

Competency in Diabetes Foot Care Practices in Saudi Arabians through the lens of Orem's Self-Care Deficit Theory

Dr. Hussien Alkeff¹, Dr. Sami Eid¹, Wael Gusti¹, Sattam Aljohani¹, Badr Alharbi¹,
Mohammed Alghamdi¹, Faleh Aldosari², Hussain Shiky³, Faiz Alenezi⁴

¹*Directorate of Health Affairs in Jeddah, Ministry of Health, Saudi Arabia.*

²*Wadi Al-Dawasir General Hospital, Ministry of Health, Saudi Arabia.*

³*Prince Abdul Majeed Healthcare center, Ministry of Health, Saudi Arabia.*

⁴*Alshamly General Hospital, Ministry of Health, Saudi Arabia.*

Abstract

Saudi Arabia has disproportionately high prevalence of Type 2 Diabetes Mellitus, which translates to high incidences of diabetes complications with severe socioeconomic and health burden. Diabetes foot ulcers are some of the debilitating diabetes complications with serious ramifications on socioeconomic and health dynamics. Self-care practices have been shown to improve diabetes foot care outcomes. However, the efficiency of such practices seems to heavily rely on individual's competency, which is herein delineated with knowledge, practice and attitude. This narrative review discussed the level of diabetes foot care competency among Saudi resident through the lens of Orem's self-care deficit theory. Moreover, the diverse factors affecting self-care competency, such as socioeconomic status, level of education, access to information, and demographic characteristics have been discussed. Overall, the sharp inconsistencies in the literature evidence call for meta-analysis for a more focused view of self-care competency levels.

Keywords: Type 2 Diabetes, ulcers, Orem's self-care deficit theory.

Introduction

Type 2 diabetes mellitus (T2DM) is a worrisome global health challenge due to its ever-rising prevalence (Liu et al., 2020). Saeedi et al. (2019) reported that the "global diabetes prevalence in 2019 [was] estimated to be 9.3% (463 million people), rising to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045" (p. 107843). Similarly, In Saudi Arabia, reports indicate that the prevalence of Type 2 diabetes is gradually peaking (Fareed et al., 2017). While Alotaibi et al. (2017) noted that the rise is more apparent among the females residing in the urban areas, the nationwide survey conducted by Alqahtani et al. (2023) in Saudi Arabia reported a slightly higher

prevalence in males (10.3%) than female (9.9%).

Type 2 diabetes mellitus presents critical global health burden, with reports showing that it claims more than 1 million deaths each year (Khan et al., 2020). Mortality often arises from the associated complications, such as cardiovascular diseases, neuropathy, nephropathy, retinopathy, foot ulcerations and amputations, dermatological conditions, and even cognitive decline (Zhang et al., 2020; Tinajero & Malik, 2021). Lin and colleagues noted that, in 2017 alone, more than 1.3 million deaths from T2DM were confirmed. The complications, notably neuropathy and diabetes foot ulcers, are widespread in Saudi Arabia (Al-Esawi & Amer, 2021; Robert et al., 2017;

Al-Jedai et al., 2022). For instance, Sulimani et al. (2019) indicated that 48% of the surveyed participants had cases of peripheral vascular disease. Of critical concern is diabetes foot ulcer (DFU), which mostly lead to amputations and disability of not treated well. In a country-by-country comparative review of the prevalence of diabetes foot ulcers in the middle eastern countries, Saudi Arabia had the highest incidence of 11.8% (Mairghani et al., 2017).

The level of patients' competency in care for diabetes foot ulcers is a thematic interest in the Kingdom of Saudi Arabia, especially in the context of self-care deficit theory of Orem (1989). Therefore, it is persistently challenging to identify the gaps in self-care efficiencies, owing to the increased cases of diabetes complication and comorbid conditions in the current times. Moreover, many studies have examined the level of self-care practices, knowledge and attitude towards DFU, yet with inconsistent outcomes. Therefore, this review becomes necessary as it concentrates on assessing competency in diabetes foot care among Saudi Arabian residents through the lens of Orem's self-care deficit theory, so as to avail current evidence for practical recommendations.

Self-care deficit theory and diabetes foot care competency

This review draws its guide and framework from Orem's (1989) self-care deficit theory, which identifies gaps in the self-care activities and individual limitations due to certain conditions. In regards to self-care and self-management of DFU, proper foot care becomes a crucial universal need due to the increased risk of foot ulcers. However, this essential self-care practice requires specific knowledge, skills, and attitudes among the affected individuals, forming a 'foot care competency'. As such, the individuals who are unable to meet such competency fall short of the competency lines and are thus termed as deficit in the care for DFU (Şahin & Cingil, 2020). The identifications of such deficits would thus call for the assistance of healthcare service providers and the input of other healthcare professionals, such as endocrinologists to

address the developmental deficit associated with diabetes, which can be done through diverse approaches, such as education and support provision. Overall, integrating self-care deficit theory with foot care competency allows healthcare professionals to understand patient needs and develop strategies to promote better self-care practices and reduce complications associated with diabetes (Hemmati Maslakpak et al., 2018).

Foot care competency

This review considers 'competency' from three different domains, that collectively describe the ability of an individuals to meet the basic foot care practices on their own (Miller, 2022). In the context of self-care activities for DFU, self-care competency encompasses knowledge and skills, practices and attitudes. Interestingly, many researchers have examined these concepts in relation to self-care for DFU among the residents of Saudi Arabia.

Knowledge levels

Understanding the intricacies of foot care is paramount for individuals who suffer from T2DM. Many research studies have been conducted in Saudi Arabia to examine the level of knowledge among the sufferers of DFU. However, it must be noted that knowledge alone does not satisfactorily confirm the level of self-care, and neither would the deficit of knowledge ascertain the self-care shortfall. As such, the outcomes from studies assessing knowledge levels would only complement the observations on other variables, i.e., practice and attitudes.

In one of the empirical research study, Alshammari and colleagues (2019) noted inadequate knowledge among 81% of the DFU suffers, who were all married. Their observations pointed towards the significance of marriage in influencing the level of knowledge regarding diabetes foot ulcers' care. In another research, Al-Yahya et al. (2020) indicated that while overall diabetes knowledge was adequate, understanding specific to diabetic complications such as peripheral nerve damage remained suboptimal, with mean score falling below the average. These two studies

give an overall negative impression, albeit inconclusive knowledge levels among sufferers of DFU in Saudi Arabia.

Wazqar et al. (2021) observed slightly different outcomes, which leans towards inadequate knowledge levels among the participants in their study. From their study, “most of the participants (72.4%) had a poor level of knowledge whereas only 4.2% expressed a good level of knowledge” (p. 123). Similarly, AlOwais and Shido (2020) observed that even though more than half of the participants expressed confidence in their knowledge towards DFU care, their overall level of knowledge was still considered to be suboptimal. Many other studies also support the observed inadequate knowledge levels among the Saudi residents (Alshaikh et al., 2023; Abdulghani et al., 2018; Alsaigh et al., 2022; Hassounah et al., 2023; Alsaigh et al., 2022). For instance, Darraj et al. (2023) established that more than 50% of the patients in their study gave incorrect responses regarding knowledge of DFU care and overall foot care. Moreover, Al Odhayani et al. (2017) further elucidated that some patients remained oblivious to diabetes foot risk knowledge and awareness, thereby engaging in inadequate foot care.

Whereas many studies have reported inadequate knowledge levels among people with DFUs, some researchers have also noted adequate knowledge levels. This paints a mixed-up picture of knowledge levels. For instance, Al-Hariri and colleagues (2017) indicated that most of the participants in the study had reliable knowledge levels regarding the care for their diabetes foot conditions. In the same way, Alharbi and Sulaiman (2022) observed that the majority of the study participants (about 56.5%) gave correct responses to the knowledge questions. Also, Solan et al. (2017) noted that about half of the participants had adequate scores in knowledge regarding diabetes foot care.

Nevertheless, discrepancies and inconsistencies within researchers' observations also characterized the study outcomes. For example, Shamim et al. (2021) discovered that while

patients possessed adequate overall knowledge of diabetes and its complications, a substantial percentage of them suffered the challenges of DFU. These observations may indicate that the participants only had good theoretical knowledge with little practical sense. Still, according to Abdulghani et al. (2018), a good proportion of the participants, about 70% scored adequate knowledge levels about the care for diabetes foot ulcers.

Self-care practices

Effective self-care practices are vital for managing diabetes foot ulcers. Many research studies have been conducted in Saudi Arabia to examine the level of practices among the sufferers of diabetes. Again, the research outcomes paint a picture of mixed observations and level of practices, which may indicate inconsistent practices. Nevertheless, the significant research outcomes are discussed in this section.

Some researchers reported adequate self-care practices for diabetes foot. For instance, Alshammari et al. (2019) demonstrated that most of the participants (about 78%) had excellent practices in caring for their feet. Similarly, Al-Yahya et al. (2020) also reported adequate practices for diabetes foot care. On the same note, Alharbi and Sulaiman (2022) observed relatively higher levels of good practices regarding diabetic foot care. Still, the study by Alharbi and Sulaiman noted some practice deficiencies; for example, specific practices such as daily foot examination and drying between the toes were not adequately done. Goweda et al. (2017) found varying levels of foot care practices, with a significant percentage examining their feet regularly but also notable instances of patients walking barefoot despite their diabetic condition were also observed.

Some researchers reported specific practices of foot care. For example, Abdulghani et al. (2018) observed that less than 50% of the participants often examined their feet; 41% regularly washed their feet using warm water, and 31% were keen to dry the interdigit spaces between toes. Lastly, 33% often used foot

moisturizers on their feet. Despite such statistics, Abdulghani et al. (2018) still reported inadequate overall practices for diabetes foot care. Indeed, many other researchers have also reported inadequate level of practices toward diabetes foot care (Shamim et al., 2021; Darraj et al., 2023). For example, Wazqar et al. (2021) highlighted significant deficits, with nearly two-thirds of patients displaying poor levels of practice related to diabetic foot self-care. Similarly, AlOwais and Shido (2020) underscored gender disparities in self-care practices, with males demonstrating higher rates of self-inspection, and females exhibiting greater adherence to daily moisturizing. However, overall practice levels remained low.

Further studies reported poor practices of diabetes foot care. Alshaikh et al. (2023) established suboptimal adherence to foot care practices among participants, with a majority obtaining poor scores in practical implementation. Al Odhayani et al. (2017) emphasized the apparent poor levels of awareness of diabetes foot risk factors and poor foot care practices among patients in Saudi Arabia. Interestingly, Alsaigh et al. (2022) noted a practice gap between knowledge and practice, where a majority of the participants had poor practices of foot care despite their satisfactory level of knowledge.

Solan et al. (2017) noted foot care practice differences based on gender whereby males focused more on drying their feet while females focused more on keeping their feet soft. Some researchers, such as Al-Khaldi (2008) expressed that the participants' practices were influenced by their negative behaviors, which discouraged them from engaging in the recommended foot care practices.

Attitude

The attitude of Saudi Arabian individuals with DFUs was also assessed by a few research studies. From the studies, it is apparent that the outcomes show sharp contradictions with some reporting positive attitude while other supporting participants' negative attitude. According to Alshammari et al. (2019), more than 86% of the participants had poor attitude

towards foot care practices. At the same time, Al-Yahya et al. (2020) noted suboptimal attitude scores among their participants toward diabetes foot care. In another study conducted by Al-Khaldi (2008), the participants exhibited general poor behaviors, which could be influenced by poor attitude towards foot care or other deficit factors sitting within the individual capacity.

However, some researchers also observed positive attitude toward foot care activities. Alshaikh et al. (2023) reported a positive attitude among 63.9% of participants towards self-care practices in diabetes foot complications. On the same theme, Al-Hariri et al. (2017) observed that a significantly large proportion of the participants had positive attitude towards the care for diabetes foot ulcerations. The same fashion is demonstrated by Shamim et al. (2021) who noted positive attitude towards diabetes foot care among their participants. Overall, there is inconsistent attitude of diabetes foot care.

Influential factors of self-care competency

Literature evidence further revealed that many different factors do affect self-care competency in diabetes foot care.

Factors affecting knowledge

Many factors were noted to affect individual's knowledge levels in diabetes foot care. Studies have noted diverse factors that can be classified under sociodemographic, clinical/medical, and educational factors. According to the self-care deficit theory, the factors situated within the individuals' capacity are thus described as deficits that need the assistance of healthcare professionals.

Level of education and other socioeconomic factors have been noted to affect level of knowledge. Particularly, many studies identified education level as critical factors in influencing knowledge levels of diabetes foot care. Studies have shown that individuals who have higher education level tend to exhibit better self-care knowledge in diabetes foot management (Alshammari et al., 2019; Darraj et al., 2023). In contrast, other researchers have

also reported that individuals who have relatively lower levels of education tend to show lower knowledge levels regarding diabetes foot self-care (Al-Yahya et al., 2020). These pieces of evidence show that education has a critical role in shaping individual's understanding and information retention for positive health behaviors.

Moreover, socioeconomic factors, such as level of income and employment have also been noted to affect an individuals' level of knowledge regarding the care and management of diabetes foot (Al-Yahya et al., 2020; Alharbi et al., 2022). Accordingly, individuals with lower socioeconomic status, having low-income values, are likely to exhibit poor knowledge levels in diabetes foot care. This relationship can be explained from the perspective of the economic values of education and information – those with better income would be able to pay for the better education and hence better their overall health literacy as opposed to those with little income (Alshammari et al., 2019). Nevertheless, Wazqar et al. (2021) observed that those who access information from the healthcare professionals tend to demonstrate better knowledge than those who seek information elsewhere.

Other factors, such as demographic and clinical elements also tend to impact the level knowledge. It was noted that the duration of illness significantly affects an individual (Alharbi et al., 2022). Those with longer duration of illness already accessed healthcare information from their regular clinic visits, which imbue them with better knowledge levels than those have only contracted the disease recently. Diabetes foot education, receivable among those attending the clinics and arranged training, also contribute massively to self-care knowledge of diabetes foot management (Goweda et al., 2017). Nevertheless, some studies reported that knowledge did not depend on age and gender (Solan et al., 2017).

Factors affecting practice

Literature evidence outlined three significant factors affecting Saudi residents' self-care practices in diabetes foot; socioeconomic status and education level, access to healthcare information, and gender.

Regarding the socioeconomic status influences, researchers have shown that those with higher income levels tend to demonstrate better self-care practices for diabetes foot than those with lower income (Alharbi et al., 2022). Income affects' the patient's ability to maintain proper diet, purchase information materials and purchase basic resources, including hygiene materials for wound care and even exercise equipment. Moreover, education level also influences self-care practices of diabetes foot, whereby higher education level translates to better self-care practices (Al-Yahya et al., 2020; Darraj et al., 2023).

Access to health information also plays a significant role in modulating the self-care practices of diabetes foot. For instance, it was noted that those who visited the clinics more frequently are better placed in terms of practicing foot care activities (Alshammari et al., 2019). This highlights the importance of regular medical consultations in providing guidance, monitoring, and reinforcing the importance of foot care. Moreover, having prior knowledge about foot care was also shown to improve self-care practices of diabetes foot care (Alharbi et al., 2022).

Gender influence individual's perceptions of worldview, roles and practices, which include health practices. Studies have shown variations in some foot care practices (AlOwais & Shido, 2020); for instance, males preferred to keep their feet dry while females use skin moisturizers. Still, some studies have also reported no relationships between gender and self-care practices of diabetes foot (Solano et al. 2017). Overall, understanding the various factors affecting patients' self-care practices regarding foot care requires a holistic approach that considers socioeconomic factors, education, healthcare access, knowledge, and gender-specific variations.

Conclusion

According to the self-care deficit theory, this narrative review has shown that the Saudi Arabian individuals with diabetes foot ulcers exhibit diverse deficits in the care and management of their conditions. The deficits are compounded by insufficient healthcare knowledge, low income, unemployment, gender, and duration of the disease, just to mention a few. Therefore, achieving competency in diabetes foot self-care practices requires interdisciplinary efforts that consider demographic, socioeconomic and knowledge/informational factors. Nevertheless, owing to the inconsistent outcomes regarding competency in self-care practices of diabetes foot care, this review does not provide a discrete state of the individual's competency level.

Recommendations

Due to the inconsistent outcomes in the literature regarding self-care competency in diabetes foot care, there is need for the Saudi healthcare systems and policymakers to consider the outlined deficits among diabetic individuals in order to curb severity of potential complications. Nevertheless, there is need to conduct meta-analysis in future to shade more light on cultural competency and show a trend whether there is an improvement or deterioration over time.

Conflict of Interest

No conflict of interest held by authors.

Reference

- [1] Abdulghani, H. M., AlRajeh, A. S., AlSalman, B. H., AlTurki, L. S., AlNajashi, N. S., Irshad, M., Alharbi, K. H., AlBalawi, Y. E., AlSuliman, Y. A., & Ahmad, T. (2018). Prevalence of diabetic comorbidities and knowledge and practices of foot care among diabetic patients: a cross-sectional study. *Diabetes, metabolic syndrome and obesity: targets and therapy*, 11, 417–425. <https://doi.org/10.2147/DMSO.S171526>
- [2] Al Odhayani, A. A., Al Sayed Tayel, S., & Al-Madi, F. (2017). Foot care practices of diabetic patients in Saudi Arabia. *Saudi journal of biological sciences*, 24(7), 1667–1671. <https://doi.org/10.1016/j.sjbs.2015.12.003>
- [3] Al-Esawi, H., & Amer, S. A. (2021). Prevalence of complications among Saudi males type 2 diabetic patients in Riyadh Primary Health Care Centers, 2019. *Diabetes Updates*, 7, 1-11.
- [4] Algshaneen, M. A., Almuhanha, M. F., Almuhanha, A. M., Alghobaish, F. F., Bari, O. S., Alajji, N. A., ... & Alzamanan, M. Y. (2017). Diabetic foot awareness among diabetic patients in Saudi Arabia. *The Egyptian Journal of Hospital Medicine*, 68(2), 1289-1290. DOI: 10.12816/0039063
- [5] Alharbi, M. O., & Sulaiman, A. A. (2022). Foot care knowledge, attitude and practices of diabetic patients: A survey in Diabetes health care facility. *Journal of family medicine and primary care*, 11(7), 3816–3823. https://doi.org/10.4103/jfmpc.jfmpc_183_21
- [6] Al-Hariri, M. T., Al-Enazi, A. S., Alshammari, D. M., Bahamdan, A. S., Al-Khtani, S. M., & Al-Abdulwahab, A. A. (2017). Descriptive study on the knowledge, attitudes and practices regarding the diabetic foot. *Journal of Taibah University Medical Sciences*, 12(6), 492–496. <https://doi.org/10.1016/j.jtumed.2017.02.001>
- [7] Al-Jedai, A. H., Almudaiheem, H. Y., Alissa, D. A., Al-Enazy, H. S., Korayem, G. B., Alghamdi, A., & Alghamdi, S. (2022). Cost of cardiovascular diseases and renal complications in people with type 2 diabetes mellitus in the Kingdom of Saudi Arabia: A retrospective analysis of claims database. *PloS one*, 17(10), e0273836. <https://doi.org/10.1371/journal.pone.0273836>

- [8] Al-Khaldi Y. M. (2008). Foot care among male diabetics in family practice center, Abha, Saudi Arabia. *Journal of family & community medicine*, 15(3), 103–106. PMID: 23012175. PMCID: PMC3377122
- [9] Alotaibi, A., Perry, L., Gholizadeh, L., & Al-Ganmi, A. (2017). Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. *Journal of epidemiology and global health*, 7(4), 211–218. <https://doi.org/10.1016/j.jegh.2017.10.001>
- [10] AlOwais, M. M., & Shido, O. A. (2020). Knowledge and practice of foot care in patients with diabetes mellitus attending primary care center at Security Forces Hospital, Riyadh, Saudi Arabia: A cross-sectional study. *Journal of family medicine and primary care*, 9(12), 5954–5960. https://doi.org/10.4103/jfmmpc.jfmmpc_943_20
- [11] Alqahtani, B., Elnaggar, R. K., Alshehri, M. M., Khunti, K., & Alenazi, A. (2023). National and regional prevalence rates of diabetes in Saudi Arabia: analysis of national survey data. *International Journal of Diabetes in Developing Countries*, 43(3), 392–397. <https://doi.org/10.1007/s13410-022-01092-1>
- [12] Alsaigh, S. H., Alzaghran, R. H., Alahmari, D. A., Hameed, L. N., Alfurayh, K. M., & Alaql, K. B. (2022). Knowledge, Awareness, and Practice Related to Diabetic Foot Ulcer Among Healthcare Workers and Diabetic Patients and Their Relatives in Saudi Arabia: A Cross-Sectional Study. *Cureus*, 14(12), e32221. <https://doi.org/10.7759/cureus.32221>
- [13] Alshaikh, A. A., Alqarni, H. M., Hassan Assiri, H. A., Shlwan, M. A., AlJebreel, M. A., Almuaddi, A. S., Asiri, M. A., Almuidh, F. N. A., Al Qasim, N. Y., Alshahrani, O. A., & Ghazy, R. M. (2023). Knowledge, Attitude, and Practice of Diabetic Foot Ulcer Care in Asser Region: A Cross-Sectional Study. *Cureus*, 15(8), e42807. <https://doi.org/10.7759/cureus.42807>
- [14] Alshammari, Z. J., Alsaid, L. A., Parameaswari, P. J., & Alzahrani, A. A. (2019). Attitude and knowledge about foot care among diabetic patients in Riyadh, Saudi Arabia. *Journal of family medicine and primary care*, 8(6), 2089–2094. https://doi.org/10.4103/jfmmpc.jfmmpc_248_19
- [15] Al-Yahya, A., Alsulaiman, A., Almizel, A., Barri, A., & Al Adel, F. (2020). Knowledge, Attitude, and Practices (KAP) of Diabetics Towards Diabetes and Diabetic Retinopathy in Riyadh, Saudi Arabia: Cross-Sectional Study. *Clinical ophthalmology (Auckland, N.Z.)*, 14, 3187–3194. <https://doi.org/10.2147/OPHTH.S269524>
- [16] Darraj, G., Somaili, M., Shaban, S., Jahlan, M., Darraj, A., Ahmed, B., Mojamamy, G., Darraj, M., Dahlan, H., & Alqassim, A. (2023). Footcare knowledge and practice among diabetic patients attending primary health care centers in Jazan region, Saudi Arabia. *Journal of general and family medicine*, 24(3), 164–170. <https://doi.org/10.1002/jgf2.613>
- [17] Fareed, M., Salam, N., Khoja, A. T., Mahmoud, M. A., & Ahamed, M. (2017). Life style related risk factors of type 2 diabetes mellitus and its increased prevalence in Saudi Arabia: A brief review. *International Journal of Medical Research & Health Sciences*, 6(3), 125–132. ISSN No: 2319-5886 Sulimani, R. A., Famuyiwa, O. O., & Mekki, M. O. (1991). Pattern of diabetic foot lesions in Saudi Arabia: Experience from King Khalid University Hospital, Riyadh. *Annals of Saudi medicine*, 11(1), 47–50. <https://doi.org/10.5144/0256-4947.1991.47>
- [18] Goweda, R., Shatla, M., Alzaidi, A., Alzaidi, A., Aldhawani, B., Alharbi, H., ... & Rawa, B. (2017). Assessment of knowledge and practices of diabetic patients regarding diabetic foot care, in Makkah, Saudi Arabia. *Journal of Family Medicine and Health Care*, 3(1), 17. doi: 10.11648/j.jfmhc.20170301.14
- [19] Hassounah, G., Al Dossari, H. J., & Robert, A. A. (2023). Knowledge of

- Complications of Diabetes Mellitus among Patients with Type 2 Diabetes in Saudi Arabia: A Descriptive Study. *Current diabetes reviews*, 19(5), e260922209161. <https://doi.org/10.2174/1573399819666220926155544>
- [20] Hemmati Maslakkpak, M., Shahbaz, A., Parizad, N., & Ghafourifard, M. (2018). Preventing and managing diabetic foot ulcers: application of Orem's self-care model. *International Journal of Diabetes in Developing Countries*, 38, 165-172. <https://doi.org/10.1007/s13410-017-0570-5>
- [21] Khan, M. A. B., Hashim, M. J., King, J. K., Govender, R. D., Mustafa, H., & Al Kaabi, J. (2020). Epidemiology of Type 2 Diabetes - Global Burden of Disease and Forecasted Trends. *Journal of epidemiology and global health*, 10(1), 107-111. <https://doi.org/10.2991/jegh.k.191028.001>
- [22] Lin, X., Xu, Y., Pan, X., Xu, J., Ding, Y., Sun, X., Song, X., Ren, Y., & Shan, P. F. (2020). Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. *Scientific reports*, 10(1), 14790. <https://doi.org/10.1038/s41598-020-71908-9>
- [23] Liu, J., Ren, Z. H., Qiang, H., Wu, J., Shen, M., Zhang, L., & Lyu, J. (2020). Trends in the incidence of diabetes mellitus: results from the Global Burden of Disease Study 2017 and implications for diabetes mellitus prevention. *BMC public health*, 20(1), 1415. <https://doi.org/10.1186/s12889-020-09502-x>
- [24] Mairghani, M., Elmusharaf, K., Patton, D., Burns, J., Eltahir, O., Jassim, G., & Moore, Z. (2017). The prevalence and incidence of diabetic foot ulcers among five countries in the Arab world: a systematic review. *Journal of wound care*, 26(Sup9), S27-S34. <https://doi.org/10.12968/jowc.2017.26.Sup9.S27>
- [25] Miller, A. E. (2022). Self-care as a competency benchmark: Creating a culture of shared responsibility. *Training and Education in Professional Psychology*, 16(4), 333. <https://psycnet.apa.org/doi/10.1037/tep0000386>
- [26] Orem, D. E. (1989). Self-care deficit theory of nursing. *Nursing theorists and their work*.
- [27] Robert, A. A., Al Dawish, M. A., Braham, R., Musallam, M. A., Al Hayek, A. A., & Al Kahtany, N. H. (2017). Type 2 Diabetes Mellitus in Saudi Arabia: Major Challenges and Possible Solutions. *Current diabetes reviews*, 13(1), 59-64. <https://doi.org/10.2174/1573399812666160126142605>
- [28] Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A. A., Ogurtsova, K., Shaw, J. E., Bright, D., Williams, R., & IDF Diabetes Atlas Committee (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes research and clinical practice*, 157, 107843. <https://doi.org/10.1016/j.diabres.2019.107843>
- [29] Şahin, S., & Cingil, D. (2020). Evaluation of the relationship among foot wound risk, foot self-care behaviors, and illness acceptance in patients with type 2 diabetes mellitus. *Primary care diabetes*, 14(5), 469-475. <https://doi.org/10.1016/j.pcd.2020.02.005>
- [30] Shamim, M., Alhakbani, M. S. A., Alqahtani, M. S. B., Alharthi, O. S. O., & Alhaqbani, Y. J. N. (2021). Knowledge, attitude, and practice regarding diabetic foot care among Saudi and non-Saudi diabetic patients in Alkharj. *Journal of family medicine and primary care*, 10(2), 859-864. https://doi.org/10.4103/jfmmpc.jfmmpc_1681_20
- [31] Solan, Y. M., Kheir, H. M., Mahfouz, M. S., Al-Faify, A. A., Hakami, D. T., Al Faifi, M. A., ... & Sharif, H. H. (2017). Diabetic foot care: knowledge and practice. *Journal of Endocrinology and*

- Metabolism, 6(6), 172-177. doi:
<https://doi.org/10.14740/jem388e>
- [32] Tinajero, M. G., & Malik, V. S. (2021). An Update on the Epidemiology of Type 2 Diabetes: A Global Perspective. *Endocrinology and metabolism clinics of North America*, 50(3), 337–355. <https://doi.org/10.1016/j.ecl.2021.05.013>
- [33] Wazqar, A. A., Baatya, M. M., Lodhi, F. S., & Khan, A. A. (2021). Assessment of knowledge and foot self-care practices among diabetes mellitus patients in a tertiary care centre in Makkah, Saudi Arabia: a cross-sectional analytical study. *The Pan African medical journal*, 40, 123. <https://doi.org/10.11604/pamj.2021.40.123.30113>
- [34] Zhang, Y., Lazzarini, P. A., McPhail, S. M., van Netten, J. J., Armstrong, D. G., & Pacella, R. E. (2020). Global disability burdens of diabetes-related lower-extremity complications in 1990 and 2016. *Diabetes Care*, 43(5), 964-974. <https://doi.org/10.2337/dc19-1614>