ORIGINAL RESEARCH

ICU nurses' knowledge, attitude and behavior about ICU acquired weakness

Mingming Li[1], Yanbin Pan*[2]

[1]Department of Intensive Care Unit, The First Affiliated Hospital of Jinan University, Guangzhou, China
[2]Critical Care and Nursing Education, The First Affiliated Hospital of Jinan University, Guangzhou, China

ABSTRACT

Background and objective: Intensive care unit (ICU) acquired weakness (ICU-AW) is muscle weakness caused by neuromuscular dysfunction, which can cause muscle mass and muscle strength decline, and is one of the common complications of ICU. ICU-AW can affect patients' daily activities and long-term quality of life. We sought to understand the current knowledge, attitude and behavior of ICU nurses relative to ICU-AW, and analyze the factors influencing the knowledge, attitude and behavior.
Methods: Design: A cross-sectional survey. A survey was conducted of 236 ICU nurses using a self-designed questionnaire.
Results: The knowledge, attitude and behavior scores of ICU nurses were 17.05 ± 6.003, 17.47 ± 5.538 and 19.84 ± 5.100, respectively. Multivariate analysis showed that education level, previous exposure to ICU-AW and ICU-AW-related knowledge were the three factors affecting ICU nurses' knowledge of ICU-AW. Education level and previous exposure to ICU-AW were the two factors affecting attitude. Education level and ICU-AW-related knowledge were the factors influencing nurses' behavior ($p < .05$).
Conclusions: ICU nurses have a lower knowledge and attitude score on ICU-AW and a higher score on ICU-AW intervention practice. Relevance to clinical practice: ICU nurses need to acquire more theoretical knowledge and deepen their understanding of ICU-AW, so as to prevent the incidence of ICU-AW.

Key Words: Intensive care unit acquired weakness, Nurses, Intensive care unit

1. BACKGROUND

Intensive Care Unit (ICU) acquired weakness (ICU-AW) is muscle weakness caused by neuromuscular dysfunction, and its essence is neuromuscular dysfunction, which can lead to decreased muscle mass and strength.[1–3] ICU-AW mainly manifests as muscular atrophy, paresis or quadriplegia, decreased reflexes, and difficulty in going offline,[4,5] and is one of the most common complications for patients in the ICU,[6,7] especially those receiving mechanical ventilation.[8] The results of a recent systematic review show that the incidence of ICU-AW is 32%-52%.[9] The incidence of ICU-AW in patients with mechanical ventilation for more

than 4-7 days can be as high as 33%-82%.[1,8,10] ICU-AW is a relatively far-reaching sequela,[1,4,11] not only prolonging the hospital stay of patients and increasing their medical expenses but also affecting their ability to perform activities of daily living and long-term quality of life.[12,13] Some research results show that the mortality of ICU-AW patients can reach 41% after discharge, and the physical function of their survivors is also significantly reduced, which greatly affects the quality of life of patients in the later period.[14]

In recent years, ICU-AW has attracted the attention of critical care experts at home and abroad, and believes that its impact on patients in the later stage is profound. There-

fore, this investigation aims to understand the current status of ICU nurses' knowledge, attitude and behavior concerning ICU-AW through a questionnaire survey, with the goal of providing a reliable basis for the formulation of systematic prevention schemes and offering a reference for clinical work.

2. SUBJECTS AND METHODS

2.1 Subjects

Convenience sampling was used and ICU nurses selected as the subjects of this survey. Inclusion criteria were: (1) ICU nurse with professional qualifications certificate; (2) nurse working in the ICU in Guangdong, China; and (3) the nurse provided informed consent. Nurses who were receiving in-service training, those who were on sick leave or maternity leave and those who were interns were excluded. The Institutional Review Boards of the relevant hospitals approved the study before it was begun.

2.2 Survey methods

2.2.1 *Survey tools*

(1) Demographic questionnaire form: This form was invented by our research team and included the items of age, gender, hospital level, post level, job title, education level and working experience in the ICU.

(2) Questionnaire on ICU nurses' knowledge-attitude-behavior about ICU-AW. With reference to relevant domestic and foreign literature and the opinions of experts, our research team designed questionnaire to test the ICU-AW knowledge, attitude and behavior of ICU nurses. The research team includes 6 members, including 3 with intermediate titles or above and 5 with bachelor degree or above. Before the survey, 20 ICU nurses were selected for pre-survey, and 5 of them were adjusted. The final questionnaire consisted of three parts with a total of 28 items. 1) Knowledge. The 10 items in this section measured the nurse's grasp of ICU-AW concepts, diagnostic methods and risk factors. The total scores for this section ranged 10-30, with 3 points given for a right answer, 2 for an uncertain answer and 1 for a wrong answer. Higher scores indicated better mastery of the knowledge. The content validity index (CVI) of this section of the questionnaire was 0.886 and the Cronbach's α coefficient was 0.889, suggesting that it had satisfactory reliability and validity. 2) Attitude. This section included 10 items to assess ICU nurses' recognition of the importance of ICU-AW. The total score of this section ranged 10-50, with 5 points given for the answer "totally agree," 4 for "agree," 3 for "reluctantly agree," 2 for "disagree" and 1 for "totally disagree." Higher scores reflected a greater recognition of the importance of ICU-AW. The CVI value of this section was

0.906 and the Cronbach's coefficient a was 0.900, suggesting that it had satisfactory reliability and validity. 3) Behavior. This section was made up of 8 items that sought to assess ICU nurses' implementation of ICU-AW preventive measures. The total scores ranged 8-32, with 4 points given for the answer "always," 3 for "often," 2 for "occasionally" and 1 for "never". The higher the score, the greater the implementation of ICU-AW preventive measures. The CVI value of this section was 0.875 and the Cronbach's α coefficient was 0.880, suggesting that it had satisfactory reliability and validity.

2.2.2 *Data collection methods*

Information was collected in October 2019 through the survey platform wjx.cn, and the questionnaires could only be submitted when completely filled in. To ensure the quality of the information collected, questionnaires answered in less than 1 minute and those with the same answers for all items were considered invalid and removed. In order to prevent multiple answers from one machine, only the first valid data filled from the same IP address were included. A total of 250 questionnaires were distributed and all were collected; 236 were valid, for a valid rate of 94.4%.

2.3 Statistical methods

SPSS 21.0 software (IBM Corp., Armonk, NY) was used for statistical analysis, and statistical description was made using frequency, composition ratio and mean $\pm$ standard deviation. The *t*-test and one-way analysis of variance were conducted to compare the differences in ICU nurses in terms of their different scores in knowledge, attitude and behavior about ICU-AW. Multiple linear regression analysis was used to analyze the factors affecting ICU nurses' knowledge, attitude and behavior about ICU-AW. P<0.05 was taken to indicate statistically significant differences.

3. RESULTS

3.1 Demographic information

Of the 236 nurses enrolled into this investigation, there were 32 males (13.6%) and 204 females (86.4%); 66 (28%) were aged 20-25 years, 67 (28.4%) were aged 26-30 years, 84 (35.6%) were aged 31-40 years and 19 (8.1%) were aged > 40 years. In terms of job titles, 71 (30.1%) were nurses, 95 (40.3%) were senior nurses, 59 (25%) were supervisor nurses and 11 (4.7%) were co-chief nurses or above. In terms of nursing clinical ladder program, 23 (9.7%) were at post level N0, 67 (28.4%) at level N1, 57 (24.2%) at level N2, 61 (25.8%) at level N3 and 28 (11.9%) at level N4. In terms of education level, 18 (7.6%) had a specialized secondary degree, 60 (25.4%) had a junior college degree, 151 (64.0%) had a bachelor degree and 7 (3.0%) had a master degree or

above. In terms of hospital levels: 8 (3.4%) were working in a level 1 hospital, 28 (22.3%) in a level 2 hospital and 199 (84.3%) in a level 3 hospital.

3.2 ICU nurses' scores of knowledge-attitude-behavior about ICU-AW

ICU nurses' average score of knowledge was 17.05 ± 6.003 (range 10-30), with the three highest scoring items being "basic concepts," "diagnostic methods" and "main risk factors." The average score of attitude was 17.47 ± 5.538 (range 10-42) and the three highest scoring items were "recognizing their ICU-AW knowledge inadequacy to meet the needs of clinical work," "accepting to include ICU-AW into the duty during the shift" and "being willing to join the ICU-AW management team." The average score of behavior was 19.84 ± 5.100 (range 8-32) and the three highest scoring items were

"evaluating ICU-AW," "accumulating knowledge of ICU-AW at work" and "actively paying attention to ICU-AW situations in clinical practice."

3.3 Univariate analysis of ICU nurses' ICU-AW scores

Univariate analysis showed that the disparity in education level, hospital level, previous exposure to ICU-AW and ICU-AW-related knowledge learning led to different knowledge scores of ICU nurses. The attitude scores of ICU nurses were affected by disparity in age, job title, education level, hospital level, previous exposure to ICU-AW and ICU-AW-related knowledge learning. Behavior scores were affected by whether ICU nurses had studied ICU-AW-related knowledge. The differences were statistically significant ($p < .05$), as shown in Table 1.

Table 1. Univariate analysis of ICU nurses' ICU-AW scores

Variable		Knowledge			Attitude			Behavior		
		Score	Statistical values	p value	Score	Statistical values	p value	Score	Statistical values	p value
Sex	Man	16.69 ± 5.44	-0.368	.713	18.00 ± 5.66	0.586	.559	19.81 ± 4.99	-0.032	.975
	Woman	17.11 ± 6.10			17.38 ± 5.53			19.84 ± 5.13		
Age (year)	20-25	17.20 ± 6.00	1.076	.360	16.73 ± 4.802	4.444	.005*	20.21 ± 4.85	0.473	.701
	26-30	17.25 ± 6.00			19.48 ± 6.45			20.01 ± 5.17		
	31-40	17.31 ± 6.30			16.46 ± 5.01			19.65 ± 5.46		
	> 40	14.68 ± 4.36			17.37 ± 5.21			18.74 ± 4.16		
Job title	Nurse	17.63 ± 6.43	1.176	.320	16.79 ± 4.61	3.662	.013*	19.93 ± 5.18	1.447	.230
	Senior nurse	17.36 ± 6.04			18.87 ± 6.42			20.51 ± 4.79		
	Supervisor nurses	16.29 ± 5.59			16.27 ± 4.80			18.85 ± 5.41		
	Co-chief nurses or above	14.73 ± 4.56			16.09 ± 4.25			18.82 ± 5.15		
Nursing clinical ladder program	N0	18.26 ± 5.91	0.624	.646	17.48 ± 4.80	1.282	.278	20.57 ± 5.41	0.714	.583
	N1	17.06 ± 6.04			18.09 ± 5.94			20.12 ± 5.44		
	N2	17.40 ± 6.54			18.16 ± 5.90			20.32 ± 4.96		
	N3	16.85 ± 6.12			16.93 ± 5.72			19.16 ± 5.23		
	N4	15.75 ± 4.53			15.71 ± 3.365			19.07 ± 3.86		
Education level	Specialized secondary degree	13.61 ± 5.12	13.407	< .001*	16.11 ± 6.70	4.778	.003*	16.61 ± 5.93	4.971	.002
	Junior college degree	15.37 ± 4.54			17.27 ± 5.02			19.57 ± 5.63		
	Bachelor degree	17.63 ± 6.04			17.36 ± 5.40			20.11 ± 4.63		
	Master degree or above	27.86 ± 3.76			24.86 ± 5.11			24.71 ± 3.25		
Hospital level	Level I hospital	11.88 ± 2.475	6.797	.001*	14.75 ± 4.53	1.111	.331*	20.50 ± 6.30	0.555	.575
	Level II hospital	14.52 ± 5.05			17.10 ± 4.59			20.69 ± 5.22		
	Level III hospital	17.63 ± 6.05			17.63 ± 5.69			19.69 ± 5.05		
Previous exposure to ICU-AW	No	16.00 ± 5.04	-2.750	.006*	16.70 ± 4.56	-2.167	.031*	19.27 ± 5.00	-1.739	.083
	Yes	18.12 ± 6.70			18.25 ± 6.30			20.42 ± 5.16		
ICU-AW-related knowledge learning	No	15.52 ± 4.86	-2.599	.010*	16.34 ± 4.84	-2.067	.040*	18.18 ± 4.92	-3.342	.001*
	Yes	17.71 ± 6.33			17.95 ± 5.76			20.55 ± 5.02		

*$p < .05$

3.4 Multivariate analysis of ICU nurses' ICU-AW scores

Using the scores of ICU nurse's knowledge, attitude and behavior about ICU-AW as the dependent variable, we used the variables found statistically significant in univariate analysis as the independent variables and performed regression analysis. The inclusion level was 0.05 and the exclusion level was 0.10. The specific value assignment is shown in Table 2. The results showed that education level, previous exposure to ICU-AW and ICU-AW-related knowledge learning were the factors affecting ICU nurses' knowledge score. Education level and previous exposure to ICU-AW were the factors affecting ICU nurses' attitude score. Education level and ICU-AW-related knowledge learning were the factors affecting ICU nurses' behavior score ($p < .05$), as shown in Table 3.

Table 2. Independent variable names and assignments

Independent variable	Assignment
Age	20-25years = 1，26-30years = 2，31-40years = 3，＞40years = 4
Job title	Nurse = 1，Senior nurse = 2，Supervisor nurses = 3，Co-chief nurses or above = 4
Education Level	Specialized secondary degree = 1，Junior college degree = 2，Bachelor degree = 3，Master degree or above = 3
Hospital level	Level I hospital = 1，Level II hospital = 2，Level III hospital = 3
Previous exposure to ICU-AW	No = 1，Yes = 2
ICU-AW-related knowledge learning	No = 1，Yes = 2

Table 3. Multivariate analysis of ICU nurses'ICU-AW scores

Variable	*B* value	*SE* value	*B* value	*t* value	*p* value
ICU-AW knowledge score					
Constant term	0.350	2.680	—	0.130	.896
Education level	2.470	0.556	0.276	4.445	< .001*
Previous exposure to ICU-AW	2.425	0.722	0.202	3.360	.001*
ICU-AW-related knowledge learning	2.348	0.792	0.185	2.965	.003*
ICU-AW attitude score					
Constant term	12.223	1.809	—	6.758	< .001
Previous exposure to ICU-AW	1.585	0.711	0.143	2.231	.027*
Education level	1.095	0.532	0.132	2.060	.041*
ICU-AW behavior score					
Constant term	11.463	1.766	—	6.492	< .001
ICU-AW-related knowledge learning	2.426	0.693	0.219	3.500	.001*
Education level	1.622	0.476	0.213	3.409	.001*

*$p < .05$

4. DISCUSSION

4.1 ICU nurses have a low level of ICU-AW knowledge

Our results showed that the average ICU-AW knowledge score of ICU nurses was 17.05 ± 6.003 (range 10-30), a low value, suggesting that ICU nurses had insufficient ICU-AW-related knowledge, a result consistent with that of previous research.[11,15] The top three scoring items were basic concepts, diagnostic methods and major risk factors, indicating that ICU nurses had a preliminary understanding of ICU-AW and had mastered its basic ideas, commonly used tools for diagnosis and main influencing factors. However, they had poor mastery of the clinical manifestations, preventive measures and secondary or potential risk factors for ICU-AW.

This situation may be attributed to the underdeveloped state of clinical research in China, so that ICU nurses experience a lag in their professional knowledge update. Meanwhile, multivariate analysis showed that education level, previous exposure to ICU-AW and ICU-AW-related knowledge learning were the factors affecting ICU nurses' knowledge score; specifically, the ICU nurses who had a higher education level[16] or those who had contact with or learning about ICU-AW also had a higher ICU-AW knowledge score. In addition, our survey found that ICU nurses were most willing to acquire ICU-AW-related knowledge through training (89%) or by attending academic conferences or lectures (54%). The qualitative research of Wu et al.[17] showed that ICU nurses

were in urgent need of ICU-AW-related knowledge. Hence, nurse managers should include ICU-AW into the continuing education for ICU nurses and arrange the learning content according to the education level of ICU nurses. Moreover, lectures and guidance should be offered in various departments, measures adopted to actively support nurses pursuing further studies and incentives provided to encourage nurses to attend academic conferences and lectures,[18] with the goal of helping them acquire cutting-edge knowledge about ICU-AW and better serve in their clinical practice.

4.2 ICU nurses had a low level of attitude towards ICU-AW

The ICU nurses' average attitude score was 17.47 ± 5.538 (range 10-42), a lower value than that reported by Cai et al.[19] The top three scoring items were "recognizing their ICU-AW knowledge inadequacy to meet the needs of clinical work," "accepting to include ICU-AW into the duty during a shift" and "being willing to join the ICU-AW management team." However, the three lowest scoring items were "whether ICU nurses need to dynamically observe ICU-AW," "whether ICU nurses need to undertake assessment work" and "whether ICU nurses need to educate patients or their family members on ICU-AW-related knowledge." The above findings suggested that ICU nurses were aware of their lack of ICU-AW-related knowledge and willing to make changes. However, since the ICU is a special nursing unit and ICU nurses already have a heavy workload, they were reluctant to add ICU-AW to their daily assessment and dynamic observation schedule. Our multivariate analysis also demonstrated that education level and previous exposure to ICU-AW were factors influencing attitude, indicating that having more education and having ICU-AW-related learning experiences led to a higher attitude score. Therefore, it is recommended that nurse managers strengthen the study of ICU-AW theoretical knowledge and allow highly educated nurses to serve as role models in preventing ICU-AW. Moreover, they should incorporate more ICU-AW-related knowledge in clinical teaching, so that nurses will attach more importance to preventing ICU-AW and be more willing to carry out relevant behaviors in clinical practice.

4.3 ICU nurses had a high level of behavior about ICU-AW

Our survey results showed that the average behavioral score was 19.84 ± 5.100 (range 8-32), the highest scoring section of the questionnaire. "Evaluating ICU-AW," "accumulating knowledge of ICU-AW in the workplace" and "actively paying attention to the ICU-AW situation in clinical practice" were the top three scoring items in this section, indicating that ICU nurses had good compliance, strove to accumulate knowledge at work and actively evaluated patients' ICU-AW. However, the four items that had the lowest scores were "whether to communicate with patients about muscle strength at work," "reporting patients' muscle strength information to doctors," "providing guidance for patients or their families about early exercise" and "timely evaluation of the effect of nursing intervention on patients' early activities." Correlational research has also suggested that ICU nurses have poor implementation of ICU-AW preventive measures.[2, 20] Thus, it can be concluded that ICU nursing teams still need to enhance training and education on the prevention, intervention and evaluation of ICU-AW, in order to improve nurses' implementation of these measures. In addition, the nurses surveyed also reported that relevant standard processes and intervention schemes for ICU-AW are yet to be developed, so that the lack of a relatively complete system hindered their ability to implement the measures. The research results of Gao et al.[21] echo this finding. They found that the lack of rehabilitation physicians in the ICU to evaluate ICU patients' neuromuscular status and guide their early activities led to unsatisfactory ICU-AW results. This finding also suggests that researchers need to not only advance theoretical knowledge but also use this knowledge to develop interventions for clinical practice, in order to better provide clinical guidance for ICU nurses.

4.4 Limitations

This study has certain limitations. First, this is a self-reported questionnaire and has the limitations associated with this type of study. Second, although we cover as many important items as possible when designing the questionnaire, some important information may still be missing. Also, it covered the knowledge, attitudes and behaviors of a sample of ICU nurses; nurses elsewhere may differ in any of these domains. However, the demographics of this population is likely representative of ICU nurses as a whole and our results were in line with those from researchers in other regions.

5. CONCLUSIONS

In conclusion, ICU nurses have a low level of knowledge and attitude about ICU-AW, but a high level of behavior. Efforts to help them acquire more ICU-AW theoretical knowledge and deepen their understanding of ICU-AW may will to better promote the practice of ICU-AW, improve the clinical outcomes of patients, and provide empirical evidence for the development of systematic prevention programs and provide references for clinical work.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

REFERENCES

[1] Yu L, Zhang N, Yin A. The current situation of intervention research on acquired weakness in ICU. Chinese Journal of Nursing. 2013; 48(01): 82-83.

[2] Liao Y, Huang H, Cong L. Research progress of acquired weakness in ICU. Chinese Journal of Nursing. 2011; 46(05): 524-526.

[3] Zhang N, Zhang B. Research progress of early activity in preventing ICU acquired weakness. Nursing Journal of Chinese People's Liberation Army. 2014; 31(05): 43-45.

[4] Kress JP, Hall JB. ICU-acquired weakness and recovery from critical illness. N Engl J Med. 2014; 370(17): 1626-1635. PMid:24758618 https://doi.org/10.1056/NEJMra1209390

[5] De JB, Bastuji-Garin S, Sharshar T, et al. Does ICU-acquired paresis lengthen weaning from mechanical ventilation? Intensive Care Med. 2004; 30(6): 1117-1121. PMid:14767593 https://doi.org/10.1007/s00134-004-2174-z

[6] Hermans G, Gosselink R. Should we abandon manual muscle strength testing in the ICU? Crit Care. 2011; 15(2): 127. PMid:21371345 https://doi.org/10.1186/cc10038

[7] Wu L. Investigation on the status quo of knowledge, belief and practice of acquired weakness in ICU nurses and analysis of influencing factors. Jiangxi: Nanchang University, 2016.

[8] Stevens RD, Marshall SA, Cornblath DR, et al. A framework for diagnosing and classifying intensive care unit-acquired weakness. Crit Care Med. 2009; 37(10 Suppl): S299-308. PMid:20046114 https://doi.org/10.1097/CCM.0b013e3181b6ef67

[9] Li M, Luo J, Xie L. Overviews of systematic reviews on ICU acquired weakness. Journal of Nursing Science. 2019; 34(05): 32-37.

[10] Ramsay DA, Zochodne DW, Robertson DM, et al. A syndrome of acute severe muscle necrosis in intensive care unit patients. J Neuropathol Exp Neurol. 1993; 52(4): 387-398. PMid:8355028 https://doi.org/10.1097/00005072-199307000-00006

[11] Feng J, Tian Y, Nie M, et al. An analysis of the cognitive status of 253 ICU nurses in a hospital. Journal of Nursing. 2015; 22(17): 43-47.

[12] Sacanella E, Pérez-Castejón JM, Nicolás JM, et al. Functional status and quality of life 12 months after discharge from a medical ICU in healthy elderly patients: a prospective observational study. Crit Care. 2011; 15(2): R105. PMid:21443796 https://doi.org/10.1186/cc10121

[13] Herridge MS, Cheung AM, Tansey CM, et al. One-year outcomes in survivors of the acute respiratory distress syndrome. N Engl J Med. 2003; 348(8): 683-693. PMid:12594312 https://doi.org/10.1056/NEJMoa022450

[14] Ni Y, Wang S, Song W, et al. Chinese Expert Consensus on Neurological Critical Rehabilitation (Part 1).Chinese Journal of Rehabilitation Medicine. 2018; 33(01): 7-14.

[15] Dong D, Feng B, Duan Y, et al. Investigation and analysis of ICU nurses' recognition of acquired asthenia in four tertiary hospitals in Nanjing. Journal of Nursing Management. 2016; 16(10): 723-725.

[16] Ding X, Weng X, Wu C, et al. A survey of cognition level of ICU nurses in primary hospitals on acquired asthenia. China Rural Medicine. 2016; 23(14): 58-59.

[17] Wu L, Wang J. Qualitative research on ICU nurses' cognition of acquired asthenia. Nursing Practice and Research. 2016; 13(14): 9-11.

[18] Song Q, Liang Z, Jiang Y, et al. Investigation and analysis of the cognition of ICU nurses to acquired asthenia in a top three general hospital in Qingdao. Medical Information. 2019; 32(12): 144-146.

[19] Cai Y, Xu Y, Chen Y. Investigation on the status quo of knowledge, belief and practice of acquired weakness in ICU and analysis of influencing factors. Journal of Nursing Management. 2019; 19(04): 251-254, 266.

[20] Liu M. analysis on the current situation of cognition of acquired weakness among ICU nurses. The Road to Health. 2017; 3: 271-272.

[21] Gao X, Li Y. Investigation and Analysis on the cognitive level of rehabilitation nursing knowledge of nurses. 2008; 7(12): 894-895.