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Original Article

Development of the Chinese Version of Nurses' Perception of Risk Factors for Injurious Falls and a Pilot Study

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SUMMARY

Background: Patient falls have nursing-sensitive outcomes, and nurses have a unique role in preventing them. We adapted the USA questionnaire to the Chinese version to understand the views of Taiwanese nurses on the risk factors for injurious falls.
Methods: This study was divided into two phases. In the first phase, based on Tzeng & Yin's English questionnaires of the Injurious Fall Risk Factors and Fall Prevention Interventions Survey, we translated and developed Chinese questionnaires that were culturally sensitive. The second phase, a cross-sectional study with purposive sampling, collected nurses' views on risk factors for injurious falls in Taiwan.
Results: The Chinese version of the questionnaire has two more items than the original, namely "use of non-narcotic analgesics" and "no caregiver accompaniment," content validity index (CVI' Expert Validity): CVI = 0.88, and internal consistency reliability: Cronbach's α = 0.98. Of 225 registered nurses, 220 (97.8%) were females, 70.7 % (n = 159) were aged 25–45 years, mean work experience was 8.28 years, and 86.7% (n = 195) received fall prevention education within a year. Among the frequent risk factors, 70% were associated with diseases and physical status. Out of the top 10 most preventable risk factors, 4 each were environment-related and improper or defective equipment use-related.
Conclusion: The two additional risk factors in Taiwan may be because of differences in medication policy, drug use habits, and patient companionship culture between Taiwan and United States. The development process of this questionnaire and the topics of cultural differences discussed can be used as references for developing culturally adaptive questionnaires.

1. Introduction

Falls are the most common inpatients safety accidents and are important reference markers used for quality care in institutions. A World Health Organization (WHO) survey reveals around 37.3 million people yearly suffer fall injuries that require treatment worldwide.[1] In USA, this incidence is around 3.3%–11.5%[2] and around 50% of inpatients are at risk of falling. 30%–50% of all inpatient falls lead to injuries.[3] In Taiwan, the incidence of inpatient falls 22.6%.[4] Among them, 30%–35% of patients were injured. Inpatient fall accidents not only prolong the length of hospitalization but also increase medical expenditure.[5] Therefore, fall prevention is extremely important.

Fall risk factors are complex and diverse. On average, every fall patient may have 7–9 fall risk factors. The 2012 WHO report on Global Falls Prevention in Older Age classified risk factors as biological, behavioral, environmental, and socioeconomic.[1]

Biological risk factors include age, gender, ethnicity, and body aging, such as female gender, old age, unsteady gait, and reduced daily activities. Patients with a history of falls, poor mental state, insomnia, lower limb weakness, and unstable blood pressure have increased risk and incidence of falls.[8,9]

Behavioral risk factors include sedative and sleeping drugs, anti-convulsant drugs, anti-hypertensive drugs, blood glucose-lowering drugs, and non-blood pressure lowering diuretics.[10,11] Additionally, this risk is increased in the elderly if appropriate correction measures are not taken or inappropriate corrective measures are taken with decreased vision and hearing due to aging.

Environmental factors include overly high bed, lack of guard rails, lack of auxiliary equipment, lack of supporting facilities for bath tub and toilet, poor environmental design, wet floor, cracked flooring, uneven corridor, and poor illumination.[9]

Socioeconomic risk factors can be classified as personal and social background factors that include low income, low education level, lack of social interactions, inaccessible health, social care services, and social resources. Shuman et al. (2019) found that older people with low social participation and malnutrition have a higher incidence of falls.[12]

In hospitals, the most common fall prevention measures include installation of bedside alarms, increasing the frequency of patient checkups, employing temporary caregivers, arranging patients to be admitted to wards near nursing stations, and limiting physical activities in patients.[13] Elderly patients account for a majority of

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inpatients. In addition to physical discomfort caused by diseases, elderly inpatients also face an unfamiliar environment. Therefore, they are more prone to accidents, and prevention of accidents in the elderly is especially important in hospitals. Kalu et al. (2019) found that improving the medical staffs' awareness of falls can decrease the incidence of falls.[14] This study further developed the USA questionnaire to adapt it to the Taiwan Chinese version; in addition, the questionnaire was used to conduct a pilot study to understand the views of Taiwanese nurses on the risk factors for falls.

2. Materials and methods

2.1. Design

This research was divided into two phases. In the first phase, we developed culturally sensitive Chinese questionnaires based on Tzeng & Yin's (2013) English questionnaires of the Injurious Fall Risk Factors and Fall Prevention Interventions Survey (IFRF).[15] In the second phase, nurses' views on risk factors for injurious falls were collected using a cross-sectional study with purposive sampling in Taiwan.

2.2. Phase 1: Development of a culturally sensitive Chinese questionnaire

The tool used in this study was developed by modifying part I of IFRF by Tzeng & Yin (2013).[15] The IFRF consisted of three parts: Part 1 included 81 risk factors that could lead to injurious falls in adult inpatients and was used to understand the registered nurses (RNs)' perception of their associated frequency and effective preventive measures. Part 2 listed 75 fall prevention measures for adult inpatients to understand the frequency at which RNs performed these measures and effective preventability. Part 3 involved personal and work information of the subjects, such as age, work experience, type of ward, and education on falls prevention. For details on the development and reliability of this questionnaire, please refer to the study by Tzeng & Yin (2013).[15]

Part 1 contained 81 questions on risk factors for injurious falls, including the frequency of injurious fall risk factors in adults and was used to understand the RN's perception of their associated frequency and effective preventive measures. The questions included: age, balance, muscle strength, mobility, awareness, diseases, and fall history. A 5-point Likert scale was used to assess the frequency of injurious fall risk factors. Subjects selected the frequency of risk factors causing injurious falls based on their nursing experience with 1 = rarely, 2 = occasionally, 3 = sometimes, 4 = often, and 5 = always. In the "effective preventability" section, the RNs assessed the effectiveness for each risk factor in causing injurious falls after appropriate preventive measures were taken based on their care experience. A 5-point Likert scale was used, with 1 = rarely effective, 2 = occasionally effective, 3 = sometimes effective, 4 = often effective, and 5 = always effective.

2.2.1. Translation of the Chinese version of IFRF

There were five steps as described in the following section: Step 1: Forward translation of the original English version to Chinese (version C1) by a bilingual RN with a Ph.D. degree; Step 2: A review of the C1 performance by four professionals (two in nursing, one rehabilitation physician, and one physical therapist); Step 3: According to the results of step 2, another three health professionals revised the C1 version and suggested the C2 version (one supervisor, one head nurse, and one staff nurse); Step 4: Backward translation of C2 by a bilingual RN who was "blinded" to the original English version; Step 5: Comparison of the original and back-translated version and sending it to the original author who developed.[16]

2.2.2. Reliability and validity

We use the content validity index (CVI) and internal consistency reliability (Cronbach's α) to evaluate the reliability and validity of questionnaires.

The CVI evaluates the questionnaire's content and invites experts to rate and comment on its "importance and applicability" item by item. The following four scoring standards were adopted: 1 = very unimportant and inappropriate, 2 = inappropriate, 3 = appropriate, 4 = very appropriate. The CVI for each question (the number of experts with 3–4 points/total number of experts) is calculated.

The overall CVI (CVI for each question/total number of questions) is subsequently calculated and results ≥ 0.8 are considered.

The scale reliability uses Cronbach's α to test for internal consistency. The higher the coefficient, the better the reliability (≥ 0.7).

2.3. Phase 2: Conducting a pilot study to reveal the nurses' perception on risk factors for injurious falls

2.3.1. Settings and sampling

Purposive sampling was used to enroll nurses from the internal medicine, surgical, obstetrics, gynecology, oncology, and intensive critical care units in two acute care hospitals in Taiwan. All subjects met the following criteria: worked as a nurse in adult inpatient wards, aged $\geq$ 21 years, with $\geq$ 1 year of working experience, a full-time staff, worked at least 20 hours on average per week, provided direct care for patients, and possessed a nurse practice license.

2.3.2. Study procedures

After review and approval by the Institutional Ethics Committee (IRB: 12MMHIS172), approval was obtained from the receiving hospital. In Taiwan, from December 2012 to February 2013, the investigator explained the study to the head nurse before obtaining consent from the subjects. Next, the investigator provided a consent form and questionnaire to the study participants. Each ward invited a nurse to assist in the distribution and collection of the questionnaire, as well as to remind the participants to check the completeness of the questionnaire, and then provided a gift to all the participants.

2.4. Data analysis

The SPSS 20.0 statistical software (IBM Corp., Armonk, NY, USA) was used for data processing. First, the mean values and standard deviation of the frequent risk factors and preventable risk factors for injurious falls were calculated (based on the original study). The top 10 of the 81 questions with the highest frequencies for risk factor for injurious falls perceived by RNs were then ranked according to the mean values to compare differences. The analysis method for preventable risk factors was the same as that used for the frequency of the risk factors.

3. Results

After five steps of translation, seven clinical experts were invited to ensure cultural sensitivity and completeness of the Chinese version; these included one rehabilitation physician, one physical therapist, one supervisor, one head nurse, and one staff nurse in hospitals, and two nursing professors. There are 83 questions in the

Chinese version. The clinical experts suggested adding two more questions of "use non-narcotic analgesics" and "no caregiver accompaniment" to the Chinese version in step 3.

Seven experts (nursing, rehabilitation physicians, and physical therapists) in total were invited to rate the importance and applicability of the questionnaire after completion of the expert validity analysis (CVI: 0.88). Thirty RNs met the inclusion criteria and were invited to participate in the study. The internal consistency (Cronbach's $\alpha = 0.98$) was good.

Among the 225 RNs (recruited from 34 wards), 90.8% (n = 220) were female, mean work experience was 8.28 years, most nurses (70.7%) were in the age group of 25–45 years, 77 RNs (34%) worked in medical wards, 56 RNs (25%) in surgical wards, followed by the intensive care unit (n = 54, 24%). Altogether, 195 RNs (86.7%) were found to have received fall prevention education within a year, in which the method of teaching was mostly verbal (48.6%), 34.2% received digital materials, and 22.7% used printed materials (Table 1).

The total mean score for frequency of injurious fall risk factors perceived was 2.51 ± 0.91 (range: 1–5). The top 10 frequent risk factors were altered gait problems, increased toileting needs, fall history, postural hypotension, cognitive impairment: confusion, vertigo or dizziness, time of the day: night, impaired balance, impaired muscle strength, and a desire for independence. Among these 10 risk factors, 70% are associated with diseases and physical conditions (Table 2). In addition, in the Chinese version of the questionnaire, "no caregiver accompaniment" was scored higher than other risk factors.

The total mean score for preventable risk factors perceived was 3.00 ± 0.88 (range: 1–5) (Table 2). RNs believed that the effectiveness of preventive measures for specific risk factors was very high (mean score ≥ 3). The top 10 preventable risk factors were slippery or wet floor surfaces, improper use of side rails, age ≤ 25 years, bed brakes not in locked position, poor lighting, tripping hazards, height of the bed not lowered, clutter, lack of handrails in patient bathroom, and age ≥ 25 and < 45 years. Among the risk factors that nurses can effectively prevent, four are associated with the environment, and four are associated with improper use of equipment or insufficient equipment (Table 2).

4. Discussion

4.1. Cultural differences

In the Taiwanese version of the "injurious fall risk factors" and "effective preventability" questionnaire, two new questions related to injurious fall risk factors specific to the Taiwanese culture were added. These questions were "use of non-narcotic analgesic" and "no caregiver accompaniment." Firstly, non-narcotic analgesics are frequently used oral drugs in clinical practice with compound efficacy as they have antipyretic, anti-inflammatory, and analgesic effects. However, they can cause vasodilation and a decline in blood pressure, thereby increasing the fall risk.[10] When patients are on non-narcotic analgesics, nurses should strengthen the evaluation and guidance on medication safety in patients to prevent falls.

"No caregiver accompaniment" is one of the top 10 fall factors perceived by Taiwanese RNs. The participation in patient care by

Table 1
Demographic characteristics (n = 225).

Item	Mean	N	%
1. Gender	Male	5	2.2%
	Female	220	97.8%
2. Work experience	8.28 years		
3. Age	Less than 25 years old	54	24%
	25 years old and less than 45 years old	159	70.7%
	45 years old and less than 65 years old	12	5.3%
4. The type of unit/department	Medical	77	34%
	Surgical	56	25%
	Obstetrics and gynecology	24	11%
	ICU	54	24%
	Oncology	14	6%
5. Received fall prevention education within a year	No	30	13.3%
	Yes	195	86.7%
	Verbal	98	43.6%
	Printed materials	51	22.7%
	Computer materials	77	34.2%
	Demonstration	17	7.9%

Table 2
Top 10 frequently observed risk factors and the potential of effective prevention for injurious falls in Taiwan (n = 225).

Rank	Frequency of specific risk factors	Mean (SD)	Potential for prevention	Mean (SD)
1	Altered gait problems	3.41 (1.19)	Slippery or wet floor surfaces	3.78 (1.04)
2	Increased toileting needs[a]	3.35 (1.16)	Improper use of side rails	3.77 (1.04)
3	Fall history	3.30 (1.22)	Age ≤ 25 years	3.71 (1.32)
4	Postural hypotension[a]	3.28 (1.14)	Bed brakes not in locked position	3.70 (1.10)
5	Cognitive impairment: confusion	3.26 (1.24)	Poor lighting	3.66 (1.03)
6	Vertigo or dizziness[a]	3.24(1.17)	Tripping hazards	3.65(1.05)
7	Time of day: night[a]	3.24 (1.33)	Bed not kept in low position	3.65 (0.98)
8	Impaired balance	3.23 (1.32)	Clutter[b]	3.64 (1.07)
9	Impaired muscle strength	3.22 (1.29)	Lack of handrails in patient bathroom[b]	3.63 (1.07)
10	A desire for independence[a]	3.18 (1.29)	Age ≥ 25 and < 45 y	3.62 (1.23)

[a] Frequently observed risk factors that were different between American and Taiwanese nurses. [b] The potential of effective prevention that were different between American and Taiwanese nurses.

family members or primary caregiver in hospitals is a patient accompaniment culture that is unique to Taiwan. This may be associated with the concept of family culture that is unique to the Chinese people. In Taiwan, when family members are hospitalized, family accompaniment is a very common thing. In addition to providing emotional support and alleviating anxiety, accompaniment provides assistance for patients in executing daily care tasks, and also provides observation on patient's needs in order to assist medical staff in providing preventive measures and reminders to further prevent falls. In 2020, in wake of the COVID-19 epidemic, Taiwanese hospitals reduced but did not restrict the number of visits by family members. There is no consensus and conclusion on whether this patient accompaniment culture will affect infection control in the hospital. We recommend that further examination of the effects of patient accompaniment culture on fall prevention and infection control carry out in the future.

4.2. Frequency of injurious fall risk factors

In regards to frequency of fall risk factors, RNs believed that altered gait problem, impaired muscle strength, cognitive impairment: confusion, and fall history are the most common risk factors in inpatients. This is similar to the results of many studies.[4,9] However, compared with the research findings of Tzeng & Yin (2013), three risk factors had different frequencies in Taiwan and the USA: "increased toileting needs," "vertigo or dizziness," and "a desire for independence." These 3 are among the top 10 risk factors responsible for falls in Taiwan, whereas they are among the top 20 risk factors responsible for falls in the USA (13th, 14th, and 17th).[15] Taiwanese nurses believed that elderly patients tended to experience injurious falls at "postural hypotension" and "time of day: night," but American nurses did not. Moncada & Mire (2017) found that older adults may fall because of symptoms of postural hypotension caused by nervous system or muscle balance problems.[17] Therefore, nursing staff should warn the elderly about this risk factor, instruct them to change their postures slowly, or improve the environmental equipment in the ward, such as adjusting the lighting in the ward, lowering the height of the bed, etc., to prevent falls. There are a few possible reasons for considering "time of day: night" responsible for falls. Firstly, the frequency of "increased toileting needs" in patients was high in Taiwan. Park et al. (2014) pointed out that patients are prone to falls if they suffer from polyuria or increased toileting frequency.[18] However, a correlation study would be required to find out if "time of day: night" that was perceived by Taiwanese nurses as a fall risk factor is related to nocturnal urination as this questionnaire was unable to differentiate between the two. Another possible reason may be due to differences in nurse to patient ratio between the two countries.[19,20] The studies have found that patient safety events tend to occur when the number of patients cared by nurses is high.[8,21] However, there is no evidence on nurse to patient ratio and fall ratio currently and future studies are required for validation.

4.3. Effective preventability of fall risk factors

Of the 10 top effective preventability of injurious fall risk factors, 9 items were identical to Tzeng & Yin (2013). Inspection of these identical items found that these are mostly "environment and facilities" related, such as "lighting, bed, improving disorderly environment, etc." In addition, the effective preventability of injurious falls is higher in younger patients than older age group. This result is the same as many studies.[5,15]

Compared with the findings of Tzeng & Yin (2013), "Clutter" ranks 11th and Taiwan ranks 8th.[19] Taiwanese nurses believed that "lack of handrails in the patient bathroom" is a risk factor with high effective preventability, which differs from the views of American nurses. Jiang et al. (2020) & Pati et al. (2019) pointed out that the bathrooms in hospital wards should be equipped with handrails, effectively preventing patients from falling.[18,22] We recommend that handrails be installed in bathrooms in hospital wards to prevent inpatient falls.

This study found that mean values of preventable risk factors, as perceived by nurses, were more than frequent risk factors of falls. According to observations, this may be because most fall prevention education programs in Taiwan focus on risk factors and assessment. We recommend that Taiwanese hospitals translate fall prevention measures that were proven to be effective or refer to these measures before formulating care guidelines to prevent inpatient falls in hospitals for clinical application by nurses. In addition, studies on fall prevention measure effectiveness can carry out. These measures will effectively decrease the danger and severity of falls in inpatients.

4.4. Limitations and future research

The current study investigated the perception of nurses based on their clinical experiences. Therefore, we were unable to validate the effectiveness of measures provided by RNs. The pilot study and the generalizability were limited, and the results can only use for preliminary understanding. In addition, the results could not use to present the causal relationship between specific risk factors and effective preventability. In the future, the scope of the investigation should expand to observe further the essential risk factors to provide specific fall prevention measures and recommendations.

In addition, we rechecked the data for 81 variables and found that the data were not normally distributed (kurtosis and skewness of 0.61 and -0.54). Further, also found significant differences in the number of men and women. The scoring and statistics of this questionnaire base on the suggestions of Tzeng & Yin (2013),[15] but this published article did not provide data verification; hence, it is not possible to evaluate the appropriateness of the statistical methods. In the future, we will discuss scoring issues with the original author. In addition, it cannot rule out the fact that this study is a pilot study wherein the data were collected using a purposive sampling method.

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Conflicts of interest

None.

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