DOI: 10.1097/NUR.0000000000000174

Pre-publication version of: Chan, W. F., Bond, T. G., Adamson, B., & Chow, M. (2016). Identifying core competencies of infection control nurse specialists in Hong Kong. *Clinical Nurse Specialist, 30*(1), E1-E9.

IDENTIFYING CORE COMPETENCIES OF INFECTION CONTROL NURSE SPECIALISTS IN HONG KONG

Abstract

Purpose: To confirm a core competency scale for Hong Kong Infection Control Nurses at advanced nursing practice level from the core competency items proposed in a previous phase of this study that would serve as the foundation of competency assurance.

Designs: A cross-sectional survey design was used.

Setting: All public and private hospitals in Hong Kong.

Subjects: All infection control nurses in hospitals of Hong Kong.

Methods: The 83-item proposed core competency list established in an earlier study was transformed into a questionnaire and sent to 112 infection control nurses of 48 hospitals in Hong Kong, who were asked to rate the importance of each item in common Likert-style response categories. Data were analyzed using Rasch measurement.

Results: The response rate of the survey was 81.25%. Seven items were removed from the proposed core competency list, resulting in a scale of 76 items that fit the requirements of the unidimensional Rasch model.

Conclusions: Essential core competency items of infection control nurses of Hong Kong were identified based on the objective criteria of Rasch measurement. Some items of the scale are distinguished from the overseas standards that reflecting the local characteristics.

Implications: The local-specific study results may serve as the education and certification foundations for infection control nurse specialists in Hong Kong. Rasch measurement is a potential tool to identify the core competency of advanced practice nurses of other specialties in an objective manner.

Introduction In Hong Kong, the speciality of infection control nursing was established only in the 1980s, and advanced nursing practices were developed in the following decade[1]. After the Severe Acute Respiratory Syndrome epidemic in 2003, more resources including manpower and financial support, were deployed directly to infection control services. The importance of infection control nurses (ICNs) was further emphasized in the influenza pandemic of 2009, when Hong Kong was one of the affected regions, and by the recent Ebola outbreak in Africa that has had global ramifications. Hospital management, clients and the public became aware that competency assurance for ICNs was a key issue in ensuring patient safety and quality of healthcare, and this awareness chimed with the worldwide trend of regulating healthcare specialists.[2,3]

The core competencies of ICNs consist of the knowledge and skills that are necessary for adequate job performance and they forms the foundation of education and assessment for the advanced practices of ICNs. Currently in Hong Kong, the minimum specialty training requirement for the Advance Practice Nurse in the field of infection prevention and control is a course led by clinical experts. It is a 50-hour lecture-based programme with no clinical practicum. As such, this programme may serve as a specialty training course for infection prevention and control but it is inadequate in preparing ICNs to become Advanced Practice Nurses. In contrast, in the United States, the required training for Advanced Practice Nurses to become ICNs is a master's degree incorporating 400-500 hours each for theoretical and clinical training (Wong, 2009). The Hospital Authority, the largest public healthcare organization in Hong Kong, established the framework of qualifications for Advanced Practice Nurses in 2005.[4] A context-specific core competency in a specialty is still a more practical scale to guide the development of the advanced

practice nurses. The pioneering countries in infection control, such as the United Kingdom, United States of America and Canada, have published their competencies or education and practice standards to guide initial training and professional development.[5,6] However, such infection control standards from overseas should not be adopted automatically by practitioners in Hong Kong because of the different healthcare settings, cultural and educational backgrounds, and other important factors. Local-context-specific core competencies for advanced practices of ICNs can serve as the foundation of developing an educational programme for Advanced Practice Nurses in infection prevention and control. On the other hand, this core competency is an important basis to develop the content of certification programme for the field to identify the competent Advanced Practice Nurses in infection prevention and control. In an earlier study (REF), a core competency list for advanced practices of ICNs was proposed using the Delphi technique with the input of infection control experts in Hong Kong. The reliability and validity of the 83-item proposed core competency list were established at that time.[8] To create buy-in effect of the practitioners, this present study implemented and extended the earlier work to confirm the core competencies using objective measurement drawing on both quantitative and qualitative approaches.

Methods

Rasch measurement

Ever since the ground-breaking assertions of Stevens (1946), researchers in the human sciences have been aware that a particular level of data (i.e., interval data, as opposed to nominal or ordinal data) is required for the vast majority of analytical techniques routinely applied to quantitative data. Unfortunately, Stevens's data

requirements, although quoted ubiquitously, are usually ignored, or, at least presumed to hold, in contemporary research practice. The Rasch model[16], instead, focuses exactly on the construction of interval data for research purposes. It does so by implementing a log-odds transformation to convert ordinal-level data into interval-level measures and utilizing quality control (or fit) statistics to determine which item responses might considered as productive for measurement of the underlying latent trait. Bond and Fox (2015) provide a comprehensive exposition of the application of Rasch Measurement across the human sciences. A briefer introduction to using Rasch analysis principles related to the work of home-care nurses and other health professionals is demonstrated in the derivation of the short form of the Family Strain Questionnaire (FSQ-SF)[15] so that it could be used as a screening device for caregiver stress.

The Rasch model was developed by the Danish mathematician Georg Rasch in the 1960s.[16] It is a one-parameter item response theory model.[14] Instead of modeling the responses as classical test theory, it attempts to model the probability of responses. Being an objective measurement, the results of the Rasch measurement is reproducible with the acceptable range of error (Institute for Objective Measurement, 2000).

Though being a young analyzing tool in the research world for only half decade, it

has been predominantly used in the field of education in setting and evaluating the assessments and passing standards of tests, including high-stake tests (Griffin, Cuc, Gillis & Thanh, 2006). On the other hand, it is often used in the psychometric analysis of the developed scales to ensure or validate the scores in the scales in social science research.[15]

The Rasch rating scale model is one of the Rasch measurement models for analyzing the rating scale data, such as the Likert scale data used in this study.[16,17] The application of Rasch measurement manages the ordinal data based on the real nature of unfixed distances between the rating options, for which traditional statistical methods of analyzing the ordinal data using the assumption of Classical Test Theory would not be appropriate. The use of Rasch measurement can convert the ordinal data to an interval scale, which, in logit form, facilitates the comparison of results within and between the items and subjects. Misfit of items or subjects means that their performances are out of the expectation of the model that may confound the construct of the measuring scale. As a data control mechanism, fit statistics assist in the analysis process to include or exclude subjects or items so that the construct of the scale can be ensured. However, it would not be considered as an absolute solution that combining the qualitative analysis of the item text would be crucial to justify on removing the “misfitting” items. [18]

Although all responses to items such as these must be subjective evaluations of the item content (in this case, how important are each of these advanced practices for ICNs), Rasch measures produced from these responses are held to be objective measures in a very important sense. To the extent that the data fulfill the model's requirements, Rasch item measures are independent of the distribution of the underlying latent trait in the sample who provide the data; i.e., they are objective measures, not dependent on the particular nature of that sample.(Andrich, 1988; Bond & Fox, 2015)

Design

The project applied a cross-sectional survey design involving all hospital ICNs in Hong Kong (48 hospitals).

Subjects

The name list of ICNs who belonged to Hospital Infection Control Teams (ICTs) was obtained from the ICNs of service clusters/hospitals in public and private sectors in September 2008. Those whose ranks of registered nurses or higher who had clinical duties in the team were included regardless of their specialty training status or work experience as they were considered to be field practitioners. The line managers who were only involved in managerial duties would be excluded. We also excluded four nurse specialists in infection control who had been involved in previous phases of the study on drafting and establishing the reliability and validity of the proposed core competency list.A total of 117 ICNs were identified, of whom 89 were working in public hospitals and 28 in private hospitals.

Data collection

The questionnaire

Based on the literature review, the proposed core competency list was drafted by experts in infection control, including nurses and doctors in Hong Kong, using the Delphi approach. The list was acceptably unidimensional, with 85.1% of the variance explained by the Rasch model.[16] Cronbach's alpha was 0.98. The content validity index was 0.75 (before splitting into 83 items), with a free-marginal multi-rater Kappa of 0.67.[8] A number of the items were split, creating 83 items from 64 to ensure a clear and single focus message for each item. The 83-item proposed core competency list was transformed into a questionnaire using a randomized sequence of the items. As recommended in the Competency Outcomes and Performance Assessment Model[9], competency items were written as behavioral statements or action statements as proposed by Gonczi[9], to reflect practice-related abilities. This format is simple and clear and the related knowledge, skills and attitudes could be easily further identified for training program development or subsequent testing.[10] As a Likert-style rating scale had been used successfully to validate the questionnaire content in the previous study, a 5-point rating scale with the same structure: (1) Not very important, (2) Not important, (3) Neutral, (4) Important and (5) Very important, was used in this study with a view to subjecting the subsequent data to analysis using the Rasch Rating Scale Model.[11-13] Subjects were asked to rate the level of importance to ICN advanced practice of each of the 83 proposed items, from "not very important" to "very important". Their demographic details were also requested.

The survey

An invitation email was sent to each subject in September 2008. After the subject

accepted the invitation, the questionnaire was then provided by email between 3 September and 30 September 2008. Participants were requested to return the questionnaire by email or fax anonymously within two weeks. A reminder email was sent when the deadline for submitting the questionnaire was approaching.

Data analysis

The frequency and percentage of the subjects' demographic data were summarized using Statistical Product and Service Solutions (SPSS) version 15.0. The ratings on the importance of the core competency items were analysed by the Rasch measurement software, Winsteps 3.61.12[23] to check if the items and persons (subjects) were sufficiently fit to the Rasch model.[16] After diagnosing the misfitting items from the software, further examination of the misfitting items, such as item text, was carried out subsequently before a further decision was made on removing or retaining any "misfitting" items.Principal component analysis of the residuals was conducted using Winsteps to ensure the unidimensionality of the competency scale. Differential item functioning (Mantel Haenszel test) in the Winsteps was used to analyze the significant different patterns of results between meaningful subgroups that may be considered as item biases.

Results

1. Response rate and demographics

A total of 117 ICNs were identified. One could not be contacted. Four of them were unwilling to participate in the survey. In all, 112 questionnaires were sent out and 91 returned, giving a response rate of 81.25% (91/112), representing 77.78% of all ICNs in Hong Kong (91/117). There were no ceiling or floor effects in our subjects, as all the ICNs were included in this study. The subjects were skewed towards

full-time ICNs with work experience of less than the equivalent of five -years, working in public hospitals, acute settings and hospitals with more than 1,000 patient-beds. Table 1 summarizes the demographics of the subjects.

2. Person analysis

Among the 91 subjects, one rated the same extreme category (5) for all the items. Therefore, only the responses from 90 subjects contributed to the analysis, with valid responses of 99.9%. Fifteen (16.5%) were identified as misfitting; 14 of those respondents were trained in infection control. ICN experience in equivalent-years ranged from less than one year to 14 (mean of 3.98 years), with 11 (73.3%) of the misfitting cases having fewer than five equivalent-years of experience. The value of person reliability of the final scale was 0.98. The Cronbach's alpha was 0.99.

3. Item analysis

There were 83 items in the survey list. Three rounds of analyses were conducted until the results were concluded. The summary of analyses included:

1st analysis for 91 persons/ 83 items: 15 persons/ 7 items were found as misfit (Then, 15 misfitting persons were removed)

2nd analysis for 76 persons/ 83 items: 6 misfitting/ 1 marginal fit items were found (Then, context of the 7 misfitting/ marginal fit items (Table 2) were further examined and finally removed)

3rd analysis for 76 persons/ 76 items: all persons/ items fit to the model

The item reliability of the 76-item scale was 0.91. The principal component analysis of residuals showed that 77.3% of the variance could be explained by the model, while only 1.7% of the unexplained residuals were left in the second dimension.

4. Differential item functioning (DIF)

DIF was estimated for:

Experienced (five or more equivalent-years) vs. inexperienced ICNs

Senior vs. junior rank ICNs (Registered Nurse)

ICNs with vs. without master's degrees

Full-time vs. part-time ICNs

ICNs working in acute vs. non-acute hospitals

ICNs working in public vs. private hospitals

No significant DIF contrast was identified between the ICN subgroups of experienced and inexperienced, and those working in acute and non-acute hospitals. However, a total of 14 DIF items (18.4% of the whole scale) were found between the subgroups of junior and senior rank, ICNs with and without master's degrees, full-time and part-time ICNs, and ICNs in public and private hospitals.

Discussion

The final ICN advanced practice core competency scale

Reliability

Regardless of person or item, reliability is considered as very good when the value lies between 0.91-0.94, and excellent if the value is over 0.94 in Rasch measurement.[19] The high item reliability, such as in the finding of this study, means that the order of item estimates is likely to be replicated when using another suitable sample of ICN respondents. Person reliability of Rasch measurement is similar to the "conventional reliability coefficient", Cronbach's alpha. The Cronbach's alpha of the final scale was 0.99, which is up to the common standard of $\geq$ 0.7.[20] In this study, the Cronbach's alpha overestimated the person reliability (0.98) because the extreme person (who rated all items in the same category for the entire questionnaire) had been included in the analysis. Nevertheless, with the above different reliability

estimates, we may conclude that this core competency scale is a reliable measuring scale.

Unidimensionality

To demonstrate unidimensional, the scale should account for a large proportion of variance (more than 60%) with less than 5% of residuals of unexplained variance in the second dimension.[21] The results of our study fit these criteria to show its good construct validity.

Differential item functioning (DIF)

DIF was used to examine whether there were any significantly different patterns of results between meaningful subgroups of ICN respondents. A significant DIF contrast is often defined as half of the standard deviation of the whole scale, which is simple and practical, but no statistics are available to support its significance.[22] In this study, a statistical approach was used. When an item had a DIF contrast of 0.5 logits or larger, the Mantel Haenszel test was used to check for significance.[23] Significant DIF in this study meant that different perceptions of importance on individual items between subgroups. That might be due to the subgroups' different knowledge and educational levels, exposure and practice in that particular area. Although a small number of DIF items were found, it is still acceptably adopting a general core competency scale for advanced practices of ICNs in the issues of education and assessment in view of the practicability as DIFs was spread in different subgroups.

Comparing the content with other overseas competency standards

Apart from various published articles, the proposed core competency list used as the basis to consult ICNs in Hong Kong in this study was developed mainly from the ICN core competency of the United Kingdom[5] and the ICN professional and

practice standards of North America, which was developed by the combined efforts of The Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) and the Community and Hospital Infection Control Association of Canada (CHICA-Canada).[6] During this study period, APIC and CHICA-Canada revised their ICN professional and practice standards in 2008.[7] One component, "occupational health", was added in the revised standard. The contents of each component were slightly adjusted. To compare the results from this present study of the core competencies of Hong Kong ICNs at the advanced practice level with the core competencies/ practice standards of the two infection control pioneer countries, the United Kingdom and North America, we grouped the competency items of each competency list into 15 competency categories. Figure 1 provides a graphic representation of the similarities and differences between the competencies of Hong Kong, United Kingdom and North America. The core competency boundary of each region is represented by one circle. The overlapping areas indicate where they share common competencies. Nine common competency areas of these regions are found (at the centre in Figure 1), including surveillance, programme evaluation, evidence-based practice (including occupational health), education, team and service management (including leadership and quality management), collaboration and partnership, research and development, expert knowledge, and continuing education and professional development. The knowledge demonstration under "professional development" in the North American standard has been extended to include occupational health, emergency preparedness, product evaluation, information technology, legislative issues/ policy making and research. Under "collaboration and partnership", the North American standard further extends the collaboration with other external parties, such as academic entities and community health organizations,

beyond the parties within the organization. Although all the geographic areas cover "surveillance" in their standards, data management is not covered in the United Kingdom's core competency list. To the best of our knowledge, statisticians are hired in the ICT of hospitals in the United Kingdom, so data management and analysis could be excluded from the job of ICNs. Both Hong Kong and the United Kingdom include "outbreak investigation and control" in the ICN advanced practice core competency, but North America only includes knowledge demonstration instead of a list of expected behaviours. Two components are included in the other countries' ICN core competencies/ practice standards respectively, but are not found in Hong Kong's: "financial management" from North America and "patient and public involvement in clinical governance" from the United Kingdom. The distinctive practices between regions are discussed below:

Infection control link person system (Hong Kong)

Infection control link persons are clinical practitioners who liaise between the clinical areas and Hospital ICT to ensure the infection control practices are implemented effectively in their practising units. The Infection Control Link Nurse system has actually been adopted in the United Kingdom, the Netherlands and Portugal.[24] The Infection Control Link Doctor system is a programme used in the United Kingdom and Portugal.[25,26] The influence of the Infection Control Link Nurse network was considered more dominant in different situations, such as educating the ward nurses on new infection control policies, and notifying the ICT about the infected cases or suspicion of infection outbreaks. As an extension of the ICT, the leadership of the ICT is crucial to ensure its success. while absent from the ICN core competency lists of the United Kingdom and North America, "using an infection control link person system" is emphasized in Hong Kong. In the Hong

Kong setting, the ICT even extends these resources and practices to allied health professionals in order to spread the infection control culture more broadly, showing that the infection control link system is considered more important in Hong Kong than in other countries.[27]

Professional competency is influenced by local political, social and economic conditions, health needs, resource availability and the structure of the healthcare system.[28] This study shows that the ICN core competencies in advanced practice of Hong Kong is different from that of other countries.

Financial management in ICT (North America)

In Hong Kong, the ICT in a hospital is generally not a department, but rather a team composed of members of different departments, such as ICNs from nursing services and the Infection Control Officer from the Department of Microbiology or Medicine. As a result, the hospital ICT in Hong Kong usually does not have its own budget. Financial resources are usually managed by the original departments or made available by the relevant hospital committee as required on a project basis. Therefore, financial management is not applicable in the local situation in most of the time. Instead, the skill of preparing proposals with budgets is more appropriate.

Patient and public involvement in clinical governance (The United Kingdom)

Infection control involves patient safety. The World Health Organization and many overseas countries have recently promoted patient and public engagement or empowerment in patient safety.[29-31] However, implementing patient involvement strategies is affected by patient and healthcare worker factors. Patients need to understand their roles and acquire sufficient knowledge and skills, while healthcare workers need to accept input from patients. Mutual support and respect between the two parties are key components in making the strategies work,[32] although, in

practice, unfavourable patient factors such as unwillingness to voice their needs are commonly reported.[33,34] This situation tends to be exaggerated in a Chinese community like Hong Kong, where people often feel shy about expressing their views or articulating their needs. Also, the elderly, who form the majority of patient groups in Hong Kong, usually possess insufficient healthcare knowledge to participate in patient empowerment programmes. Because of their knowledge and skills in healthcare, healthcare workers in Hong Kong are usually perceived by patients and themselves to be in a superior position when it comes to interacting with patients.[35] Thus it is not easy for healthcare workers to accept advice from patients when involving them in clinical governance in the present healthcare setting. Indeed, even though patient groups have been incorporated into hospital management in Hong Kong, it still takes time to spread this culture and practice of listening to the clients to the frontline of healthcare system. Although this competency area has not been included in this version of ICN core competency of Hong Kong, it is inevitably the future direction of education and behaviour modification for our junior healthcare professionals.

Conclusion

The identification of core competencies with specific local features is essentiale. The expert-generated list of core competencies for ICNs in Hong Kong has been refined using Rasch measurement in this study. Items were removed based on the objective analysis provided by Rasch fit indicators to ensure construct validity. The final scale fits the model's unidimensionality requirements well. Data quality is ensured based on item analysis in the model with context analysis. The product is a reliable and valid set of indicators for the local situation, as identified by field practitioners, and could become an important tool to guide the education and assessment of ICNs in

Hong Kong.

The ICN advanced practice core competency of Hong Kong developed in this study involved inputs from both field experts and practitioners. Acceptance of the product by practitioners would be ensured. This enhances the future work on educational and professional development. Core competencies represent the foundation for professional education. With this piece of important work, a practice-based educational programme for ICNs can be developed for preparing the ICNs to perform at the advanced practice level. Even in clinical practice areas, ICN mentors can utilize this core competency list to guide the development of the ICN trainees. As Hong Kong is moving in the direction of certifying Advanced Practice Nurses, the newly-developed core competency list for ICNs in advanced practices may serve as the foundation in this area.

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