RESEARCH ARTICLE

A cross-sectional observational study on the level of diabetes knowledge and related influencing factors among orthopaedic nurses

Wenli Shi[1] | Huilan Yao[2] | Zihe Guo[1] | Shunwu Fan[1] | Hongying Pan[3] | Chao Liu[1]

[1]Department of Orthopedics, Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University, Hangzhou, China

[2]Department of Endocrinology, Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University, Hangzhou, China

[3]Department of Nursing Education, Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University, Hangzhou, China

Correspondence
Chao Liu, Department of Orthopedics, Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University, Address: #3 E. Qingchun Rd, Hangzhou 310016, Zhejiang Province, China.
Email: liuchaozju@zju.edu.cn

Funding information
Medicine and Health Science and Technology Plan Program of Zhejiang Province, Grant/Award Number: 2021454695

Abstract

Aim: To evaluate the level of diabetes knowledge and related influencing factors among Chinese orthopaedic nurses.

Design: A cross-sectional observational study. The STROBE checklist was followed.

Methods: A convenience sampling method was adopted by using the Questionnaire Star application to publish online questionnaire. The nurses' diabetes knowledge levels were assessed, including a total of 34 items from the "Orthopaedic Nurses Diabetes Knowledge Mastery Questionnaire" and the "Orthopaedic Nurses General Information Questionnaire" between July 2020 and September 2020.

Results: Altogether, 363 nurses participated in the survey. Their levels of diabetes-related knowledge were moderate or lower (16.51 ± 2.96 out of 25 points). The knowledge level was closely related to five factors: professional title, education level, whether the hospital employed diabetes specialist nurses or treated outpatients, type of diabetes-related training received and whether the individual was familiar with and adhered to current treatment guidelines. The knowledge level can be improved by providing additional training that accounts for these factors.

KEYWORDS
diabetes, influencing factors, knowledge, nursing

1 | INTRODUCTION

Diabetes is a serious non-communicable disease that affects human health globally. Over the past 30 years, the prevalence of diabetes has continually increased (Weng & Bi, 2010; Xu et al., 2013; Yang et al., 2010). According to data released by the International Diabetes Federation in 2019, there are currently 463 million diabetic patients worldwide. China accounts for a quarter of these cases, with approximately 129.8 million people suffering from this disease (Guo, 2020).

Although diabetes is a non-communicable disease, it is still considered a major public health problem due to the severe complications that can occur and its negative impact on the quality of life of patients, requiring a multidisciplinary approach to treatment. Among patients with diabetes, the types of complications encountered may differ; for example, 15%–25% of patients are afflicted by diabetic ulcers, with 19.03% of such cases requiring amputation (Alavi et al., 2014; Bi, 2015). In addition to coping with the dysfunction and pain associated with the disease itself, patients must also cope with

---

Wenli Shi and Huilan Yao contributed equally to this work.

a great economic burden. In 2017, the medical expenditure for the treatment of diabetes in China reached 110 billion US dollars, with the treatment of diabetic ulcers accounting for 40% of these costs (International Diabetes Federation, 2017; Raghav et al., 2018).

2 | BACKGROUND

The treatment of patients with diabetic ulcers is dependent on the cooperation of orthopaedic professionals, diabetes specialists, plastic surgeons and professionals at wound stoma treatment centres and rehabilitation departments, which can effectively improve the patients' clinical outcomes. However, given China's current medical resources, most patients with diabetic ulcers cannot receive multi-disciplinary, cooperative treatment, and most of the treatment processes are currently completed in the orthopaedic ward. Therefore, health education and follow-up rehabilitation of patients with diabetic ulcers are largely dependent on the intervention of orthopaedic nurses. Unfortunately, Chinese nurses with little experience in endocrinology have an insufficient knowledge of diabetes. This lack of knowledge, combined with certain beliefs and behaviours, has an impact on the monitoring and management of diseases or complications in diabetic patients (Xiong, 2013; Zhu et al., 2017). In addition, the recurrence rate for diabetic ulcers is as high as 30%–40% following the successful treatment of a first ulcer, with inadequate control of blood glucose levels being one of the main causes (Chu et al., 2016; Loveman et al., 2008). Diabetic patients often describe a lack of professional guidance in managing their own disease, which may be attributable, in part, to the lack of diabetes-related knowledge among orthopaedic nurses (Alotaibi et al., 2016). Studies have confirmed that when medical staffs are provided with high-quality health education, patients' blood glucose management and clinical outcomes are significantly improved (Jiang et al., 2015). However, few studies have assessed the level of knowledge related to diabetes and its treatment among orthopaedic nurses in China, and the influencing factors that affect their level of knowledge are unclear.

Therefore, this study had two aims. The first was to evaluate the knowledge level of orthopaedic nurses through the administration of a diabetes knowledge questionnaire to identify knowledge gaps. The second aim was to assess the relevant factors affecting their level of diabetes knowledge to facilitate targeted training. It is hoped that by improving the health education level of orthopaedic nurses, patients with diabetic ulcers can improve their own health literacy, reducing the rate of ulcer recurrence and improving the quality of life of patients.

3 | THE STUDY

3.1 | Design

This was a cross-sectional survey, and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (Von Elm et al., 2007) was followed (See File S1).

3.2 | Method

3.2.1 | Participants and inclusion/exclusion criteria

This study adopted a convenience sampling method to select 380 active nurses who had worked in public hospitals in China between July 2020 and September 2020 as the survey patients. The inclusion criteria were as follows: (1) the patient must be an orthopaedic clinical nurse, (2) the patient must be a registered nurse and (3) the patient must have demonstrated an understanding of the research content and agreed to participate in the survey. The exclusion criteria were as follows: (1) nurses in administrative or education-related positions in hospitals, (2) nurses in training and (3) nurses absent due to pregnancy or long-term leave. Since almost all nurses participating in the survey were female, the only two male nurses were excluded in this study.

3.2.2 | Online questionnaire

The Questionnaire Star application through WeChat network was used to publish the online questionnaire for data collection. The patients were asked to complete the questionnaire online after receiving a link. Each internet protocol address could only be completed once, and the questionnaire could only be submitted after all the questions had been answered. Following submission, the web link could no longer be accessed to view the questionnaire or responses. The contents of the survey included a total of 34 items, and the first nine questions were the background information of each participant and their hospitals, such as the hospital level, years of work experience, job title, job position and the level of education.

3.2.3 | Development of the questionnaire

The "Orthopaedic Nurses Diabetes Knowledge Mastery Questionnaire" was jointly prepared by members of the endocrinology and orthopaedic medical care staff at our hospital. The questionnaire was designed based on the "Diabetes Management Knowledge Evaluation Scale," compiled by Dr. Mary Beth Modic of Ohio State's Diabetes and Metabolism Research Centre; the "Diabetes Knowledge Questionnaire" and the "Chinese Diabetes Care and Education Guidelines," compiled by Xiong Yan of Xinjiang Medical University (Shen & Guo, 2010; Xiong, 2013). The questionnaire consisted of 25 multiple-choice questions, with each correct response accounting for one point, allowing for a total possible score of 25. A higher score was indicative of a greater level of diabetes-related knowledge. The scale assessed the following seven dimensions: blood glucose management and monitoring knowledge (seven questions), emergency knowledge (five questions), drug knowledge (four questions), dietary knowledge (two questions), exercise knowledge (three questions), foot care knowledge (two questions) and knowledge pertaining to the injection of insulin (two questions).

For example

☐ *According to the guideline for diabetes prevention and control in China, the target of glycosylated haemoglobin control in patients with diabetes is:*

a. <6.0 mmol/L *b. <6.5 mmol/L* *c. <7.0 mmol/L* *d. <7.5 mmol/L*

☐ *Which of the following exercises is suitable for elderly patients with diabetes?*

a. Running *b. Swimming* *c. Table tennis* *d. Brisk walking*

3.2.4 | Measurements

This questionnaire was finished twice by each participant with 3 weeks' interval. During this period, the nurses were asked not to conduct any relevant training or to query any of the questionnaire information.

Evidence-based methods were used to design the "Orthopaedic Nurses General Information Questionnaire". Keywords and subject terms were used to conduct searches of eight English and Chinese databases, including The Cochrane Library, the American National Guideline Clearinghouse, the Registered Nurses Association of Ontario, PubMed, EMBASE, Medline, China National Knowledge Infrastructure and Wanfang. The search was performed to collect the list of influencing factors that could affect the level of diabetes knowledge among non-diabetes specialist nurses. The search period ranged from the establishment of each database until July 2020. Using the Cochrane database as an example, the search strategy was as follows: #1 orthopaedics or #non-endocrine specialist, #2 nurse or #nursing and #3 knowledge or #cognitive or #factors. Additionally, #1AND#2#1AND#3, #2AND#3 and #1AND#2AND#3 were used. Ultimately, a total of nine potential influencing factors were identified by the searches.

3.3 | Analysis

Due to the potential impact of confounding factors, the required sample size was 5–10 times the total number of items included in the survey. Therefore, assuming an attrition rate of 20%, a total of 380 questionnaires were issued; 363 questionnaires were effectively recovered with an effective recovery rate of 95.5%.

Because the questionnaire consisted of single-dimensional multiple-choice questions, the internal consistency could not be determined by the conventional means involving the calculation of Cronbach's α reliability coefficient. Therefore, this study assessed test–retest reliability and content validity to analyse the reliability and validity of the questionnaire. Since the sample size for the test–retest reliability calculation was 20% of the total sample size, the first 80 nurses who completed the questionnaire were selected in chronological order to assess the test–retest reliability (Hao et al., 2004). The interval between the two questionnaires was 3 weeks. During this period, the nurses were asked not to conduct any relevant training or query any of the questionnaire information. The test–retest reliability of the questionnaire was determined to be 0.732, and the test–retest reliability coefficient of each dimension was 0.871–1.

Two endocrinologists from the Chinese Medical Association, two orthopaedic experts in the clinical treatment of diabetic ulcers and a diabetes specialist nurse were invited to conduct a content validity analysis. The content validity of the questionnaire was determined to be equal to 1.

Statistical analyses were conducted using Statistical Package for the Social Sciences software (version 26.0; IBM Corp., Armonk, NY, USA). Descriptive statistics were used to describe the general demographic information and diabetes knowledge of the orthopaedic nurses. As single factor analysis could have affected the influencing factors related to the orthopaedic nurses' level of diabetes knowledge, linear regression analysis was used to determine the independent risk factors, including professional titles, levels of education, whether the hospital employed diabetes specialist nurses or treated outpatients, the type of diabetes knowledge training received or whether they were familiar with and adhered to the current treatment guidelines.

3.4 | Ethics

The study was conducted in accordance with the tenets of the Declaration of Helsinki. The study protocol was approved by the Ethics Committee of our affiliated university hospital.

4 | RESULTS

This study investigated the level of diabetes-related knowledge among 363 Chinese orthopaedic nurses. Their characteristics are summarized in Table 1. Nearly half of the participants worked in Level 3A hospitals with more than 5 years work experience. The majority of them (85.95%) were head nurses, and more than two-thirds had rotation experience in endocrinology department.

Based on the mean scores on the questionnaire, the orthopaedic nurses generally had a moderate or low level of diabetes knowledge (16.51 ± 2.96 points), with the highest score being 25 points and the lowest score being four points. The highest scores were related to foot care knowledge, whereas the lowest scores were related to blood glucose management and monitoring knowledge (Table 2).

The results of the univariate analysis revealed that the orthopaedic nurses' knowledge of diabetes was affected by their professional titles, their levels of education, whether the hospital employed diabetes specialist nurses or treated outpatients, the type of diabetes

TABLE 1 General characteristic information of the orthopaedic nurses who completed the questionnaire (N = 363).

Dimensions	N (%)
Hospital level	
Level 2 B	30 (8.26)
Level 2 A	130 (35.81)
Level 3 B	30 (8.26)
Level 3 A	173 (47.66)
Years of work experience	
1–3	81 (22.31)
3–5	56 (15.42)
5–10	121 (33.33)
>10	105 (28.92)
Job title	
Nurse	109 (30.00)
Licensed practical nurse	159 (43.80)
Head nurse	83 (22.58)
Deputy chief nurse	12 (3.30)
Job position	
Head nurse	312 (85.95)
Registered nurse	30 (8.26)
Responsible nurse	21 (5.78)
Level of education	
Specialist	109 (30.00)
Undergraduate	251 (69.14)
Postgraduate	3 (0.82)
Is a diabetes specialist nurse or clinic at the hospital?	
Yes	321 (88.42)
No	42 (11.57)
Types of training related to diabetes knowledge	
Self-study	73 (20.11)
Self-study + online training	75 (20.66)
Self-study + online training + on-site training	212 (58.40)
Self-study + online training + on-site training + assessment	3 (0.82)
Do you have endocrinology rotation experience?	
Yes	112 (30.85)
No	251 (69.14)
Do you know and adhere to the current treatment guidelines?	
I know them, but I do not adhere to them	142 (39.11)
No	56 (15.42)
I know and adhere to them to patient care	165 (45.45)

knowledge training received and whether they were familiar with and adhered to the current treatment guidelines. Among these factors, job title (p = .63), position (p = .11), education level (p = .17), the type of diabetes knowledge training received (p = .01) and whether they were familiar with and adhered to the current treatment

guidelines (p = .47) were the factors that most influenced the level of knowledge pertaining to blood glucose management and monitoring. Education level (p = .16), whether the hospital employed diabetes specialist nurses or treated outpatients (p = .36) and the type of diabetes knowledge training received (p = .01) were the influencing factors that affected the nurses' knowledge of emergency treatment. Drug knowledge was affected by the type of diabetes knowledge training received (p = .02), whether they were familiar with and adhered to the current treatment guidelines (p = .05) and whether the hospital employed diabetes specialist nurses or treated outpatients (p = .18). The level of sports knowledge was only affected by the level of education (p = .01). Foot care knowledge was affected by the level of education (p = .15) and whether the hospital employed diabetes specialist nurses or treated outpatients (p = .01). The factors influencing knowledge pertaining to injection skills were the job title (p = .17) and the level of education (p = .14; Table 3).

The linear regression analysis demonstrated that the independent factors influencing the degree of mastery of diabetes-related knowledge included whether the hospital employed diabetes specialist nurses or treated outpatients (p = .36) and the type of diabetes knowledge training received (p = .01). Knowledge of blood glucose management and monitoring, emergency knowledge and drug knowledge were all affected by the type of diabetes knowledge training received, whereas foot care knowledge was affected only by the level of education (Table 4).

5 | DISCUSSION

This study showed that the average score on the survey of orthopaedic nurses' level of diabetes-related knowledge was moderate or lower (16.51±2.96 out of 25 points). This result is similar to that of other studies that have investigated diabetes knowledge among non-endocrinology nurses (Modic et al., 2014). Because orthopaedic nurses mainly care for patients with diabetic ulcers, they generally receive systematic training in foot care; therefore, it is not surprising that their scores related to foot care knowledge were high. On the other hand, the orthopaedic nurses had an intermediate level of knowledge related to diet, exercise and medications, probably because they typically receive uniform basic knowledge training from hospitals or schools. However, their blood glucose management and monitoring knowledge and their knowledge related to emergency treatment and injection skills, were poor, which is consistent with previous findings (Qian et al., 2011). It is difficult to improve professional health education through short-term training in hospitals, and in clinical practice, orthopaedic nurses have few opportunities to administer insulin injections, leading to poor skills in drug administration in the treatment of diabetic patients.

This study also showed that the orthopaedic nurses had poor emergency response capabilities. Most patients with diabetic ulcers lack the knowledge needed to optimally manage their blood glucose levels, resulting in prolonged elevation. In the event of a diabetic crisis, orthopaedic nurses must be able to respond to emergency situations.

TABLE 2 Orthopaedic nurses' mastery of diabetes knowledge (total score and score for each dimension).

Dimensions	Max.	Min.	Score ($x\pm s$)	Scoring rate (%)
Knowledge of blood glucose management and monitoring	7	1	4.07 ± 1.18	58.21
Emergency knowledge	5	0	2.96 ± 1.02	59.23
Drug knowledge	4	0	2.88 ± 0.92	71.92
Dietary knowledge	2	0	1.40 ± 0.55	69.94
Sports knowledge	3	0	2.17 ± 0.77	72.45
Foot care knowledge	2	0	1.94 ± 0.26	96.83
Injection skills	2	0	1.09 ± 0.59	54.56
Diabetes knowledge total score	25	4	16.51 ± 2.96	66.04

TABLE 3 Univariate analysis of risk factors affecting knowledge of diabetes among orthopaedic nurses ($x\pm s$).

Dimensions	b	Sb	t	p
Knowledge of blood glucose management and monitoring				
Job title	0.03	0.09	0.48	.63
Job position	0.09	0.14	1.61	.11
Level of education	0.08	0.15	1.37	.17
Types of training related to diabetes knowledge	0.13	0.08	2.53	.01
Do you know and adhere to the current treatment guidelines?	0.04	0.07	0.72	.47
Emergency knowledge				
Level of education	0.16	0.07	1.43	.16
Types of training related to diabetes knowledge	−0.43	0.13	−2.51	.01
Whether or not there is a diabetes specialist nurse or clinic	0.06	0.05	0.91	.36
Drug knowledge				
Types of training related to diabetes knowledge	0.14	0.06	2.39	.02
Whether or not there is a diabetes specialist nurse or clinic	0.15	0.15	−1.35	.18
Do you know and adhere to the current treatment guidelines?	−0.05	0.05	1.95	.05
Foot care knowledge				
Level of education	−0.12	0.04	−2.74	.01
Whether or not there is a diabetes specialist nurse or clinic	−0.02	0.03	−0.82	.41
Injection skills				
Level of education	0.11	0.07	1.49	.14
Job title	0.06	0.04	1.38	.17
Diabetes knowledge total score				
Job title	0.29	0.21	1.38	.17
Level of education	0.52	0.36	1.44	.15
Types of training related to diabetes knowledge	−1.19	0.48	−2.48	.01
Whether or not there is a diabetes specialist nurse or clinic	0.60	0.19	3.14	.01
Do you know and adhere to the current treatment guidelines?	0.20	0.17	1.21	.23

Therefore, nursing managers must develop training plans to fill gaps in the knowledge and skillsets of orthopaedic nurses. For example, these plans should include cooperative learning, interactive teaching and multidisciplinary nursing team training or internal training (Liang et al., 2015; Wang et al., 2016; Xiong et al., 2015; Zhu et al., 2017). These initiatives would ensure that orthopaedic nurses are able to provide patients with high-quality health education, improving the patients' ability to respond to sudden changes in their condition.

The orthopaedic nurses' knowledge of diabetes was closely related to their professional title, the level of education, whether the hospital employed diabetes specialist nurses or treated outpatients, the type of diabetes knowledge training received and whether they were familiar with and adhered to the current treatment guidelines. These influencing factors were similar to those identified in previous studies (Xiong, 2013; Zhu et al., 2017). The level of diabetes-related knowledge differed with respect to the

TABLE 4 Multivariate analysis of risk factors affecting diabetes knowledge among orthopaedic nurses.

Dimensions	b	Sb	t	p
Knowledge of blood glucose management and monitoring				
Job title	0.03	0.09	0.48	.63
Job position	0.09	0.14	1.61	.11
Level of education	0.08	0.15	1.37	.17
Types of training related to diabetes knowledge	0.13	0.08	2.53	.01
Do you know and adhere to the current treatment guidelines?	0.04	0.07	0.72	.47
Emergency knowledge				
Level of education	0.16	0.07	1.43	.16
Types of training related to diabetes knowledge	−0.43	0.13	−2.51	.01
Whether or not there is a diabetes specialist nurse or clinic	0.06	0.05	0.91	.36
Drug knowledge				
Types of training related to diabetes knowledge	0.14	0.06	2.39	.02
Whether or not there is a diabetes specialist nurse or clinic	0.15	0.15	−1.35	.18
Do you know and adhere to the current treatment guidelines?	−0.05	0.05	1.95	.05
Foot care knowledge				
Level of education	−0.12	0.04	−2.74	.01
Whether or not there is a diabetes specialist nurse or clinic	−0.02	0.03	−0.82	.41
Injection skills				
Level of education	0.11	0.07	1.49	.14
Job title	0.06	0.04	1.38	.17
Diabetes knowledge total score				
Job title	0.29	0.21	1.38	.17
Level of education	0.52	0.36	1.44	.15
Types of training related to diabetes knowledge	−1.19	0.48	−2.48	.01
Whether or not there is a diabetes specialist nurse or clinic	0.60	0.19	3.14	.01
Do you know and adhere to the current treatment guidelines?	0.20	0.17	1.21	.23

number of years spent working and the experience of nurses with different professional titles. For example, nurses with titles indicative of higher professional ranks are responsible for teaching, scientific research and department management, and they have a more comprehensive understanding of the care of orthopaedic patients with various diseases, including diabetic ulcers. The educational background of nurses affects their motivation to acquire new knowledge and the ways they access information. Nurses with a higher level of education will have certain advantages that facilitate their ability to improve their level of diabetes knowledge. Liu et al. (2021) identified the current level of diabetes knowledge in Chinese nursing interns and found that the skills and knowledge they most wanted to acquire were the treatment of hypoglycaemia, functional test simulation and blood glucose monitoring technology. From the perspective of hospitals, medical institutions with specialist diabetes nurses or outpatient clinics conduct professional training and management throughout the hospital and pay more attention to it, which affects the knowledge level of orthopaedic nurses. In addition, treatment guidelines provide high-quality evidence to allow nurses to improve health education. Nurses who are familiar with the guidelines and adhere to them in clinical practice will be capable of providing patients with standardized guidance and care to improve their ability to control their blood glucose levels and the prognostic outcomes.

Among aforementioned factors, it is difficult to promote higher professional title and achieve advanced education level in the short term. Therefore, refined on-the-job rotation seems to be a facilitated and effective way to improve the orthopaedic nurses' knowledge of diabetes. At the first 1–1.5 years being a registered nurse in orthopaedic department, Chinese orthopaedic nurses have specialist rotations in other departments. During this period, the level of diabetes-related knowledge would be greatly improved if they could get systematic diabetes guidelines training from hospital, receive guidance from diabetes specialist nurses or have more time of rotation in endocrinology department. This study indicated that nurses must be aware of their responsibilities when caring for patients with diabetic ulcers, the training system must be sound, and the content must be scientific and continuously updated. Optimizing training protocols and education are directions for future work.

6 | LIMITATIONS

First, this research was conducted via online surveys; therefore, the possibility that some nurses retrieved answers when filling out the questionnaire cannot be ruled out. Second, the questionnaire only objectively evaluated the orthopaedic nurses' degree of understanding of diabetes. In the future, qualitative methods are needed to better characterize the knowledge and attitude of orthopaedic nurses related to diabetes. Third, although the study included nurses working in hospitals in different cities in China, the sample size was small and large-scale investigations are still needed in further study. Fourth, this study was conducted at public hospitals in China, potentially limiting generalizability to nurses from private settings or other countries elsewhere.

7 | CONCLUSIONS

This was the first survey conducted to assess Chinese orthopaedic nurses' knowledge of diabetes in public settings. Their overall score was not ideal; hence, orthopaedic nurses must focus on improving their knowledge of blood glucose monitoring and management of patients, emergency treatment and injection skills. Care managers must work with diabetes experts to develop standardized training content and methodology, and orthopaedic nurses from public hospitals should actively participate in continuing education to improve their critical thinking skills and to acquire new knowledge related to technological developments and treatments for diabetes.

RELEVANCE TO CLINICAL PRACTICE

To the best of our knowledge, this was the first study conducted to assess the level of knowledge related to diabetes among orthopaedic nurses from public hospitals in China. It highlighted the fact that their level of knowledge was insufficient and identified certain factors that were responsible. By accounting for these influencing factors when designing standardized training programmes, the level of knowledge among nurses can be improved; in turn, they would be able to better educate their patients, improving their quality of life and allowing them to better control their blood glucose levels.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Chao Liu https://orcid.org/0000-0003-0374-1974

REFERENCES

Alavi, A., Sibbald, R. G., Mayer, D., Goodman, L., Botros, M., Armstrong, D. G., & Kirsner, R. S. (2014). Diabetic foot ulcers: Part I. Pathophysiology and prevention. *Journal of the American Academy of Dermatology*, *70*, 1.e1–1.e18. https://doi.org/10.1016/j.jaad.2013.06.055

Alotaibi, A., Al-Ganmi, A., Gholizadeh, L., & Perry, L. (2016). Diabetes knowledge of nurses in different countries: An integrative review. *Nurse Education Today*, *39*, 32–49. https://doi.org/10.1016/j.nedt.2016.01.017

Bi, Y. (2015). Current status of epidemiological research on chronic complications of diabetes in China. *Chinese Journal of Diabetes*, *7*, 467–469 [in Chinese]. https://doi.org/10.3760/cma.j.issn.1674-5809.2015.08.002

Chu, Y. J., Li, X. W., Wang, P. H., Xu, J., Sun, H. J., Ding, M., & Feng, S. H. (2016). Clinical outcomes of toe amputation in patients with type 2 diabetes in Tianjin, China. *International Wound Journal*, *13*, 175–181. https://doi.org/10.1111/iwj.12249

Guo, L. (2020). The epidemic situation and intervention strategies of diabetes mellitus. *Chinese Journal of Clinical Healthcare*, *23*, 433–436 [in Chinese]. https://doi.org/10.3969/J.issn.1672-6790.2020.04.001

Hao, Y., Sun, X., Fang, J., Wu, S., & Zhu, S. (2004). The study of statistical methods used for item selection. *Chinese Health Statistics*, *21*, 209–211 [in Chinese]. https://doi.org/10.3969/j.issn.1002-3674.2004.04.006

International Diabetes Federation (IDF). (2017). *IDF Diabetes Atlas* (8th ed.). International Diabetes Federation.

Jiang, Y., Wang, X., Xia, L., Fu, X., Xu, Z., Ran, X., & Li, Q. (2015). A cohort study of diabetic patients and diabetic foot ulceration patients in China. *Wound Repair and Regeneration*, *23*, 222–230. https://doi.org/10.1111/wrr.12263

Liang, Z., Liu, X., Huang, Y., Lu, X., Tan, L., & Lu, Y. (2015). The influence of cooperative learning training mode on the knowledge of diabetes health education for nurses in non-diabetic wards. *Internal Medicine*, *10*(1), 115–117. https://doi.org/10.16121/j.cnki.cn45-1347/r.2015.01.48

Liu, F., Weng, H., Xu, R., Li, X., Zhang, Z., Zhao, K., Zhou, Z., & Wang, Q. (2021). Nursing interns' attitudes toward, preferences for, and use of diabetes virtual simulation teaching applications in China: National web-based survey. *JMIR mHealth and uHealth*, *9*, e29498. https://doi.org/10.2196/29498

Loveman, E., Frampton, G. K., & Clegg, A. J. (2008). The clinical effectiveness of diabetes education models for type 2 diabetes: A systematic review. *Health Technology Assessment*, *12*, 1–116. https://doi.org/10.3310/hta12090

Modic, M. B., Vanderbilt, A., Siedlecki, S. L., Sauvey, R., Kaser, N., & Yager, C. (2014). Diabetes management unawareness: What do bedside nurses know? *Applied Nursing Research*, *27*, 157–161. https://doi.org/10.1016/j.apnr.2013.12.003

Qian, J., Sha, S., Zhao, C., & Liu, W. (2011). Investigation on the knowledge of diabetes among nurses in general hospitals. *Chinese Nursing Research*, *25*, 1530–1531 [in Chinese]. https://doi.org/10.3969/j.issn.1009-6493.2011.17.011

Raghav, A., Khan, Z. A., Labala, R. K., Ahmad, J., Noor, S., & Mishra, B. K. (2018). Financial burden of diabetic foot ulcers to world: A progressive topic to discuss always. *Therapeutic Advances in Endocrinology and Metabolism*, *9*, 29–31. https://doi.org/10.1177/2042018817744513

Shen, L., & Guo, X. (2010). Introduction to "Chinese diabetes care and education guidelines". *Chinese Journal of Diabetes*, *18*, 310 [in Chinese]. https://doi.org/10.3969/j.issn.1006-6187.2010.04.022

Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbrouche, J. P. (2007). The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Epidemiology*, *18*(6), 800–804. https://doi.org/10.1097/EDE.0b013e3181577654

Wang, X., Su, J., & Xu, J. (2016). Training model of non-endocrine professional nurses with interactive teaching. *Shanxi Medical Journal*, *45*, 97–98 [in Chinese]. https://doi.org/10.3969/j.issn.0253-9926.2016.01.040

Weng, J., & Bi, Y. (2010). Diabetes in China: The challenge now. *Journal of Diabetes Investigation*, *1*, 170–171. https://doi.org/10.1111/j.2040-1124.2010.00053.x

Xiong, Y. (2013). *Study on the grasp situation of diabetes mellitus knowledge and needs and training effectiveness in non-endocrine department nurses*. Xinjiang Medical University Thesis of Master Degree [in Chinese].

Xiong, Z., Yuan, L., He, L., Zhu, H., Ma, L., Yang, L., & Ou, Q. (2015). Influence of multi-disciplinary diabetes-oriented nursing team on blood glucose control knowledge of nurses not working in endocrinology department. *Modern Clinical Nursing*, *14*, 66–69 [in Chinese]. https://doi.org/10.3969/j.issn.1671-8283.2015.07.018

Xu, Y., Wang, L., He, J., Bi, Y., Li, M., Wang, T., Wang, L., Jiang, Y., Dai, M., Lu, J., & Xu, M. (2013). Prevalence and control of diabetes in Chinese adults. *JAMA*, *310*, 948–959. https://doi.org/10.1001/jama.2013.168118

Yang, W., Lu, J., Weng, J., Jia, W., Ji, L., Xiao, J., Shan, Z., Liu, J., Tian, H., Ji, Q., & Zhu, D. (2010). Prevalence of diabetes among men and women in China. *The New England Journal of Medicine*, *362*, 1090–1101. https://doi.org/10.1056/NEJMoa0908292

Zhu, Y., Huang, J., Ye, S., Lou, M., Cao, N., & Liu, G. (2017). The development and application of internal model on nursing training in China. *Health Education*, *35*, 83–84 [in Chinese].

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Shi, W., Yao, H., Guo, Z., Fan, S., Pan, H., & Liu, C. (2023). A cross-sectional observational study on the level of diabetes knowledge and related influencing factors among orthopaedic nurses. *Nursing Open*, *10*, 730–737. https://doi.org/10.1002/nop2.1340