on vaccination involved one hundred and ninety eight physicians in Hungary (Rurik *et al.*, 2011). They believed that the influenza outbreak represented less of a threat to their practices than to Hungary or the

world as a whole. They mostly agreed that vaccination was important and were frequently dissatisfied with the support from health authorities. Physicians who were satisfied with the payment for procedures and underwent vaccination themselves were more active in vaccination.

Risk perception and vaccination coverage concerning seasonal and pandemic influenza was very poor among European travelers to resource-limited destinations as compared with traditional at-risk groups (Pfeil *et al.*, 2010). The findings revealed influenza vaccination as recommended by the family doctor (37.7%), travel to regions with known high risk of influenza (35.1%) and influenza vaccination required for job purposes (26.8%) were the most frequently mentioned considerations for influenza vaccination. The study suggested that information strategies about influenza should be more intensified and include health professionals (Pfeil *et al.*, 2010). Another study among travelers was conducted by Wilder-Smith *et al.* (2007) using questionnaire survey to assess the KAP toward pertussis in adult travelers who had presented at the Travelers' Health & Vaccination Centre in Singapore. They reported 38% did not know or gave a wrong answer for the mode of transmission of pertussis, 83% had never heard of pertussis vaccine for adults and almost none of them had received an adult pertussis vaccine booster. The researchers recommended awareness about pertussis, its risks, and prevention via vaccination to be increased among adult travelers.

Studies related to more severe form of ARI revealed similar low knowledge. A study was conducted to explore the KAP related to avian influenza among poultry workers in Nepal using a structured questionnaire administered face-to-face interviews Being employed as compared to being an owner of a poultry farm as well as having a high knowledge was associated with using more preventing behaviors. In addition, a

majority of over 60% among respondents felt afraid of contracting avian influenza (Neupane *et al.*, 2012). Another population study by Benner and Al-Khal (2004) showed 77% of the population of Qatar responded to the KAP questionnaire towards severe acute respiratory syndrome (SARS). Only 8% had accurate knowledge about all of the symptoms of SARS and half of the subjects said they gained most of their knowledge on SARS through television and radio programmes. The survey found high level of stress and fear among the respondents.

Two recent studies on KAP among hajj pilgrimage reported KAP on ARI and its general protective measures. The first study was a study on KAP conducted among French Hajj pilgrims towards protective measures against acute respiratory symptoms (ARI) (Gautret *et al.*, 2010). Most of them believed the sources of contamination for ARI were sneeze, cough products, dirty hands, and contact with ill persons, saliva, promiscuity, food and drink, air conditioner and contact with animals. Only 14.4% of pilgrims surveyed did not know any ARI symptoms. Less than 50% of respondents were aware of social distancing, curative treatment and use a facemask as precautions to reduce the spread of ARI agents. Meanwhile, the next study done by Balaban *et al.* (2012) surveyed KAP on H1N1 protective measures among US travelers to the 2009 Hajj. 77% of respondents reported engaging in recommended protective behaviors during the Hajj. The researchers had noticed that influenza A (H1N1) health messages during the Hajj were associated with more protective measures and shorter duration of respiratory illness. Influenza communication and education in the Kingdom of Saudi Arabia (KSA) during the Hajj may also have been an effective component of the efforts to mitigate illness. However, both of the articles did not discuss on the validation of their questionnaire used. Thus, a questionnaire for Malaysian Hajj pilgrims needs to develop and validate somehow.

2.4 Questionnaire development and methods administration

A KAP survey is a quantitative type method questions and formatted in standardized questionnaires that provides access to quantitative and qualitative information. It is also tend to reveal not only characteristic traits in knowledge, attitude and behaviors about health related to religious, social, traditional factors, but also the idea that each person has of the body or of disease (Gumucio *et al.*, 2011). Therefore, any questionnaire-based research study that collects personal information which can be linked to individual human subjects must be designed and conducted in an ethical manner that protects the research subjects. Development and implementation of the research protocol and questionnaire are part of human subject's protection (McDonald *et al.*, 2003). Any questionnaire must describe the purpose, risks and benefits of the research to potential respondents in language they can understand, so that they have the information needed to decide whether to participate in the research. Informed consent provision and participant confidentiality should be protected to the extent provided by law.

There was variety of ways to administer a questionnaire such as in person or over the phone by an interviewer, or through postal or electronic mail services without the aid of an interviewer (McDonald *et al.*, 2003). In epidemiologic studies, two main types of questionnaires are used: interviewer-administered and self-administered. Additionally, when designing a questionnaire, investigators must weigh the questions they would like to ask against the limitations of what most respondents are able and willing to provide. Once the variables are identified, questionnaire development can proceed.

An interviewer-administered questionnaire can be designed for use either in person or over the telephone, whichever is more suitable for the particular study. Whether a

questionnaire is administered in person or by telephone, the personal characteristics of interviewers and the training and supervision they receive are critical to collecting accurate and consistent data from the respondents. Therefore, the interviewers should be trained and monitored both to uniformly administer questionnaire and to record the responses in a standard fashion (McDonald *et al.*, 2003).

Self-administered questionnaires are useful for collecting simple information that is relatively easy for respondents to response. The benefits from having self-administered questionnaire is more economical and practical for collecting data from large numbers of respondents, particularly when dispersed over wide geographic areas. Besides, the absence of an interviewer also prevents the introduction of interviewer bias in the data. In addition to that the respondents may be more willing to disclose certain kinds of sensitive information when an interviewer is not involved (McDonald *et al.*, 2003).

2.5 Validation of questionnaire

2.5.1 Overview

The concepts of validity and reliability are the most often used in epidemiologic research to evaluate how well a given question will yield an accurate and precise measure. Measurement validity is defined as the degree to which the data measure what they were intended to measure. In other words, how close the data reflect the true state of what being measured or the true value of the phenomenon under study (Fletcher, Fletcher and Wagner, 1996). It is often known as accuracy. It is also interpreted as integrity, character or quality in which the assessment is tailored to its objectives and situations (Costello and Osborne, 2005). Reliability, on other hand, means

repeatability, reproducibility, consistency or precision (Fletcher, Fletcher and Wagner, 1996; Gordis, 2009; Trochim, 2006). It is extent to which repeated measurements of a stable phenomenon by different people and instruments, at different times and places get similar result (Fletcher, Fletcher and Wagner, 1996).

Assessment of validity and reliability in the context of questionnaire design involves qualitative as well as quantitative procedures, which are integrated throughout design activities. In other words, these two terms of measurement validation would answer the questions of how well a questionnaire reflects the truth, and how dependable it really is.

2.5.2 Measurement of validity

Measurement of validity usually divided into three parts: Content validity, criterion validity and construct validity (Fletcher, Fletcher and Wagner, 1996; Carmines and Zeller, 1979).

2.5.2(a) Content validity

Content validity is viewed as to what extent a sample of test items can reflect the universe of items, of a particular concept, or in other words, how representative the items are of the concept (Cronbach and Meehl, 1955). It is how well a measure includes all the facets of an idea or concept, which a researcher intends to measure, for instance when one intends to measure disease, he/she should include questions related to disease such as symptoms, risk factors, mode of transmission and so on (Fletcher, Fletcher and Wagner, 1996).

2.5.2(b) Criterion validity

Criterion validity of measurements indicates how well they predict a directly observable phenomenon (Fletcher, Fletcher and Wagner, 1996). In other words, a researcher compares his set of measurements for which he/she believes would measure a particular concept, to a criterion (gold-standard) of his/her choice. It is of two types: predictive and concurrent (Streiner and Norman, 2008). It is predictive when the measurement is used to predict something, while it is concurrent when it is used to discriminate between present groups (Trochim, 2006). Consequently, with concurrent validation, a new scale is correlated with an established criterion scale, while in predictive validation; the criterion is only established in the future (Streiner and Norman, 2008).

2.5.2(c) Construct validity

Construct validity involves theory and the relationship of data to the theory. Some researchers (Carmines and Zeller, 1979; Fletcher, Fletcher and Wagner, 1996) stated that construct validity is the extent to which a measure of concern relates to other measures with similar concept or construct. There are three steps involved in construct validation: firstly is specify theoretical relationship between the concepts; second is examine empirical relationship between measures of the concepts; third, interpret the empirical evidence as to how it can clarify the construct validity of particular measure (Carmines and Zeller, 1979). Factor analysis is one of the methods to investigate the construct validity (Cronbach and Meehl, 1955). Regardless of purposes, factor analysis is used in the determination of a small number of factors based on a particular number of inter-related quantitative variables (Brown, 2006; Thompson, 2004; Stevens, 2009).

Convergent and discriminant validity are considered as subtypes of construct validity as they provide evidence to construct validity (Trochim, 2006). Convergent validity evidence is established when items that are supposed to be correlated theoretically are observed to correlated to each other, while discriminant validity is established when items that are supposed to be uncorrelated theoretically are observed to be uncorrelated to each other (Trochim, 2006; Brown, 2006). As for which items should be correlated or uncorrelated, the researcher should know better. In practice, the evidence of the validity (convergent and discriminant) is proven by examining correlation matrix of observed items for evidence of convergence or discrimination, assessing the association between each item with its corresponding construct (factor loading) and its significance (Floyd and Widaman, 1995), by calculating average variance extracted of items of a construct (Fornell and Larcker, 1981), and also by seeing how closely constructs from one instrument (i.e. newly developed one) are related to other measures of theoretically similar constructs in other established instrument and how different they are in relation to other instrument which they are not supposedly to have any relationship on theoretical basis (Streiner and Norman, 2008).

2.5.3 Measurement of reliability

Reliability is synonym to consistency, repeatability and accuracy. A reliable construct will have consistent results internally, and each item is correlated to each other. There are few types of measurement reliability: Test-retest reliability, parallel-forms reliability, interrater reliability and internal consistency reliability (Trochim, 2006; Kline, 2011). However, Cronbach's alpha coefficient for internal consistency reliability is the most often reported in literature which is the degree to which responses are

consistent across the items within a specific factor, or specific instrument (Kline, 2011). If all the items measure the same thing (factor), then they should be correlated with one another, thus consistent internally. Cronbach's alpha can be interpreted as the percent of variance the observed scale would explain in the hypothetical true scale composed of all possible items in the universe. Test-retest reliability is relevant when a researcher wants to know whether his instrument is reliable to the same group on second occasion, and if the two sets are closely correlated, the temporal factors contribute minimally to random error (Kline, 2011). While parallel-forms reliability is relevant when the consistency of the responses of two tests (parallel-forms) constructed in the same way from a larger set of questions addressing the same factor is in question, with a implication that if the parallel forms are indeed similar, the forms can be used independently of each other and considered to be equivalent (Trochim, 2006). Inter-rater reliability is relevant when human factor is an important part of an assessment, and thus contributes to the observe score reliability (Trochim, 2006; Kline, 2011).

2.6 Factor analysis

2.6.1 Overview

Nowadays, factor analysis becomes one of the most widely used multivariate analysis in many fields of applied sciences (Brown, 2006). The factor analysis is usually applied for psychometric evaluations of multiple items inventory, construct validation and data reduction. Thompson (2004) stated that there were three main applications of factor analysis. Firstly, to evaluate whether scores obtained are in fact measuring something instead of being randomly generated scores that measure nothing. Secondly, to develop theory regarding the nature of constructs and thus, provides empirical evidence of the

constructs. The third one is being used as an intermediate step to form a more parsimonious set of factors to be used in subsequent analysis, by summarizing the relationships among the factors. The factor analysis was divided into two main types of analysis based on common factor model; Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

2.6.2 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) is generally discussed in line of principal component analysis (PCA) and common factor analysis (based on common factor model). EFA was employed as an exploratory or descriptive technique to determine appropriate number of common factors and to uncover which variables are reasonable indicators of the various latent dimensions (Brown, 2006). The other use of EFA is for data reduction (Floyd and Widaman, 1995), in which a set of measured variables is to be combined into summary indices. A large set of related variables can be reduced to a smaller set of general summary scores that have maximal variability and reliability. For example, a study done by Al-Shair *et. al* (2009) reported 57 items of the Manchester COPD (chronic obstructive pulmonary disease) fatigue scale (MCFS) has been reduced to 27 items after conducted exploratory PCA. The analysis applied both orthogonal and oblique rotation techniques and Kaiser's criterion of eigenvalue >1 with Cronbach's alpha of 0.97. In EFA, there was no expectation of the number or nature of the variables and it is exploratory in nature. There were three steps basically done in EFA for this study which is descriptive, extraction and rotation. Descriptive included the production of correlation matrix between items, Kaiser-Mayer-Olkin (KMO) test and Bartlett's Test of Sphericity. Extraction includes the communalities, scree plot and factor

loadings values. While rotation includes the factor loading value after rotation. The KMO index with 0.50 and above was considered suitable for factor analysis (Hair *et al.*, 1995; Tabachnick and Fidell, 2004). KMO compares the magnitudes of the calculated correlation coefficients to the magnitudes of the partial correlation coefficients. Besides, they stated the Test of Sphericity should be significant ($p<0.05$).

2.6.3 Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) is a special form of factor analysis. It is employed to test whether the measures of construct are consistent with the researcher's understanding of the nature of that construct. CFA has built upon and replaced older methods of analyzing construct validity. The number of factors and the pattern of indicator-factor loadings in advance, as well as other parameters such as those bearing on the independence or covariance of factors indicator unique variances would be specified in CFA (Brown, 2006). CFA offers a strong analytic framework for evaluation the equivalence of measurement models across distinct groups (e.g., types of job, education level). In addition, CFA is used as a precursor to SEM (Structural Equation Modeling) models that specify structural relationship among the latent variables (Stevens, 2009). SEM models are divided to major components: firstly, the measurement model, which specifies the number of factors, how the various indicators are related to the latent factors, and the relationships among indicator errors; secondly, the structural model, which is specifying how the various latent factors are related to one another (Kline, 2011).

2.6.4 EFA versus CFA

EFA is typically used earlier in the process of scale development and construct validation, whereas CFA is used in later phases after underlying structure has been established on prior empirical (EFA) when prior evidence and theoretical grounds (Brown, 2006). In addition, EFA allows items to load freely on all factors, while in CFA the items are fixed to load on specific factors only (Stevens, 2009). Besides, EFA is theory generating while CFA is theory testing. Unlike the approach in EFA, only the number of factors can be pre-specified, but, in CFA the researcher usually tests a much more parsimonious solution by indicating the number of factors, the pattern of factor loadings, and an appropriate error theory (Brown, 2006). Another comparison is CFA produces many goodness-of-fit measures to evaluate the model but do not calculate factor scores like in EFA. CFA requires special purpose software packages such as Mplus, LISREL, Amos, EQS, and SAS/STAT CALIS (Albright and Park, 2009).

2.7 Literature search

Search engines used include PubMed, Google Scholar and ISI Web of Knowledge. Databases used include Science Direct, Springer Link and Wiley Online Library. Literature search was done for respiratory tract infection, preventive measures and validation. The keywords used to find the literature such as "respiratory tract infection", "respiratory tract infection AND preventive measures", "respiratory tract infection AND hajj pilgrims", "respiratory tract infection AND knowledge AND perception OR attitude OR believe AND practice AND preventive measures", "KAP study and validation", "factor analysis".

2.8 Conceptualized of development Knowledge, Perception and Practice Questionnaire (KPP-PMQ)

The development of questionnaire was conceptualized to assess the level of knowledge, perception and practice towards respiratory tract infection protective measures among Malaysian Hajj pilgrims. The protective measures emphasized more on physical fitness, spiritual, dietary intake, facemask and vaccination (Figure 2.1).

Once the questionnaire was developed, it was conducted to evaluate the validity and reliability analysis. Content validity, face validity and construct validity are part of validity assessment. While internal consistency showed the reliability of questionnaire.

Factor analysis; part of construct validity where exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted (Figure 2.2).

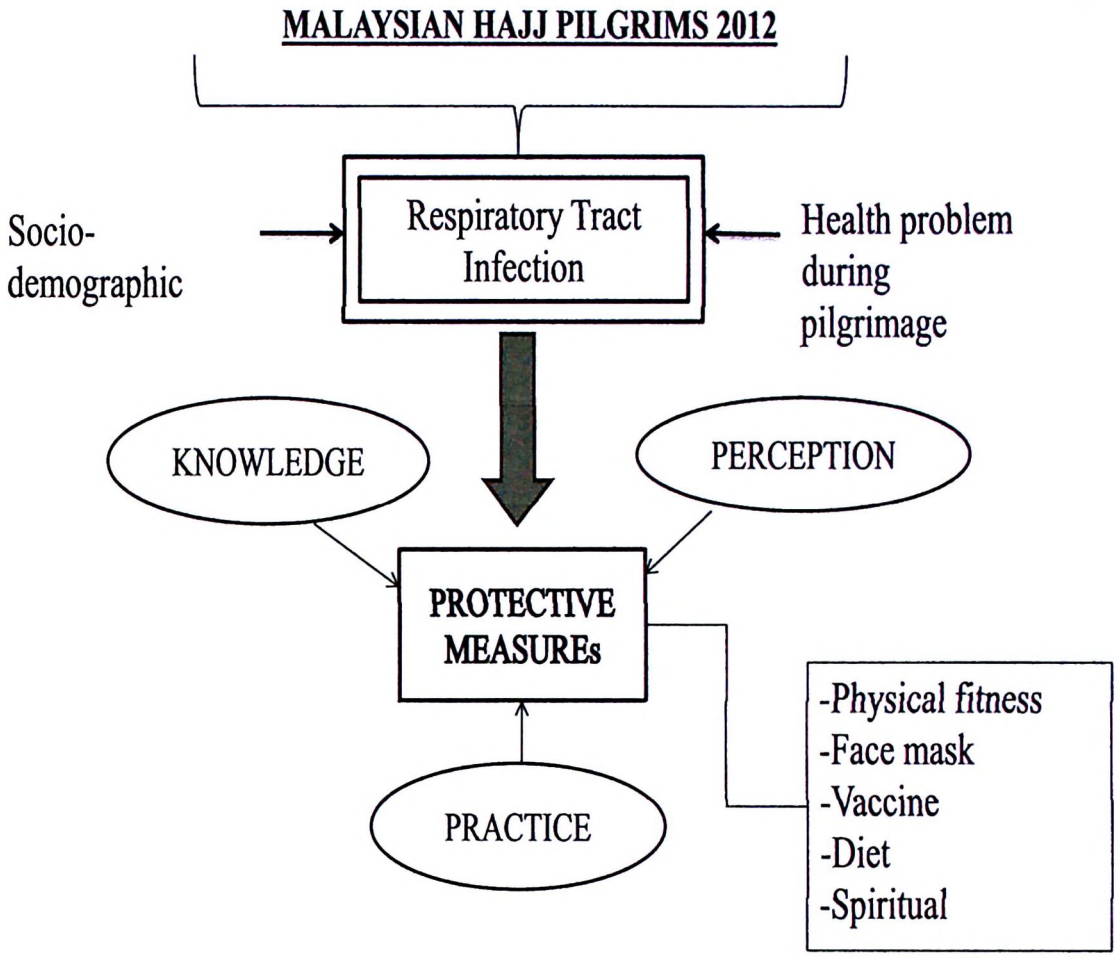

Figure 2.1: Conceptualized development of KPP-PMQ

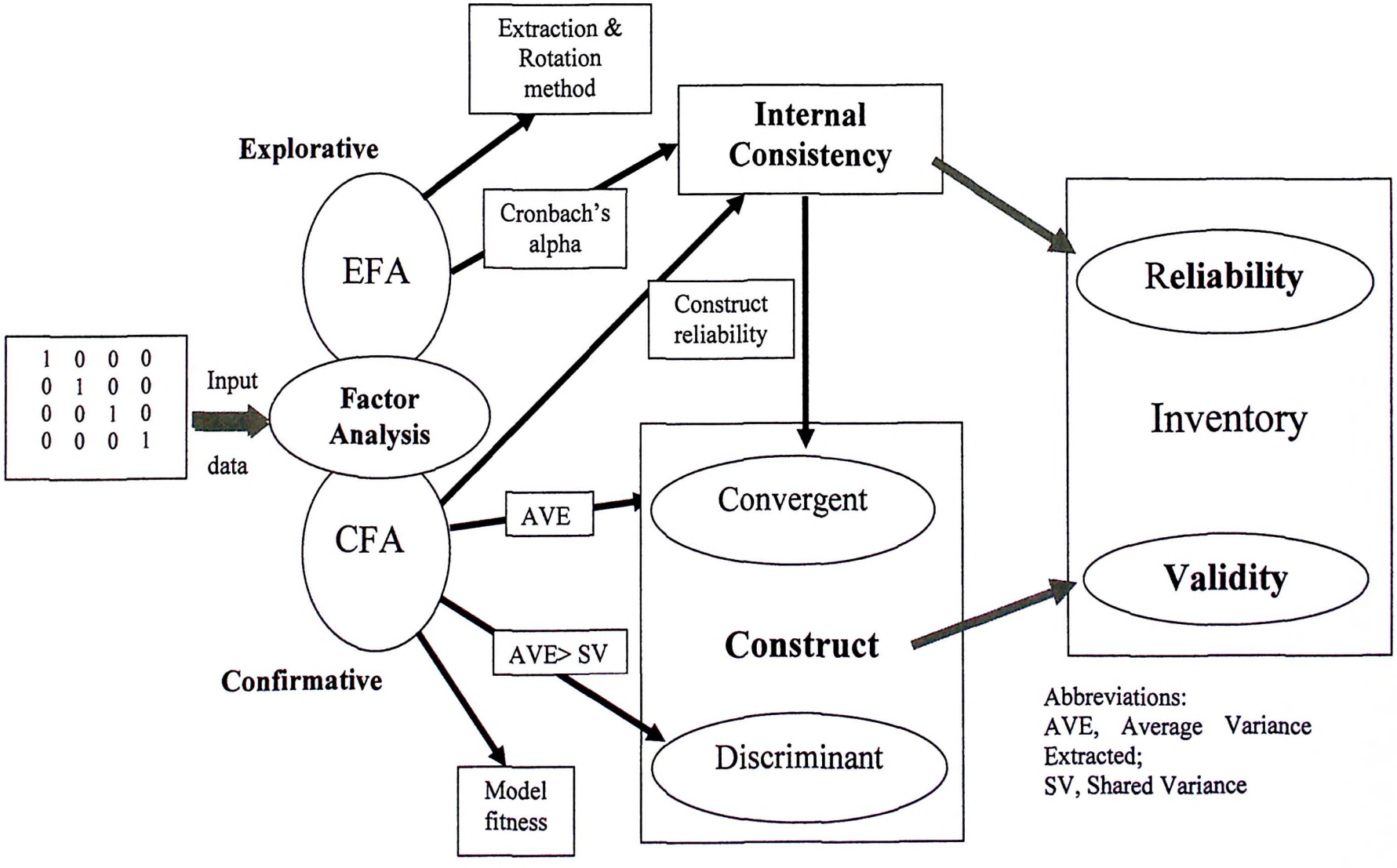

Figure 2.2: Conceptual framework of Exploratory Factor Analysis (EFA) & Confirmatory Factor Analysis (CFA)