Evaluation of the use of the “Natural Disaster Preparedness Scale for Hospital Nursing Departments” tool in Japan

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Abstract

Aim: This study aimed to evaluate the use of the “Natural Disaster Preparedness Scale for Hospital Nursing Departments” tool, before applying it in real health settings.

Methods: The study subjects were representatives of nursing departments in hospitals across Japan and nursing managers in charge of disaster prevention and response within these hospitals. In this two-phased study, 5,093 hospitals were informed about the development of the Scale and invited to test it. Five months later, a questionnaire was sent to these hospitals by postal mail, to seek feedback on their use of the Scale. In the second phase, participants were invited to use an online version of the Scale and provide feedback about it.

Results: Survey responses for Phase 1 were obtained from 1,366 hospitals (26.8%). The uptake of the Scale was extremely limited, with only 5.3% (n = 72) of the hospitals reporting having used it. Sixty-two out of 72 hospitals (86.1%) that had used the Scale answered they would like to use the Scale again. In Phase 2, the Scale was provided online. It was used 214 times by 186 hospitals, and the evaluation items were completed by 29 hospitals that used it frequently.

Conclusions: Implementing systems in Japanese hospitals to measure how nurses prepare for disasters is a complex process. The majority of nurses in Japan remain to be convinced that their disaster preparedness can be measured by a validated Scale. Further education in Japan’s hospitals will be necessary to change these perspectives, given that nurses’ preparation for such emergencies is mandated by law in their role as nurses in disaster base hospitals.

Key words: disaster nursing, disaster preparedness, disaster response, hospital nursing departments, online tool, Japan

INTRODUCTION

Japan is prone to frequent disasters due to natural hazards and because of its topography, geological features, and weather (Cabinet Office, Government of Japan, 2010). After the Great Hanshin Earthquake in 1995, which was centered in Kobe, “disaster base hospitals” were established throughout Japan and disaster response systems were promoted in these hospitals (Yamamoto, 1996). In hospitals, planning for full-scale external rescue services in response to disasters is an ongoing process (Ishihara, 2000; Ohashi, 2008). Hospitals in Japan must continually develop their disaster response strategies (Tokyo Metropolitan Government, undated).

Some of the larger hospitals in Japan, such as disaster base hospitals, have committees working on disaster prevention. These committees play an important role when a disaster occurs, but their methods of preparation for such emergencies are not clear. In fact, there are very few instruments to measure how hospitals (whether disaster base services or other hospitals) prepare for disasters. Existing instruments focus on areas such as construction and quake resistance, or on administrative procedures within the institution (Association for Professionals in Infection Control and Epidemiology/Centers for Disease Control and Prevention, 2001;
Table 1 Summary of disaster preparedness activities

| 1. Plan | Collect information about hospital disaster prevention planning with hazard and risk assessments |
|---------|--------------------------------------------------------------------------------------------------|
|         | Define the nursing department’s role and function                                                    |
|         | Define leaders’ roles and responsibilities during a disaster                                        |
| 2. Organize | Belong to the hospital’s disaster prevention and response committee                              |
|         | Maintain the nursing department’s disaster prevention and response committee                     |
|         | Confirm that contracted services are available to provide necessary resources, personnel, and goods in the event of a disaster |
| 3. Equip | Secure, equip, and check stockpiles of supplies related to different roles within nursing services |
| 4. Train | Educate and train nurses and patients to cope with a disaster                                     |
| 5. Exercise | Participate in joint training with relevant personnel within the hospital and outside of it (such as first responders) |
| 6. Evaluate and improve | Evaluate the nursing department’s functioning through its effectiveness in actual disasters or exercises |

Measuring Japanese nurses’ disaster preparedness

The NDP-Scale is an adaptation of a tool used in the United States of America (USA) that measures how organizations prepare to respond to disasters. Called the “Preparedness Cycle”, this tool was developed by the Department of Homeland Security in 2008. The USA model comprises six activities that encapsulate the disaster preparedness process: plan, organize, train, equip, exercise, and evaluate & improve.

The USA’s Preparedness Cycle was adapted for use in Japan and tested for its validity. Adaption to local conditions was achieved by interviewing nurses working in disaster base hospitals in 2007, reviewing existing checklists and questions used in previous surveys regarding disaster readiness in hospitals, and studying literature on the subject (Nishigami, 2015b). Legitimacy of the NDP-Scale was established through content validity and face validity by experts, a pretest, and by assessment of the reliability and validity of the survey instrument (Nishigami, 2015c).

The NDP-Scale for hospital nurses in Japan consists of six disaster-preparedness activities, with 114 individual items/actions (Nishigami, 2015a, 2014b). Even with this large number of items, pretesting and other data have established that completion of the Scale takes ~25 min (Nishigami, 2015a).

Table 1 demonstrates the types of activities that are covered in the NDP-Scale. To apply the NDP-Scale, users assess their disaster preparedness via four possible measures: 1 (the action is never done), 2 (the action is hardly done), 3 (the action is mostly done), and 4 (the action is done).

An online version of the NDP-Scale has been developed and can be used with a secure login ID and password. The online model has an inbuilt calculation function that provides a disaster preparedness “score” on the basis of individuals’ responses to the six activities (Nishigami, 2014a). The system thus enables individuals’ data, and data within the same institution, to be compared over time. The online model also produces radar chart results for each of the six activities.

METHODS

This study was carried out from May 2015 to December 2015...
2015. The potential study population consisted of nurses employed in 5,093 hospitals in Japan, including ward staff and nurse managers responsible for disaster management and disaster prevention preparation. The 5,093 hospitals were identified in the database of the Welfare and Medical Services Agency (WAM), an independent administrative agency for hospitals in Japan. The database has been used in pilot studies involving the NDP-Scale (Nishigami, 2015c). Nursing department managers or the people in charge of disaster nursing in each hospital were invited to respond to the questions. The study comprised two phases: (1) implementation of a paper-based version of the NDP-Scale and user evaluation; and (2) implementation of an online version of the NDP-Scale and user evaluation.

Phase 1 of the study began in May 2015. An information pack was sent, by postal mail, to nursing department representatives of the 5,093 identified hospitals. The pack included the NDP-Scale, information about its development, instructions on how to access and use it, and an invitation to participate in the study. The study population was allowed 5 months to access and use the NDP-Scale. In October 2015, the nursing department representatives of these same hospitals were invited to report on their use of the NDP-Scale. These nurses were sent a questionnaire by postal mail with a self-addressed envelope for return of the completed questionnaires. The questionnaire consisted of 13 items addressing the following: whether they used the NDP-Scale, how often they used it, what they thought about it (e.g., ease of understanding the questions, ease of understanding the results, the tool’s helpfulness and effectiveness). The questionnaire included closed- and open-ended questions. Based on previous studies (Sugimoto, Aruga, & Shindo, 1998; Minami, 2004; Moriwaki et al., 2004; Manley et al., 2006; Mizushima & Hayashi, 2006; Nishigami & Yamamoto, 2010a, 2010b; Niska & Burt, 2006; Tanaka, Harada, Yoneyama & Ina, 2007; Yoneyama, Tanaka, Harada & Ina, 2007; Nishigami & Yamamoto, 2009), the questionnaire also sought data on the hospitals’ characteristics, including: location, size/bed capacity and whether they were undergoing hospital function evaluation.

Locations were divided into three types: “Low-density population area”, “20 major cities in Japan”, and “Neither of the above”. The “20 major cities in Japan” category refers to those cities in which the population exceeds 500,000. Bed capacity was separated into four categories according to hospital size. “Hospital function evaluation” is a form of accreditation in Japan’s healthcare system, assessing an organization’s entire operations and management, medical and nursing care, as well as safety and security, from a neutral, scientific, and technical perspective (Foundation Japan Council for Quality Health Care, 2016).

In Phase 2, participants were invited to use the online version of the NDP-Scale and evaluate this model. The user evaluation covered: (1) how often the online Scale was used, and the number of responses; and (2) how user-friendly the tool was (ease of understanding the questions, ease of understanding the diagnosis results, and effectiveness and helpfulness of using the tool). The questionnaire included space for user comments for this study. The study was conducted as an anonymous survey.

**Ethical considerations**

This study was performed after obtaining approval from the research ethics committee of the Baika Women’s University (the then author’s academic institution). The participants were informed of the purpose, procedures, and potential publication of this study, as well as their rights of refusal and confidentiality.

**Statistical Analyses**

Based on previous research (Niska & Burt, 2006; Moriwaki et al., 2004; Sugimoto, Aruga & Shindo, 1998), results for the 13 items on hospital characteristics were aggregated by item. IBM SPSS Statistics version 23 (SPSS Inc., Chicago, IL, USA) was used for cross-tabulation and comparison of the 13 items by subject background and online tool use. A chi-squared test was used to compare the 13 items on hospital characteristics and utilization of the online tool. Responses to the open-ended questions were categorized and summarized.

**RESULTS**

**Phase 1**

Responses were obtained from 1,369 hospitals; data from three hospitals were excluded for incompleteness, leaving 1,366 (26.8% of the original sample) to be analyzed. This total included 222 designated, disaster base hospitals. The backgrounds of the respondents are shown in Table 2.

**Use and content of the Scale**

Use of the Scale was limited. Only 5.3% (n = 72) of the 1,366 hospitals reported using the tool, resulting in a much smaller sample than anticipated. Sixty-two out of 72 hospitals (86.1%) that had used the Scale answered they would like to use the Scale again. Those who had used the NDP-Scale found it beneficial; for example, “The question items are useful” (Hospital A); “It tells us
| Variable                          | Total n (%) | Have used the tool n (%) | Have not yet used the tool n (%) | Have never considered using the tool n (%) | Did not know about the tool n (%) | p-value |
|----------------------------------|-------------|--------------------------|----------------------------------|------------------------------------------|----------------------------------|---------|
| **Location (n = 1,361)**         |             |                          |                                  |                                          |                                  | 0.715   |
| Hokkaido and Tohoku              | 222 (16.3)  | 10 (4.5)                 | 37 (16.7)                        | 16 (7.2)                                 | 159 (71.6)                      |         |
| Kanto                            | 334 (24.5)  | 18 (5.4)                 | 61 (18.3)                        | 16 (4.8)                                 | 239 (71.6)                      |         |
| Chubu                            | 184 (13.5)  | 12 (6.5)                 | 36 (19.6)                        | 12 (6.5)                                 | 124 (67.4)                      |         |
| Kinki                            | 211 (15.4)  | 13 (6.2)                 | 32 (15.2)                        | 16 (7.6)                                 | 150 (71.1)                      |         |
| Chugoku                          | 124 (9.1)   | 8 (6.5)                  | 21 (16.9)                        | 7 (5.6)                                  | 88 (71.0)                       |         |
| Shikoku                          | 69 (5.1)    | 0 (0)                    | 17 (24.6)                        | 6 (8.7)                                  | 46 (66.7)                       |         |
| Kyushu and Okinawa               | 217 (15.9)  | 11 (5.1)                 | 31 (14.3)                        | 11 (5.1)                                 | 164 (75.6)                      |         |
| **Bed capacity (n = 1,362)**     |             |                          |                                  |                                          |                                  | 0.018   |
| <100                             | 510 (37.3)  | 16 (3.1)                 | 88 (17.3)                        | 42 (8.2)                                 | 364 (71.4)                      |         |
| 100–199                          | 435 (31.8)  | 27 (6.2)                 | 75 (17.2)                        | 22 (5.1)                                 | 311 (71.5)                      |         |
| 200–399                          | 294 (21.5)  | 19 (6.5)                 | 52 (17.7)                        | 9 (3.1)                                  | 214 (72.8)                      |         |
| ≥400                             | 123 (9.0)   | 10 (8.1)                 | 19 (15.4)                        | 12 (9.8)                                 | 82 (66.7)                       |         |
| **Site location (n = 1,319)**    |             |                          |                                  |                                          |                                  | 0.103   |
| Low-density population area      | 121 (8.9)   | 11 (9.1)                 | 21 (17.4)                        | 12 (9.9)                                 | 77 (63.9)                       |         |
| 20 major cities in Japan         | 299 (21.9)  | 14 (4.7)                 | 59 (19.7)                        | 21 (7.0)                                 | 205 (68.6)                      |         |
| Neither of the above             | 899 (65.8)  | 45 (5.0)                 | 146 (16.2)                       | 50 (5.6)                                 | 658 (73.2)                      |         |
| **Disaster base hospital (n = 1,354)** |         |                          |                                  |                                          |                                  | 0.116   |
| Yes                              | 222 (16.3)  | 17 (7.7)                 | 44 (19.8)                        | 10 (4.5)                                 | 151 (68.0)                      |         |
| No                               | 1132 (82.9) | 54 (4.8)                 | 186 (16.4)                       | 74 (6.5)                                 | 818 (72.3)                      |         |
| **Emergency ward (n = 1,355)**   |             |                          |                                  |                                          |                                  | 0.190   |
| Yes                              | 573 (41.9)  | 37 (6.5)                 | 102 (17.8)                       | 31 (5.4)                                 | 403 (70.3)                      |         |
| No                               | 782 (57.2)  | 34 (4.3)                 | 130 (16.6)                       | 56 (7.2)                                 | 562 (71.9)                      |         |
| **Hospital has disaster-affected experience (n = 1,356)** | | | | | | 0.267 |
| Yes                              | 252 (18.4)  | 19 (7.5)                 | 40 (15.9)                        | 18 (7.1)                                 | 175 (69.4)                      |         |
| No                               | 1104 (80.8) | 52 (4.7)                 | 195 (17.7)                       | 68 (6.2)                                 | 789 (71.5)                      |         |
| **Experience of accepting disaster-injured people (n = 1,356)** | | | | | | 0.160 |
| Yes                              | 299 (21.9)  | 23 (7.7)                 | 47 (15.7)                        | 17 (5.7)                                 | 212 (70.9)                      |         |
| No                               | 1057 (77.4) | 48 (4.5)                 | 186 (17.6)                       | 69 (6.5)                                 | 754 (71.3)                      |         |
| **Disaster rescue experience of nurses (n = 1,362)** | | | | | | 0.005 |
| Yes                              | 510 (37.3)  | 39 (7.6)                 | 97 (19.0)                        | 28 (5.5)                                 | 346 (67.8)                      |         |
| No                               | 852 (62.4)  | 32 (3.8)                 | 139 (16.3)                       | 59 (6.9)                                 | 622 (73.0)                      |         |
| **Undergoing the hospital function evaluation (n = 1,363)** | | | | | | 0.002 |
| Yes                              | 538 (39.4)  | 39 (7.2)                 | 110 (20.4)                       | 33 (6.1)                                 | 356 (66.2)                      |         |
| No                               | 825 (60.6)  | 33 (4.0)                 | 125 (15.2)                       | 54 (6.5)                                 | 613 (74.3)                      |         |
| **Satisfaction with disaster preparedness (n = 1,355)** | | | | | | 0.817 |
| Satisfied                        | 6 (0.4)     | 0 (0)                    | 0 (0)                            | 1 (16.7)                                 | 5 (83.3)                        |         |
| Almost satisfied                 | 252 (18.4)  | 9 (3.6)                  | 45 (17.9)                        | 19 (7.5)                                 | 179 (71.0)                      |         |
| Less satisfied                   | 742 (54.3)  | 43 (5.8)                 | 129 (17.4)                       | 44 (5.9)                                 | 526 (70.9)                      |         |
| Not satisfied                    | 355 (26.0)  | 20 (5.6)                 | 60 (16.9)                        | 22 (6.2)                                 | 253 (71.3)                      |         |
| **Stockpile for disasters (n = 1,360)** | | | | | | 0.725 |
| Yes                              | 212 (15.5)  | 11 (5.2)                 | 35 (16.5)                        | 10 (4.7)                                 | 156 (73.6)                      |         |
| No                               | 1148 (84.5) | 60 (5.2)                 | 200 (17.4)                       | 76 (6.6)                                 | 812 (70.7)                      |         |
| **Total (n = 1366)**             |             |                          |                                  |                                          |                                  | 0.817   |
| Total                            | 72 (5.3)    | 236 (17.3)               | 87 (6.4)                         | 971 (71.1)                               |                                 |         |
what is lacking” (Hospital B); and “It enables objective evaluation” (Hospital C). One respondent (Hospital D) noted that the study provided the respondent’s institution the opportunity to develop its own disaster readiness manual. Other respondents, however, were not so positive. Some reported that they had no time to complete the Scale, it was troublesome to complete, it included difficult content and it had too many items (Hospitals E, F).

A number of respondents (17.3% (n = 236)) stated that they had not used the Scale and gave reasons why. These explanations are similar to the negative impressions of those who did use the Scale: 55.5% (n = 131) stated that they had no time to complete it; 33.1% (n = 78) said that it seemed troublesome to undertake; and 2.1% (n = 5) said that there was no point using the tool. This latter group of non-user respondents reported problems with the Scale itself: the lack of an online version and inconvenience of having to complete a paper questionnaire; a cumbersome registration process (this included maintaining a login ID and password); difficult content; and too many items. Other respondents from this group said that it was not necessary to use the Scale because the institution already had its own manual. Others reported: “We will consider it in the future” (Hospital G); “We have no experience using the Web” (Hospital H); and “There was “poor awareness in the institution” about the Scale “(Hospital I). Two respondents (Hospitals J, K) registered concerns about the reliability of Scale’s online site.

Respondents who reported that they had not considered using the Scale (6.4% n = 87) said they had delayed using it because they were “not at a stage to address it” (Hospital L); they were not good at using the Web, or they did not know about the Scale.

**Locations where the NDP-Scale was used**

Cross-tabulation was used to compare hospital characteristics and utilization of the online tool.

Based on a chi-squared test, the following items showed significant differences in the results: “bed capacity”, “disaster rescue experience of nurses”, and “undergoing the hospital function evaluation” (p < 0.05) (Table 2). The rate of using the Scale was higher in disaster base hospitals, designated emergency hospitals, and critical care centers, although there was no significant difference. The Scale was used most extensively in hospitals with 400 beds or more. Hospitals with the most experience of disasters used the tool more. Hospitals that had undergone hospital function evaluation used the tool more than those that who had not.

**Phase 2**

During the survey period (May to December 2015), of the original sample of 5,093 hospitals, 186 hospitals (3.7%) agreed to participate in Phase 2, which used the online version of the NDP-Scale. The Scale was used at 186 hospitals 214 times with only 29 hospitals (15.6%) responding to the evaluation questions. All of these 29 respondents (100%) believed the tool to be useful. Specific comments from different respondents include: “The tool was useful for our measures” (Hospital I); “It is useful for evaluation” (Hospital J); “It is a chance to take action” (Hospital K); and “It is useful as an information source” (Hospital L). Most respondents (93.1% n = 26) observed that the content was easy to read and that the Scale’s results for individuals were easy to understand.

**DISCUSSION**

This study is believed to be the first, large-scale assessment of how hospital nurses in Japan are prepared to respond to disasters. The Scale is to identify the requisite items for hospital nursing departments for natural disasters and to measure their preparedness. More and detailed education about the Scale’s purpose and operation will be necessary. While systems to prepare hospitals for disasters in Japan have advanced in recent years (Ochi, Kato, Kobayashi, & Kanatani, 2015), not all hospitals are able or willing to participate in the process. This may explain why the response rate in this study was lower than expected. Responses from nurses in this study indicate that Japanese hospitals are busy. Nurses at work are time-poor and have little opportunity for professional education while at work.

There are other explanations for the low response rate. In terms of logistics, it is possible that, in some cases, the information pack did not reach the intended recipient (a disaster nursing nurse). To improve the disaster-preparedness of hospital nurses across Japan, further work with hospitals will be necessary to identify and target who is responsible for developing such activities in each institution, and to establish communication pathways with these individuals.

The form of the questionnaire is likely to have influenced the response rate because use of the Scale in Phase 2 was higher than in Phase 1. Phase 1 required the NDP-Scale to be tested, and evaluated, using a paper-based questionnaire. Japanese nurses’ use of the Internet is known to be high (Kodaka & Nozue, 2007), and in feedback about Phase 1, some respondents who did not use the Scale expressed a preference for an online version.
Despite the low usage of the Scale in Phase 1, many of those hospitals that reported non-use of the Scale did explain why. Many of the hospitals approached were unfamiliar with the Scale, indicating that the accompanying guidance document supplied with it did not achieve its intended purpose. More and detailed education about the Scale purpose and operation will be necessary in a broader roll-out of the Scale.

Previous studies of disaster preparedness (Moriwaki et al., 2004; Niska & Burt, 2006; Sugimoto, Aruga & Shindo, 1998) have determined that better preparation is associated with: (a) greater hospital bed capacity; and (b) those that have undergone hospital function evaluation/accreditation. These findings are reinforced in the present study. For example, usage of the NDP-Scale was higher in Japan’s disaster base hospitals, designated emergency hospitals, and critical care centers. This is not surprising, given that nurses in these hospitals have considerable experience in various forms of disaster relief work and the disaster base hospitals play a specific role in disaster response. Following disasters, the duties of hospital nurses in disaster areas may be taken on by volunteer nurses, members of a disaster medical assistance team, teams sent by the local government or nurses from an associated institution such as the Red Cross, or disaster relief nurses from other locations whose placements are coordinated via the Japan Nursing Association.

Unsurprisingly, usage of the NDP-Scale was higher in hospitals with experience in the face of disasters and also in accepting and treating those injured in disasters. For example, many more evaluation responses came drawn from the Kanto region than other areas. Kanto is heavily populated, with some of Japan’s largest hospitals located there, including: Tokyo, Kanagawa, Saitama, Gunma, Tochigi, Ibaraki, and Chiba Prefectures.

This study sought to understand how facilities themselves were prepared for disasters. It is known that hospitals in Japan have difficulty preparing for disasters in terms of conducting cost-benefit analysis (Kobayashi & Yokomatsu, 2002). In this study, there were no significant differences in the items on disaster countermeasures or supplies for emergencies. This may be related to the NDP-Scale not generally being used, despite being provided to the hospitals. But of concern is that the levels of satisfaction with hospitals’ disaster preparedness was low. Respondents reported that stock available for emergencies was inadequate in more than 80% of cases.

Of the 186 individuals who reported use of the tool, most had used it only once. However, it is possible that the tool was used more often or outside the study period, especially in hospitals, which are accustomed to hospital function evaluation. This form of accreditation has had a significant effect on improving some hospital’s preparedness for disasters in Japan (Foundation Japan Council for Quality Health Care, 2016).

One of the most important results to emerge from this study is that hospital nurses in Japan are busy and cannot find the time to determine their own level of disaster preparedness. The mean time taken to complete the NDP-Scale is 25 min, yet some responders felt that they had no time to do this. Acknowledging that 25 min to assess disaster preparedness is not insubstantial, we know from previous studies (Shiono et al, 2009) that educative processes can prepare people well for disaster situations. It is difficult for hospitals to claim to be “disaster-ready”, when the nurses working within them are not permitted time to educate themselves about disaster response expectations. Furthermore, it is incumbent for hospitals to provide this education time for nurses, given that the role of hospital nurses in disaster response is mandated by Japanese law. Forming disaster nursing committees is one way that this can occur with peer support.

CONCLUSION

This study demonstrates the complexities in introducing a model to measure hospital nursing staff’s preparedness to respond to disasters in Japan. Not only does nurses’ level of preparedness for disasters vary enormously from hospital to hospital, some hospital nurses do not believe that assessing their preparedness is necessary, despite the fact that preparation is mandated in their role as nurses in disaster centers. The limited uptake of the specific tool applied in this study, the NDP-Scale, as a measurement of disaster preparedness shows that, while it is well applied in larger disaster base hospitals, smaller hospitals will need more education about why disaster preparedness is important. A significant challenge in improving nurses’ preparedness for disasters is the lack of time that hospital nurses have for education. Further research in this field could focus on how workplaces can enable nurses to undertake this necessary education and planning.

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DISCLOSURE

The author has no conflicts of interest to declare.

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