Development of a Water-Related Disaster Decision Model for Nurses in Thailand

Ann Jirapongsuwan PhD*,
Andrew J. Englande PhD, PE**, Peter J. Fos PhD***

** Department of Public Health Nursing, Faculty of Public Health, Mahidol University, Bangkok, Thailand*
*** Department of Environmental Health Sciences, School of Public Health and Tropical Medicine, Tulane University, Louisiana, USA*
**** University of New Orleans, Louisiana, USA*

Background: *Disasters, be they natural or manmade, are catastrophic events that confront nursing managers with the challenge of acting to reduce the impact of such events upon society as a whole.*
Objective: *Provide nursing management personnel with a guide organized in such a fashion as to facilitate the decision making process in water related disasters. To develop a model to guide the decision-making process regarding water-related disaster management.*
Material and Method: *The combination of the two-round of modified Delphi method and The Simple Multi-attribute Rating Technique (SMART) was used to develop a decision tool. Thirty-four experts, including nurses, physicians and manager from three hospitals situated in previous disaster zones participated in this project. Delphi consensus was reached when the mean score of agreement was above 4.0 and standard deviation was below 1.0. Kendall's Coefficient of Concordance and the Kruskal Wallis H-test were performed to determine the degree of agreement and association of criteria rankings.*
Results: *The 36 variables were constructed with seven alternatives: policy, communications, materials, human resource management, operation effectiveness, health and stakeholder participation. An agreement in attribute ranking among the experts was found. The trade-off scores of model variables were presented to identify feasible arrays of disaster planning needs.*
Conclusion: *The authors proposed a practical method to develop a decision model based on the input of key individuals in disaster management. The model can be used to guide the decision making for nurse managers resulting in the best practice for water-related disaster management.*

Keywords: *Nursing management, Decision model, Water-related disaster management, Delphi technique, Simple multi-attribute rating technique*

J Med Assoc Thai 2012; 95 (Suppl. 6): S120-S126
Full text. e-Journal: *http://jmat.mat.or.th*

Climate change seems to have led to an increase in the number of floods and windstorms affecting populated areas[1,2]. Resulting death, injury, trauma, disease, infection and psychological issues tend to take their toll on society at large[3].

In Thailand, water-related disasters have been a significant problem. The most frequent event occurring in this decade was flooding[4]. This occurrence has heightened the recognition of the role of nurses in disaster management. However, disasters may cause mass-casualty incidents that limit the ability of the nurse manager to provide nursing management[5]. The magnitude of the hazards and the urgent threat to public health further the importance of having decision makers and management structures in place to deal with the barrage of situations following major disasters. In order to better prepare nursing decision makers and enhance their capacity, guidelines for management must be developed to allow the nurse to respond to the disaster at hand. In Thailand, however, there are no standards specifying guidelines for water-related disaster preparedness and response. Also, there is little known about nursing management pertaining to water-related disasters. The present study was designed to develop such a model to optimize preparedness and respond to mass casualty operations. The results also provided nursing executives with a systematic procedure for developing a management model in the

Correspondence to:
Jirapongsuwan A, Department of Public Health Nursing, Faculty of Public Health, Mahidol University, Ratchathewi, Bangkok 10400, Thailand.
Phone & Fax: 0-2354-8542
E-mail: ann.jir@mahidol.ac.th

chaotic events of disasters. Also, the decision model will be used to guide management of Thai nurses which could result in the best practices for water-related disaster preparedness and response.

Material and Method

Design

The methodology of the present study consisted of two phases:

Phase 1) The development of disaster preparedness and response variables: The two-round modified Delphi method was used to obtain a consensus on experts' opinions of the decision variables through a series of questionnaires. The value of this method is its ability to generate ideas to stimulate a consensus of expert opinions[6-8].

Phase 2) The development of a scoring system for the decision model: The Simple Multi-attribute Rating Technique (SMART) was applied to establish the decision model[9]. This approach requires that the selection be made among decision "alternatives" described by their "attributes". The alternative refers to options or choices for selection. The attributes serve as the performance measures for the application. Then system scoring, by assigning weights called the "direct ranking and rating" method[10], were developed. In direct ranking, experts were asked to rank variables regarding their relative importance; the variables were ranked from most to least important.

Once variables were ranked, they were arranged according to their relative importance, called the direct rating method. The least important variable is assigned a value weight, usually 10[10]. The relative importance of the other variables is evaluated by comparing in a pair-wise manner based on the relative importance of each variable in the pair with respect to disaster management. Finally, the weight was normalized for each alternative and attribute. Normalizing the weights refers to adding all the individual weights provided by each expert and then dividing each weight by that sum[10]. Once the weights were normalized, the weight of each variable was depicted on the decision tree illustrated for water-related disaster preparedness and the response decision tree.

Setting

The present study was conducted in the three hospitals located in previously affected areas and were classified as a general hospital (equipped with 200 to 500 inpatient beds) or a regional hospital (equipped with over 500 inpatient beds).

Delphi panel

The Delphi panel was purposively selected upon individual expertise and knowledge[7,11] which had been experienced in healthcare management/activities in water-related disaster preparedness and response. A total of 36 individuals met the criteria to qualify as an expert. After the two-rounds to modify the Delphi method, the 34 remained experts including 28 nurses, 5 physicians and 1 manager who participated in phase two. With the approval from Tulane University's Institutional Review Board for the protection of human subjects, the researcher personally met with qualified individuals, provided them with information about the study and asked them to give consent of intention to participate in the present study.

Material and procedure

The research instruments for phase one was Delphi questionnaires. The Round one interview questionnaire had a list of potential management variables developed from literature concerning disaster management. The variables were stated as a single-statement format of a five-point Likert scale: 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), 5 (strongly agree). The Round 2 questionnaires duplicated the statements created for the Round one questionnaire along with the additional statements added from the experts. Each statement of the Round 2 questionnaires included the expert's own previous Round 1 rating as well as the mean and standard deviation for that item. The Phase 2 questionnaire asked the experts to develop a scoring system by ranking and rating the alternatives and attributes.

Statistical analysis

In phase 1 of the Delphi process, the mean and standard deviation were used to determine consensus and defined it as the level of the mean score above 4.0 and standard deviation below 1.0. In phase 2, the Kendall's coefficient of concordance (W) test was used to measure the degree of correlation among experts. The Kruskal-Wallis H-test was performed to measure the association in ranking of variables elicited from different groups of experts[12].

Results

The majority of experts were female (85%). The mean number of years spent in the health care profession was about 25. With respect to the highest level of education, the majority of them possessed a bachelor's degree (41.18%), followed by a master's degree (38.24%) and doctoral degree (17.65%). Nearly 50% of the experts were certified in hospital/nursing management. The average number of times the experts had experience in water-related disaster management was 2.68. The greatest number of times the experts participated in such management was 20, with the least number of times reported as 1. Roles and responsibilities of participants with previous disaster management experience included 82.35% as team leaders with 76.47% having had experience with human resource management.

The responses offered by all 36 experts to the Round one interview contained a total of 281 statements-117 for pre-disaster variables, 91 for during disaster variables and 73 for post-disaster variables. Using the lists generated, a list of variables was compiled by grouping and synthesizing any variable duplication. This process permitted the variables proposed by the experts to be condensed to 95 statements. These variables were employed in Round 2. The evaluation of Round 2 revealed that there was consensus reached among the 34 remaining experts for 78 of the 95 statements, including 26 pre-disaster variables, 29 during disaster variables and 23 post-disaster variables. Once the two rounds of the Delphi method were completed, the 78 statements of pre-disaster, during disaster and post-disaster were organized into 36 variables. These variables were categorized into seven alternatives.

After meeting with experts in Round three, the value tree was framed (Fig. 1). The larger the numerical value of this result, the better the variable. The weights within each variable refer to the average of the normalized weight of the individual expert weights. The trade-off scores on the right most branch of the decision tree are the average of the adjusted scores (multiplying two sets of "alternative" normalized weights and "attribute" normalized weights for each individual expert). For example, the public awareness of disaster tradeoff-score of 0.0269 was measured from multiplying the human health alternative normalized weight of 0.0903 and the public awareness of disaster attribute normalized score of 0.2981. Trade-off scores are necessary to make the judgments in any decisions regarding preferences among variables. The higher trade-off score presents the more important of the variable.

Table 1 presents the results on the relative importance of the alternatives and attributes determined by experts through the process of pairwise comparison.

Goal	Alternatives		Attributes		Trade-off scores	
			Public awareness of disaster	W_{HH1} = 0.2981	$W_{HH} * W_{HH1}$	= 0.0269
			Physical health problems	W_{HH2} = 0.4170	$W_{HH} * W_{HH2}$	= 0.0377
			Mental health problems	W_{HH3} = 0.0918	$W_{HH} * W_{HH3}$	= 0.0083
	Health	W_{HH} = 0.0903	Public ability of primary health care	W_{HH4} = 0.0925	$W_{HH} * W_{HH4}$	= 0.0084
			Infectious diseases	W_{HH5} = 0.0602	$W_{HH} * W_{HH5}$	= 0.0054
			Environmental health problems	W_{HH6} = 0.0227	$W_{HH} * W_{HH6}$	= 0.0021
			Socioeconomic problems	W_{HH7} = 0.0082	$W_{HH} * W_{HH7}$	= 0.0007
			Continuum health care	W_{HH8} = 0.0094	$W_{HH} * W_{HH8}$	= 0.0009
			Process owner	W_{OE1} = 0.3576	$W_{OE} * W_{OE1}$	= 0.0342
			Operational planning	W_{OE2} = 0.1458	$W_{OE} * W_{OE2}$	= 0.0139
			Drills	W_{OE3} = 0.0319	$W_{OE} * W_{OE3}$	= 0.0030
	Operation effectiveness	W_{OE} = 0.0956	Cost effectiveness	W_{OE4} = 0.0069	$W_{OE} * W_{OE4}$	= 0.0007
			Food/supplies for nurses	W_{OE5} = 0.0828	$W_{OE} * W_{OE5}$	= 0.0079
			Severity of event	W_{OE6} = 0.0194	$W_{OE} * W_{OE6}$	= 0.0019
			Leadership abilities	W_{OE7} = 0.3555	$W_{OE} * W_{OE7}$	= 0.0340
Optimal Health Outcome	Human resource management	W_{MM} = 0.1415	Maintaining adequate manpower	W_{MM1} = 0.4608	$W_{MM} * W_{MM1}$	= 0.0652
			Physical health and security of nurses	W_{MM2} = 0.2179	$W_{MM} * W_{MM2}$	= 0.0308
			Mental health of nurses	W_{MM3} = 0.2618	$W_{MM} * W_{MM3}$	= 0.0370
			Knowledge and skills in disaster Response	W_{MM4} = 0.0594	$W_{MM} * W_{MM4}$	= 0.0084
			Communication equipment	W_{C1} = 0.3718	$W_C * W_{C1}$	= 0.0567
	Communications	W_C = 0.1524	Internal communication	W_{C2} = 0.0734	$W_C * W_{C2}$	= 0.0112
			External communication	W_{C3} = 0.2068	$W_C * W_{C3}$	= 0.0315
			Incident command center - 24 hrs	W_{C4} = 0.3479	$W_C * W_{C4}$	= 0.0530
			Medical equipment and supplies	W_{M1} = 0.3294	$W_M * W_{M1}$	= 0.0170
	Materials	W_M = 0.0516	Transportation and logistics	W_{M2} = 0.3149	$W_M * W_{M2}$	= 0.0162
			Personal protective equipment	W_{M3} = 0.2972	$W_M * W_{M3}$	= 0.0153
			Information system for data collection	W_{M4} = 0.0592	$W_M * W_{M4}$	= 0.0031
			Nurse participation in hospital policy development	W_{P1} = 0.3047	$W_P * W_{P1}$	= 0.1284
	Policy	W_P = 0.4215	Nurse participation in local policy development	W_{P2} = 0.3543	$W_P * W_{P2}$	= 0.1493
			Disaster management policy	W_{P3} = 0.1962	$W_P * W_{P3}$	= 0.0827
			Policy announcements	W_{P4} = 0.1450	$W_P * W_{P4}$	= 0.0611
			Knowledge and skills of volunteers in health care	W_{SP1} = 0.1480	$W_{SP} * W_{SP11}$	= 0.0070
			Stakeholder involvement	W_{SP2} = 0.0574	$W_{SP} * W_{SP2}$	= 0.0027
	Stakeholder participation	W_{SP} = 0.0471	Stakeholder participation in hospital disaster planning	W_{SP3} = 0.1758	$W_{SP} * W_{SP33}$	= 0.0083
			Public acceptance	W_{SP44} = 0.0531	$W_{SP} * W_{SP44}$	= 0.0025
			Public announcements	W_{SP5} = 0.5655	$W_{SP} * W_{SP55}$	= 0.0266

Fig. 1 Value tree and trade-off scores

At the agreement level of 0.05, it is concluded that there is an agreement among the thirty-four experts with respect to how they ranked the relative importance of the model variables.

Table 2 reflects Kruskal-Wallis H-test results with a significant level at 0.05. It may be concluded from the data when comparing the median ranked priorities of alternatives and attributes among the three hospital experts, there is no statistical significance for any of the variables. This result indicates the experts' agreement in variable rankings among the three hospitals.

Discussion

The two rounds of modified Delphi method were applied to establish consensus among experts regarding their expertise and knowledge in water-related disaster management. This made it possible to receive information and comments from some of the most influential and experienced Thai nurses, physicians and managers in hospitals located in previously affected areas. More than 80% of experts were experienced in the role of team leader for previously water-related disaster management cases. Hasson et al asserted that expertise and knowledge of the subject matter are the most important criteria for the Delphi study participant[11]. Furthermore, the selection of the experts in the present study was in accordance with Powell's statement that "experts should be chosen for their work in the appropriated area and credibility with the target audience[7]".

The alternative and attribute ranks provided support to the decision makers as important determinants of water-related disaster planning. Those variables with higher ranks should be initially selected for improvement[13]. Findings were similar to the studies of Nateghi-Alahi and Izadkhah[14] and Kusumasari, Alam and Siddiqui[15] in disaster management. However, the guideline for disaster management model for the health sector in Manitoba, Canada[16] indicated three more different variables. These variables included hazard assessment, risk assessment and monitoring and evaluation. In this finding decision model, much of the attention was rightly focused on the policy which was ranked the most important variable. This is not surprising in the context of developing countries, including Thailand which is in an early stage of disaster nursing management development. This finding was supported by the present study of Manyena that where a number of departments or agencies are involved, it is essential to have a policy in place, as it serves as a framework for action by all relevant departments[17].

Communication was the second ranked variable. During a disaster, information needs differ from those prevailing within conditions of normal operation. The finding of Trim supported communication is one of the key elements of successful disaster management[18]. Human resource management was in the top three variables. In health care, human resource management ensures effectiveness and quality in staff performance to meet the health services' objectives. This finding was similar to the suggestions of Gebbie and Qureshi[19] wherein they stated that emergency preparedness meant having the right people with the right skills available at the right time.

It was surprising that health was the fifth ranked variable. Prior to the present study, the authors would have theorized that health would be ranked highest in importance. However, interviews with both nurses and physicians revealed that nurses work within the parameters of the Nurse Practice Act to provide physical and psychological care to individuals. Nursing

Table 1. Kendall's Coefficient of Concordance (W) among the three hospital experts in variable rankings (k = 34)

Variables	n	df	Kendall's	Chi-square	p-value
Alternatives	7	6	0.33	66.47	<0.001*
Attributes					
Health	8	7	0.47	112.49	<0.001*
Operational effectiveness	7	6	0.43	87.12	<0.001*
Human resource management	4	6	0.52	53.05	<0.001*
Communications	4	3	0.39	39.32	<0.001*
Materials	4	3	0.52	52.84	<0.001*
Policy	4	3	0.10	9.28	0.026*
Stakeholder participation	5	4	0.19	25.72	<0.001*

* Significant at the 0.05 level

Table 2. Kruskal-Wallis H-test of variables for experts' agreement among the three hospitals (df = 2)

Variables	Chi-square	p-value
Alternatives		
Health	4.12	0.128
Operational effectiveness	0.73	0.695
Human resource management	5.61	0.061
Communications	4.96	0.084
Materials	0.97	0.615
Policy	0.91	0.636
Public acceptance/Stakeholder involvement	4.49	0.160
Health		
Public awareness of disaster	1.00	0.607
Physical health problems	1.89	0.389
Mental health problems	4.94	0.085
Public ability of primary health care	4.83	0.090
Infectious diseases	0.80	0.671
Environmental health problems	5.40	0.067
Socioeconomic problems	0.52	0.773
Continuum health care	1.36	0.508
Operational effectiveness		
Process owner	0.128	0.812
Operational planning	0.695	0.266
Drills	0.061	0.369
Cost effectiveness	0.084	0.176
Food/Supplies for nurses	0.615	0.367
Severity of event	0.636	0.540
Leadership abilities	0.106	0.793
Human resource management		
Maintaining adequate manpower	1.71	0.425
Physical health and security of nurses	0.80	0.671
Mental health of nurses	1.28	0.527
Knowledge and skills in disaster response	4.08	0.130
Communications		
Communication equipment	2.10	0.350
Internal communication	0.04	0.982
External communication	3.43	0.180
Incident command center-24 hrs	4.04	0.133
Materials		
Medical equipment and supplies	2.59	0.274
Transportation and logistics	0.28	0.868
Personal protection equipment	1.06	0.590
Information system for data collection	0.18	0.915
Policy		
Nurse participation in hospital policy development	2.26	0.323
Nurse participation in local policy development	0.07	0.966
Disaster management policy	1.15	0.564
Policy announcements	2.07	0.354
Stakeholder participation		
Knowledge and skills of volunteers in health care	3.04	0.219
Stakeholder involvement	1.84	0.400
Stakeholder participation in hospital disaster planning	0.20	0.904
Public acceptance	0.07	0.966
Public announcements	2.51	0.285

theories are the bases for professional nursing practice presented in the nursing metaparadigm including four basic concepts: person; health; environment; and nursing. These concepts have been routinely used as a framework of nursing care in variety contexts. It's of special concern that stakeholder participation was given the lowest weight of importance. More significance has been focused on the preparation and response within the hospital itself. However, Manley et al[20] stated that collaboration between local entities is required to ensure effective preparedness. Therefore, to successfully implement a disaster preparedness and response program, the stakeholder participation should be considered[21]. As the literature supports, questions still remain as to the appropriate level and ways of community participation for water-related disaster management[22]. However, the present study is limited to the field of nursing. It is limited to water-related disaster preparedness and response in the context of Thailand. Also, results reflect the opinion of those surveyed.

Conclusion

In Thailand, like most developing countries, on-going disaster nursing management is reactive. Although decision makers did their best to perform their duties, their lack of disaster decision-making tools and the lack of a disaster management systems prevented them from achieving productive results. The contingency disaster preparedness and response plans must be formulated if effective disaster preparedness and response is to be realized. The present study proposed an integrated approach to develop a decision model for nurses. Results provide useful information, strategic direction and meaningful operational guidance to decision makers regarding disaster management planning.

Potential conflicts of interest

None.

References

1. Guha-Sapir D, Vos F, Below R, Ponserre S. Natural disaster impacts by disaster sub-group:
2. 2010 versus 2000-2009 annual average. In: Guha-Sapir D, Vos F, Below R, Ponserre S, editors. Annual disaster statistical review 2010: the numbers and trends. Brussels: CRED; 2011: 21-32.
3. Guha-Sapir D, Hargitt D, Hoyois P. A look behind the numbers. In: Guha-Sapir D, Hargitt D, Hoyois P, editors. Thirty years of natural disasters 1974-2003: the numbers. Louvain-la-Neuve, Belgium: Press Universitaires de Louvain; 2004: 13-6.
4. World Health Organization. Flooding and communicable diseases fact sheet: risk assessment and preventive measure [Internet]. Geneva: WHO; 2007 [cited 2007 Mar 30]. Available from: http://helid.digicollection.org/pdf/s8231e/s8231e.pdf
5. Center for Research on the Epidemiology of Disasters. Country profile for the natural disasters [Internet]. Brussels: The OFDA/CRED International Disaster Database; 2007 [cited 2007 Mar 20]. Available from: http://www.emdat.be/result-country-profile
6. Mcilfatrick SJ, Keeney S. Identifying cancer nursing research priorities using the Delphi technique. J Adv Nurs 2003; 42: 629-36.
7. Powell C. The Delphi technique: myths and realities. J Adv Nurs 2003; 41: 376-82.
8. Price B. Delphi survey research and older people. Nurs Older People 2005; 17: 25-31.
9. Kiker GA, Bridges TS, Varghese A, Seager PT, Linkov I. Application of multicriteria decision analysis in environmental decision making. Integr Environ Assess Manag 2005; 1: 95-108.
10. Fos PJ, Zuniga MA. Assessment of primary health care access status: an analytic technique for decision making. Health Care Manag Sci 1999; 2: 229-38.
11. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. J Adv Nurs 2000; 32: 1008-15.
12. Lorenzo AB, Blanche CA, Henson JF. Concordance among extension workers, researchers, and professional arborists in rating landscape trees. Journal of Extension [Internet] 2003 Oct [cited 2007 Mar 30]; 41(5): [about 12 p.]. Available from: http://www.joe.org/joe/2003october/rb2.php
13. Fos PJ, Miller DL, Amy BW, Zuniga MA. Combining the benefits of decision science and financial analysis in public health management: a county-specific budgeting and planning model. J Public Health Manag Pract 2004; 10: 406-12.
14. Nateghi-Alahi F, Izadkhah YO. Earthquake disaster management planning in health care facilities. Disaster Prev Manag 2004; 13: 130-5.
15. Kusumasari B, Alam Q, Siddiqui K. Resource capability for local government in managing disaster. Disaster Prev Manag 2010; 19: 438-51.
16. Manitoba Health Disaster Management. Guideline for disaster management model for the health sector: guideline for program development.

Manitoba, Canada: Government of Manitoba; 2002.
17. Manyena SB. Rural local authorities and disaster resilience in Zimbabwe. Disaster Prev Manag 2006; 15: 810-20.
18. Trim PRJ. An integrative approach to disaster management and planning. Disaster Prev Manag 2004; 13: 218-25.
19. Gebbie KM, Qureshi K. Emergency and disaster preparedness: core competencies for nurses. Am J Nurs 2002; 102: 46-51.
20. Manley WG, Furbee PM, Coben JH, Smyth SK, Summers DE, Althouse RC, et al. Realities of disaster preparedness in rural hospitals. Disaster Manag Response 2006; 4: 80-7.
21. Said AM, Ahmadun F, Mahmud AR, Abas F. Community preparedness for tsunami disaster: a case study. Disaster Prev Manag 2011; 20: 266-80.
22. Osti R. Forms of community participation and agencies' role for the implementation of water-induced disaster management: protecting and enhancing the poor. Disaster Prev Manag 2004; 13: 6-12.

การพัฒนาแบบจำลองการตัดสินใจต่อภัยพิบัติทางน้ำสำหรับพยาบาลในประเทศไทย

แอนน์ จิระพงษ์สุวรรณ, *Andrew J. Englande, Peter J. Fos*

ภูมิหลัง*: ภัยพิบัติเป็นความหายนะที่ท้าทายผู้บริหารการพยาบาลในการดำเนินการที่เกี่ยวข้องกับสุขภาพและผลกระทบที่เกิดขึ้น*

วัตถุประสงค์*: เพื่อออกแบบจำลองเพื่อเป็นแนวทางในการตัดสินใจในการจัดการภัยพิบัติทางน้ำ*

วัสดุและวิธีการ*: การพัฒนาเครื่องมือการตัดสินใจใช้เทคนิคโมดิฟายด์ เดลฟาย และเทคนิคการเปรียบเทียบหลายคุณลักษณะอย่างง่าย ผู้เชี่ยวชาญ 34 คน ประกอบด้วยพยาบาล แพทย์ และผู้บริหารของโรงพยาบาล 3 แห่งในพื้นที่ที่เคยได้รับผลกระทบจากภัยพิบัติทางน้ำ ฉันทามติของผู้เชี่ยวชาญกำหนดที่ระดับคะแนนความคิดเห็นเฉลี่ย 4.0 และค่ามัธยฐาน 1.0 สถิติที่ใช้เพื่อทดสอบความเห็นพ้องต้องกันและความสัมพันธ์ของการจัดลำดับตัวแปรคือ Kendall's Coefficient of Concordance และ Kruskal Wallis H-test*

ผลการศึกษา*: ตัวแปรจำนวน 36 ตัวแปร ถูกสร้างเป็น 7 ทางเลือก ประกอบด้วย นโยบาย การสื่อสาร วัสดุอุปกรณ์ การจัดการทรัพยากรบุคคล ความสำเร็จในการดำเนินการ ภาวะสุขภาพ และการมีส่วนร่วมของผู้เกี่ยวข้อง นอกจากนี้ยังพบความเห็นพ้องต้องกันในการเรียงลำดับคุณลักษณะตามความคิดเห็นของผู้เชี่ยวชาญ ค่าคะแนนการวิเคราะห์เปรียบเทียบของแบบจำลองที่ได้จากการศึกษานี้นำไปใช้ในการจำแนกความเป็นไปได้ในการวางแผนภัยพิบัติตามความต้องการ*

สรุป*: ผู้นิพนธ์นำเสนอวิธีการพัฒนาแบบจำลองการตัดสินใจที่สร้างจากความคิดเห็นของผู้ให้ข้อมูลที่มีส่วนสำคัญในการจัดการภัยพิบัติ แบบจำลองนี้สามารถใช้เป็นแนวทางการตัดสินใจสำหรับผู้บริหารการพยาบาล เพื่อนำไปสู่ความเป็นเลิศในการจัดการภัยพิบัติทางน้ำ*