Original Article

The current status of foot self-care knowledge, behaviours, and analysis of influencing factors in patients with type 2 diabetes mellitus in China

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ABSTRACT

Purpose: To investigate the knowledge and behaviours on foot self-care in patients with type 2 diabetes mellitus; analyse the influential factors, and provide information for the intervention study.

Methods: A total of 5961 patients with type 2 diabetes mellitus from 144 hospitals in China were included in the study. The investigation content included patients’ demographic data, foot self-care knowledge and behaviours. The investigation tools were the questionnaires on the general diabetes information, on the foot self-care knowledge, and on the foot self-care behaviours.

Results: The foot self-care knowledge was medium and the foot self-care behaviour was poor. The status of knowledge and behaviours were influenced by education, duration of diabetes mellitus, periodic inspection, and education about diabetic complications. Pearson analysis demonstrated that there was positive correlation between knowledge score and behaviour score ($r = 0.27, p < 0.001$).

Conclusions: The status of foot self-care knowledge and behaviours are not optimistic. According to the patients’ own characteristics, the theory of knowledge, attitude and practice applies to encouraging patients to go for periodic inspection and education about diabetic complications so as to enhance the knowledge and promote the self-care behaviours.

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1. Introduction

Diabetes is a life-long disease, difficult to treat, often causing a variety of acute and chronic complications, seriously affecting the patient's quality of life. Diabetic foot is one of the main chronic diabetic complications. Despite medical advancements and prevention reports, the incidence rate of diabetic foot and morbidity remain high across the world [1]. Patients who had to suffer from amputation operation accounted for about 5%–10%, which is more than 50% of all non-traumatic amputation [2]. The right foot care, good blood glucose control, and the diabetes education can prevent up to 85% of the diabetic foot amputations [3]. Others have shown reduction in the foot amputation rate from 0.8% to 0.5% when appropriate diabetic foot care and education are implemented [4].

The aims of this study were to investigate the current status of the foot self-care knowledge, the foot self-care behaviours of patients with diabetes, to analyse the influencing factors, and to provide basis for related intervention researches.

2. Design and methods

2.1. Subjects

This cross-sectional research on type 2 diabetes patients used the convenience sampling method from April to July in 2010. The patients' information was collected from 50 research centres and 144 hospitals located across 31 Chinese provinces. And 50 hospitals were municipalities directly under the central government while others 94 hospitals were. To avoid the selection bias, each research centre cooperated with at least one community hospital during the investigation, patients from autonomous regions hospital occupied more than 10% of the total number of the centre. Sample inclusion criteria were: (1) type 2 diabetes diagnosis according to the WHO 1999 guidelines [5], (2) diagnosed with type 2 diabetes for >1 year, and (3) agreed to participate.

A total of 6043 questionnaires were distributed. Unqualified questionnaires were eliminated resulting in a total of 5961 questionnaires included in the study. The number of tertiary hospital patients was 5338 (89.55%). There were 623/5961 (10.45%) of community hospital patients. There were 3233/5961 (54.24%) male patients and 2728/5961 (47.76%) female patients. The patient age ranged from 16 to 94 years with average age being 59.50 ± 12.48 years. The duration of patient's diabetes was from 1.08 to 44.95 years, and the average was 8.79 ± 6.85 years. The number of patients with diabetic foot was 332/5961 (5.60%); the duration were 0.08–41.67 years, median was 0.96 years.

2.2. Surveys

2.2.1. General information

The portion of the questionnaire on the general patient information included gender, age, educational level, occupation, marital status, number of children, personal income, living habits, duration of diabetes treatment, annual check-ups (at least once a year), willingness to accept educational pamphlets provided by hospitals or community organization, acute or chronic complications, medical cost, and laboratory examination results (see Table 1).

2.2.2. Foot care knowledge questionnaire

Foot care knowledge questionnaire was developed using researchers' previous knowledge and experience as well as published information. This part of the questionnaire included six questions regarding the foot-care knowledge health providers would want patients suffering from diabetic foot to know: foot examination, foot care, foot nails trimmed, the treatment of foot problems, shoe type selection, and the processing of foot skin. Each item had “true”, “false” and “do not know” options. A true answer equalled 1 point, other options equalled 0 points. The maximum number of points was 24, indicating good foot-care knowledge. In the preliminary experiment 30 patients were selected, and interval measurements were taken for 2 weeks using the same questionnaire.

Formula for calculating the standard score was,

\[
\text{The standard score} = \frac{(\text{the actual score})}{(\text{the highest possible score})} \times 100.
\]

The standard score <60 was considered “poor”, 60–80 was “medium”, and ≥80 was “good” foot self-care [7].

2.2.3. Foot self-care behaviour questionnaire

A questionnaire on foot self-care behaviour developed by Toobert DJ, the Summary of Diabetes Self – Care Activities (SDSCA), was used to evaluate self-care behaviour in patients [8]. Prior to use by graduate students and doctors, the questionnaire was translated and converted to the Chinese scale used in endocrinology. Diabetes experts were hired to validate the content of evaluation, and select one of the 30 patients to do preliminary research centre survey [6]. The 30 patients chosen for the preliminary study had to answer five specific questions in the questionnaire on the foot self-care behaviour questionnaire: 1) “on how many of the last seven days did you check your feet”; 2) “on how many of the last seven days did you inspect the inside of your shoes”; 3) “on how many of the last seven days did you wash your feet”; 4) “on how many of the last seven days did you soak your feet”; 5) “on how many of the last seven days did you dry between your toes after washing”. Each answer was ranked from 0 to 7; the higher the score, better the foot self-care behaviour was. Using the norm analysis the standard score was calculated as follows:

\[
\text{The standard score} = \frac{(\text{the actual score})}{(\text{the highest possible score})} \times 100.
\]

The standard score <60 was considered “poor”, 60–80 was “medium”, and ≥80 was “good” foot self-care behaviour [7].

2.3. Statistical analysis

Data were analysed using Student's t test, analysis of variance, correlational and multiple regression analyses. The SPSS17.0 software (SPSS Inc., Chicago, IL, USA) was used to analyse the data. Data were presented as mean ± standard deviation, and a p < 0.05 was considered statistically significant (see Table 2).
3. Results

3.1. Foot-care knowledge

The average score for foot-care knowledge was 16.89 ± 4.13 points. The average standard point was 70.38 indicating an overall medium level of foot-care knowledge. The standard point was divided into 13 (54.17%) items that were good, six (29.16%) items that were medium, and four (16.67%) items that were poor. The items indicated that the patients had wrong cognization at issues below: “it is best to wear shoes which are a size larger than needed”, “soaking your feet is good for them”, “people with diabetes have dry skin on their feet, it is advisable to rub feet” “lace-up shoes is recommended for diabetics”.

3.2. The foot self-care behaviour

The average score was 20.82 ± 7.01 points, with standard score of 59.49, indicating a poor foot self-care behaviour overall. The question “on how many of the last seven days did you wash your feet” had the highest standard score (89.86). The question “on how many of the last seven days did you dry between your toes after washing” the standard score was 69.57. The three following questions, “on how many of the last seven days did you check your feet”, “on how many of the last seven days did you soak your feet”, and “on how many of the last seven days did you inspect the inside of your shoes” had low levels and the standard scores were 54.14, 42.86, and 54.14, respectively (see Table 3).

3.3. The analysis of factors affecting the patients’ foot-care knowledge and the foot self-care behaviour

3.3.1. The single factor analysis of foot care knowledge and foot self-care behaviour

3.3.1.1. Multiple factors analysis of foot care knowledge

The foot care knowledge score was the dependent variable. A multiple stepwise linear regression analysis was performed

Table 1 – Related factors affect diabetes foot-care knowledge and foot self-care behaviour (n = 5961)

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>Foot-care knowledge score</th>
<th>t/F</th>
<th>p</th>
<th>Foot self-care behaviour score</th>
<th>t/F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3223</td>
<td>16.80 ± 4.25</td>
<td>-1.82</td>
<td>0.069</td>
<td>20.28 ± 7.03</td>
<td>-6.466</td>
<td>&lt;0.001</td>
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<tr>
<td>Female</td>
<td>2728</td>
<td>16.99 ± 3.98</td>
<td>21.46</td>
<td>6.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;45</td>
<td>761</td>
<td>16.64 ± 4.47</td>
<td>46.799</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>45−</td>
<td>2329</td>
<td>16.82 ± 4.14</td>
<td>20.21</td>
<td>6.99</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&gt;60</td>
<td>2871</td>
<td>17.02 ± 4.02</td>
<td>21.69</td>
<td>6.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education degree</td>
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<td></td>
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<td></td>
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<tr>
<td>Primary school and below</td>
<td>365</td>
<td>15.44 ± 4.43</td>
<td>19.26</td>
<td>6.60</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Primary school</td>
<td>737</td>
<td>16.16 ± 4.41</td>
<td>20.53</td>
<td>7.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle school</td>
<td>1509</td>
<td>16.64 ± 4.24</td>
<td>20.77</td>
<td>6.93</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>High school or technical secondary school</td>
<td>1611</td>
<td>17.12 ± 4.05</td>
<td>21.13</td>
<td>7.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>college</td>
<td>938</td>
<td>17.51 ± 3.76</td>
<td>21.11</td>
<td>7.12</td>
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<tr>
<td>Bachelor degree and above</td>
<td>801</td>
<td>17.51 ± 3.75</td>
<td>20.94</td>
<td>7.09</td>
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<tr>
<td>Diabetes duration (year)</td>
<td></td>
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<td></td>
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<tr>
<td>&lt;5</td>
<td>2189</td>
<td>16.47 ± 4.45</td>
<td>19.95</td>
<td>7.01</td>
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<td></td>
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<tr>
<td>5−</td>
<td>1486</td>
<td>16.99 ± 4.17</td>
<td>20.68</td>
<td>6.93</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&gt;10</td>
<td>2286</td>
<td>17.23 ± 3.72</td>
<td>21.75</td>
<td>6.95</td>
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<td></td>
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<td>Accepted complications education</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2810</td>
<td>17.71 ± 3.64</td>
<td>22.14</td>
<td>6.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3151</td>
<td>16.16 ± 4.39</td>
<td>19.65</td>
<td>6.90</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Regular review of diabetes</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3387</td>
<td>17.25 ± 3.90</td>
<td>21.89</td>
<td>6.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2574</td>
<td>16.43 ± 4.36</td>
<td>19.42</td>
<td>6.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetic foot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>332</td>
<td>16.68 ± 3.97</td>
<td>21.43</td>
<td>7.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5629</td>
<td>16.91 ± 4.13</td>
<td>20.79</td>
<td>7.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n = number of questionnaires; p < 0.05.

Table 2 – Diabetes foot care knowledge influence factors of multiple stepwise linear regression analysis (n = 5961)

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Regression coefficient β</th>
<th>Standardized regression coefficient β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant term</td>
<td>14.003</td>
<td>-</td>
<td>57.705</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Education level</td>
<td>0.340</td>
<td>0.114</td>
<td>8.692</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration of diabetes</td>
<td>0.233</td>
<td>0.049</td>
<td>3.623</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Periodic review</td>
<td>0.407</td>
<td>0.049</td>
<td>3.757</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Received education of complications before</td>
<td>1.246</td>
<td>0.109</td>
<td>11.453</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note: R² = 0.152; p < 0.05.
using a single statistically significant factor for analysis statistically significant, education degree, diabetes duration and diabetes complications, received periodic review of education are its influence factors, and the four variables can explain 15.2% of the total variance. Independent variable assignments were: the level of education, primary school and below = 0, primary school = 1, middle school = 2, high school or technical secondary school = 3, college = 4, bachelor degree and above = 5; regular review of diabetes, no = 0, yes = 1; accepted complications education, no = 0, yes = 1.

3.3.1.2. Multiple factors analysis of foot self-care. The foot self-care behaviour score was the dependent variable. A multiple stepwise linear regression analysis was performed with variables which were statistically significant in the single factor analysis, gender, age, education level, duration of diabetes, periodic review of diabetes, and previously received educational material on diabetic foot complications; these six variables explained 16.8% of the total variation. The values of independent variables were: gender, male = 0, female = 1; education level, primary school or below = 0, primary school = 1, junior high school = 2, high school or secondary school = 3, junior college = 4, bachelor degree or above = 5; periodic review of diabetes, no = 0, yes = 1; previously received education on complications, no = 0, yes = 1.

3.3.1.3. The correlation analysis of foot-care knowledge and foot self-care behaviour. The correlation analysis of foot care knowledge and foot self-care behaviour showed that foot care knowledge was significantly and positively correlated with foot self-care behaviour ($r = 0.27, p < 0.001$).

4. Discussion

4.1. Present situation of foot care knowledge of patients with type 2 diabetes

The results of the current survey show that the foot-care knowledge in patients with type 2 diabetes is at the medium level, and the worst items involved the daily foot care, shoe selection, and dealing with dry skin on the foot. These results are consistent with the study conducted by Wang et al. [9]. Most patients are not knowledgeable enough to choose proper shoes. Patients believe that soaking feet will provide them with necessary relief, and that rubbing their feet is good when their skin is dry. However, patients are not aware that the appropriate length of time for washing their foot is 5–10 min with the water temperature at a stable 37 °C. The reason for this is that washing foot in overly hot water could cause scalding, and washing feet for too long of a time can make the skin become too soft, potentially damaging the defensive cuticle functions. Patients do not know that rubbing the feet when the skin is dry increases their risk of ulcers. Our results reveal the weakness in the foot-care knowledge intervention among type 2 diabetes patients. One of the possible explanations for this result is that patients with diabetic foot only account for 5.6% of the patients in the current study. For those patients without diabetic foot, much attention is paid to foot checking and nail trimming, enabling patients to find foot lesions in-time to reduce their risk of injury. However, interveners and patients are inclined to ignore the daily foot care, which leads to the incomprehensive knowledge of foot care in patients. Therefore, the intervener should pay attention to daily care of diabetic foot rather than just emphasizing foot checking and risk factors. This approach is more helpful in ensuring that patients understand a complete diabetic foot-care, and implement a correct way of foot self-care.

4.2. Present situation of diabetic foot self-care behaviour

Our results showed that the foot self-care behaviour is at a poor level overall, especially when it comes to performing daily foot checking and shoe-checking prior to wearing shows. These results are consistent with most domestic studies [9,10]. In this study, 70.90% of patients know about daily foot checking, while 41.00% of patients did it every day. The study conducted by Sun also demonstrated that some patients did not attach importance to daily foot- and shoe-checkings before wearing shoes due to an assumption that asymptomatic feet did not require daily checking [11]. Our results demonstrate that the rate of foot self-care behaviour is lower in comparison with patients’ awareness of foot self-care. Although the awareness rate of patients who received foot care education has improved, it is hard to change patients’ behaviour and for them to develop a habit of daily foot- and shoe-checking before wearing shoes. This is mostly due to lack of immediate effect of these daily checkings which
exhibit benefits only through long-term care. Family members may play an important supportive role through persistent daily foot-care supervisions. Meanwhile, interveners can explain the seriousness and harmfulness of the diabetic foot by showing patients cases and photos, which has been demonstrated as helpful in promoting the implementation of foot self-care.

4.3. Influence factors of foot care knowledge and foot self-care behaviour

Multiple stepwise regression analysis shows that education level, duration of diabetes, and exposure to educational material on diabetic foot complications, are important factors influencing the extent of foot self-care knowledge and foot self-care behaviour in diabetes patients. Patients who have higher education have better access to relevant health information. These patients also exhibit higher understanding of the importance of self-care behaviour. [12]

Patients with a long history of diabetes and re-examination regularly got a high score in the part on foot-care knowledge and foot self-care behaviour, suggesting that these patients pay more attention to self-care and are inclined to seek relevant information by themselves. The foot-care knowledge and foot self-care behaviour of patients who received education on complications was much better than those who did not. A study showed that patients’ frequency of foot self-care can be improved under instruction from diabetes specialist nurse [13]. The patient are willing to take action in preventing the diabetic foot only when they become aware that this condition is preventable [10]. Hence, Chinese medical institutions focus on improving diabetes educational programs, increase the size of the diabetes educational team, thus providing patients with access to formal diabetes education, regular re-examinations, and joint-educational activities.

Diabetic foot not only extends the hospital stay but also increases the in-hospital mortality [14]. Interveners need to concentrate their activities on change patients’ attitudes and minds instead of just providing them with the instructions on foot care. This attitude change could be achieved through photos or videos, especially when talking to patients with poor education. This approach would create awareness regarding complications associated with diabetic foot and gear the patients towards using the correct foot self-care.

4.4. The correlation of foot care knowledge and foot self-care behaviour

The correlation analysis of foot care knowledge and foot self-care behaviour demonstrates that there is a positive correlation between the two variables; the better the patient masters the foot care knowledge, the better he/she performs the foot self-care. These results are consistent with the study done by Huang [12]. According to the “KAF” theory, the relationship between knowledge, attitude, and behaviour is progressive with knowledge providing the basis of positive beliefs and attitudes, and right beliefs and attitudes being the power behind the change in behaviour [15]. Therefore, nurses should provide access to educational material on diabetic foot to each type 2 diabetic patient, and emphasize the serious consequences of complications, like amputation, if they would to fail to follow proper foot-care. Moreover, to ensure the continuation of foot self-care, the family members should be encouraged to supervise patients. The community hospitals also need to contribute more to follow-up work.

The current state of foot-care knowledge and foot self-care behaviour in the Chinese patients with type 2 diabetes is not optimistic. The intervener should encourage the patients to regularly re-examine and participate in educational activities through full usage of the KAP theory. The healthcare providers should focus on strengthening the weak points of the patient’s foot-care knowledge. Meanwhile, the awareness of the risk associated with diabetic foot should be cultivated among patients, since it has been helpful for maintaining good foot-care behaviour. However, in recent years, with the further promotion of diabetes education work, the knowledge of diabetes and self-management ability had a tremendous promotion. Therefore, the results of current study might not cover the situation of diabetes foot care, which remains to be a direction need to be explored in the future.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

We want to thank everyone in the education and management group of the Chinese Diabetes Society for ensuring that the study went smoothly.

References


