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KNOWLEDGE, ATTITUDE, AND PRACTICE OF PATIENTS WITH TYPE 2 DIABETES MELLITUS REGARDING SELF-CARE IN TERTIARY CARE HOSPITALS IN PESHAWAR

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Abstract

Background: *Type 2 diabetes mellitus (T2DM) is currently a huge public health problem in Pakistan, and currently an estimated of 34.5 million adults are living with T2DM in Pakistan in 2024. Self-care is an integral part of diabetes management and prevention of complications but knowledge, attitude and practice (KAP) gaps exist as powerful barrier to self-care among patients in KPK. The number of patients suffering from T2DM is high in Tertiary care centers of Peshawar, however there is lack of proper KAP assessment in this area.*

Methods: *This study aimed at evaluating the knowledge, attitudes and self care practices of T2DM patients in tertiary care hospitals of Peshawar and then exploring association between KAP and socio-demographic, clinical and behavioral characteristics.Objective: To evaluate the knowledge, attitudes and self care practices of T2DM patients in tertiary care hospitals of Peshawar and to explore the associations of KAP scores with socio-demographic, clinical and behavioral factors.*

Design: *Descriptive cross sectional design was used. Convenience sampling was used to recruit a total of 220 T2DM patients from September to November in three tertiary care hospitals namely HMC, KTH and LRH, Peshawar. The socio-demographic and clinical profiling questions, Diabetes Knowledge Test Questionnaire (DKTQ, 12 items), Diabetic Health Belief Questionnaire (DHBQ, 16 items) and Summary of Diabetes Self-Care Activities (SDSCA, 17 items) were used to gather data. SPSS v.25 was used to analyze the data by descriptive statistics, chi-square test, Mann-Whitney U test, Kruskal-Wallis test, Spearman rank correlation test and binary logistic regression.*

Results: *The mean knowledge score was 6.80 ± 1.93 (56.67%) with 73.2% of the respondents showing satisfactory knowledge. The mean attitude score was 57.86 ± 7.74 out of 80 (65.41%), with 70.9% exhibiting a positive attitude. The mean self-care practice score was 83.49 ± 13.91 out of a total of 119 (65.18%) and 84.5% were considered to be demonstrating good self-care practice. There were significant associations between knowledge and education ($p < .001$),*

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place of residence (p = .037), occupation (p = .027), age (Kruskal-Wallis H = 14.06, p = .003) and diabetes education attendance (p < .001). Attitude was significantly associated with age (p < .001), marital status (p < .001), education (p = .003), and occupation (p = .009). There was a significant association with self-care practice and occupation (p = .001) and attitude category (p = .036). Spearman correlation analysis showed that there were significant positive relationships between knowledge and attitude (r = .529, p < .001), knowledge and practice (r = .271, p < .001) and attitude and practice (r = .445, p < .001). Being a private employee (OR = 0.034, p < .001) was significantly associated with self-care practice level in the binary logistic regression.

***Conclusion**: Most of the T2DM patients had satisfactory knowledge, positive attitude and good self-care practices, but there are significant gaps especially in foot care, physical activities, dietary compliance and perceived barrier. The KAP levels were significantly influenced by education, occupation, age and attitude. The need is very urgent for targeted diabetes self-management education programs at these tertiary care centers to lower-educated, single, younger and occupationally vulnerable patient groups.*

1 Introduction

1.1 Background of the Study:

Diabetes mellitus (DM) is a metabolic disorder that is chronic in nature and is associated with a hyperglycemia that is due to defects in insulin secretion and/or insulin action. At its core, the disease is a breakdown of normal metabolism of carbohydrates, fats and proteins, and when not well managed, results in devastating long-term complications such as cardiovascular disease, diabetic retinopathy, nephropathy, neuropathy, and lower-limb amputations (American Diabetes Association [ADA], 2023). Type 2 Diabetes Mellitus (T2DM), a condition mainly characterized by insulin resistance in peripheral tissues and by a gradual loss of beta cell function, is the most prevalent type of diabetes in the world and the major clinical challenge in the 21st century (ADA, 2023).

T2DM is an alarming situation worldwide. The International Diabetes Federation (IDF) Diabetes Atlas 11th edition (2025) estimates that there were 589 million people (11.1% of the world's adult population) with diabetes in the world in 2024. This is projected to rise to 853 million by 2050, given that on-going trends are likely to continue. Diabetes is disproportionately distributed in low- and middle-income countries (LMICs) where about 80% of all diabetes cases are found. Pakistan is in the midst of this crisis. The International Diabetes Federation (IDF, 2025) estimates that there are 34.5 million adults with diabetes in Pakistan with an age-standardized prevalence of 31.4% in 2024. Worryingly, more than 26.9% of these cases aren't diagnosed, and therefore not treated in time, causing additional complications. By 2050, it is estimated that Pakistan will be one of the three countries in the world with the highest diabetes burden with 70.2 million adults having diabetes. Some of the contributing factors include rapid urbanisation, sedentary lifestyle, high caloric diet, predisposition and most importantly low awareness level and lack of health-seeking behaviour (Basit et al., 2019; Meo et al., 2023).

Khyber Pakhtunkhwa (KP) province in the North-West of Pakistan has a unique socio-epidemiological context. Its capital city Peshawar, a hub of referral services is experiencing a very steep rise in morbidity and mortality due to diabetes. This is because the patients of this region are suffering from poor self-care behaviours which often leads to polio complications and T2DM is often diagnosed at a late stage (Shrivastava et al., 2013). The three main tertiary care hospitals (Hayatabad Medical Complex (HMC), Khyber Teaching Hospital (KTH), and Lady Reading Hospital (LRH) take care of tens of thousands of

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diabetic patients each year, and are important places to conduct KAP assessment.

T2DM management is patient centred. Most of the daily care of diabetes takes place outside of the hospital, in the home, the community and the workplace, and depends heavily on the active and ongoing efforts of the patient in a variety of self-care areas. These include diet plan, regular physical exercise, taking medications, checking blood glucose, foot care, and attending follow up appointments (Shrivastava et al., 2013; Okonta et al., 2014). Each of these self care behaviors is evaluated by relating to three interrelated constructs: Knowledge (what the patient knows about his/her disease), Attitude (how the patient feels and thinks about self care) and Practice (what the patient actually does on a day-to-day basis). The three components together (measured in Knowledge Attitude and Practice (KAP) studies) delineate the behavioral health status of diabetic population in a holistic manner.

Poor levels of KAP have been reported in various studies in Asia and Africa, especially in LMICs in the context of T2DM. Kassahun and Mekonen (2017) found low knowledge and negative attitudes to health and suboptimal self-care practices among the diabetic patients in Ethiopia, due to low health literacy and health system structural gaps. Similar reports of this have been received from the countries of South Asia and neighbouring Pakistan and India. While this evidence base does exist, there are little or no published KAP data specific to patients of T2DM in Peshawar and hence there is also limited evidence base for targeted educational interventions.

The aim of this study was to meet this gap in the evidence through systematic assessment of the knowledge, attitudes and self care practice of patients with T2DM attending three tertiary care hospitals in Pakistan; Peshawar, using internationally validated instruments. The findings will develop a rudimentary database for policy makers in the health sector, diabetes educators, nurses and hospital administrators to design and utilize evidence-based strategies for strengthening of diabetes self-management in Khyber Pakhtunkhwa.

1.2 Problem Statement

Although there has been considerable progress in diagnostics and therapeutics of diabetes globally and in Pakistan but the burden of diabetes related complications has been and will remain a major issue, largely due to the poor self-care practices among patients. Poor education levels, lack of access to health care, inadequate patient health education programmes and socio-cultural barriers to behaviour change exacerbate the problem in the case of Peshawar and Khyber Pakhtunkhwa.

Every year thousands of patients with T2DM visit in three major tertiary care hospitals of Peshawar (HMC, KTH and LRH). To our knowledge however, no systematic KAP study as this one is, using validated instruments to measure all three domains, has been performed in a specific population and setting. Understanding of T2DM patients' baseline knowledge, beliefs and practices about self-care in Peshawar is essential for designing relevant and culturally appropriate education interventions for T2DM patients by healthcare providers. This is one crucial gap in the evidence-base that this study will try to fill.

1.3 Objective of the study

Specific Objectives of this study were:

- To find the level of awareness about self care among the patients of type 2 Diabetes Mellitus visiting tertiary care hospitals of Peshawar.
- To assess the attitude of the T2DM patients towards self care behaviors based on Health Belief Model framework.
- To assess the level of self care practice of T2DM patients by using Summary of Diabetes Self-Care Activities (SDSCA) instrument.
- To investigate the relationship of the level of knowledge, attitudes and practices with selected socio-demographic and clinical factors.
- To find the factors predicting poor self care practice by Binary logistic regression analysis.

1.4 The significance of the study

This study contributes to the literature of nursing and public health in Pakistan in a number of important ways:

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Clinical relevance: Outcomes will directly feed into the counselling and education of diabetes care teams (HMC, KTH and LRH) and the nursing team and give specific insights into areas of gaps in knowledge and attitudinal barriers amongst patients.

Policy implications: Outcomes can be leveraged to make a case for structured diabetes self-management education programs in outpatient diabetes clinics to be prioritized by the KP Health Department and hospital administration.

Relevance to education: The results will be applied as a basis in developing curriculum in nursing education that will highlight patient education as a key part in the care of diabetes.

As for the research contribution, it is one of very few locally validated KAP research in local context of Peshawar and KP as well as for the region/country in general, in the domain of diabetes self-management.

1.5 Operational Definitions

1.5.1 Knowledge

Knowledge in this study is defined as the level of accurate beliefs a T2DM patient has of the disease and how it works, what are the complications and what are the appropriate self-care behaviors such as diet, medication, blood glucose monitoring, foot care and exercise. To assess knowledge 12 questions were used (DKTQ) with a score of 1 for correct answers and 0 for incorrect answers. The three levels of knowledge were determined as Adequate (50% and above) and Inadequate (less than 50%) based on the percentage of the total scores.

1.5.2 Attitude

Attitude: The patient's beliefs, perceptions and evaluations concerning his/her diabetes status and the suggested behaviors. Attitude was assessed using four of the constructs of the Health Belief Model (HBM), namely perceived susceptibility to complications, perceived severity of the disease, perceived benefits to self-care and perceived barriers to self-care. Using the 16 item Diabetic Health Belief Questionnaire (DHBQ) with a 5-point Likert scale and categorised as Positive (DHBQ ≥ 60%) and Negative (DHBQ < 60%).

1.5.3 Practice

Practice is the actual behaviors performed by the person with T2DM in his or her everyday life including diet adherence, exercise, checking blood glucose level, foot care and medication adherence. The widely used Summary of Diabetes Self-Care Activities (SDSCA) is a 17 item self-report measure of how many days per week (1-7) various diabetes-related patient behaviors are performed. Total practice was divided into two categories: Good (≥ 50%) and Poor (< 50%).

1.5.4 Self-Care

Self-care is a term that refers to all of the daily activities, behaviours and approaches to managing health that people with T2DM engage in at home or in other non-healthcare settings to regulate their blood glucose, promote health and prevent complications. This encompasses diet, exercise, taking medication, monitoring blood sugar levels, and taking care of feet.

1.6 Scope and Limitations

For this study only the T2DM patients who presented at the outpatient diabetes clinics of three tertiary care hospitals of Peshawar, KP, Pakistan was included. It is a cross-sectional design, which is not suitable to draw causal inferences between the variables. There is a social desirability bias with self-reported data on practice. The sample consisted mainly of Pashtun and Muslim population which makes it less generalizable to other ethnic and religious groups in Pakistan. Further, there could be an issue of representativeness in the non-probability sampling technique. However, the number of samples (N = 220) and the use of instruments that are used and have been validated internationally give reliability and validity of the results.

2 Literature Review

2.1 The burden of Type 2 Diabetes Mellitus around the world

Type 2 Diabetes Mellitus is one of the most important Non-Communicable Diseases challenges of 21st century and is an epidemic all over the world. The IDF Diabetes Atlas 11th Edition (2025) estimated that in 2024 there were

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589 million adults (11.1%) with diabetes worldwide and expects that diabetes will reach 853 million by 2050. T2DM is the most prevalent type of diabetes, with more than 90% of the total disease burden and is due to the complex interplay of genetic and environmental factors, such as caloric excess, obesity and physical inactivity (ADA, 2023). The disease is especially prevalent in LMICs in Asia, Africa and Latin America, which might not have the infrastructure to address the disease. T2DM also has substantial economic consequences resulting from reduced productivity, health care costs and disability, resulting in a cost of over USD 966 billion globally in 2021 (IDF, 2021).

2.2 The situation of burden of T2DM in Pakistan is as follows:

The problem of T2DM in Pakistan is much more serious as compared to the neighboring countries. Basit et al., (2019) found diabetes prevalence of 26.3% in adult population in Second National Diabetes Survey of Pakistan, (NDSP, 2016-2017) and 14.2% were pre-diabetic. Based on the latest data from IDF (2025), people in Pakistan aged 20 to 74 have diabetes at the rate of 31.4 age-standardized prevalence, with over 26.9% of those with diabetes being undiagnosed. The population of people with diabetes is projected to be maximum in Pakistan in 2050 (70.2 million), with urbanisation, diet and population growth driving this population.

Some specific challenges are present in Khyber Pakhtunkhwa (KP) due to its unique demographic profile, which includes higher share of rural population, less education facilities in peripheral areas and less infrastructure for health care. The provincial capital and the tertiary level care centre, Peshawar, gets more complex T2DM cases from entire KP, FATA and neighbouring Afghanistan. Meo et al. (2023) reported that the diabetes burden has been growing faster in KP compared to the country as well as diabetes awareness amongst patients is poor and there is no proper structured program of diabetes education.

2.3 Knowledge about caring for T2DM by the patient

Studies have regularly reported levels of knowledge among T2DM patients in LMICs to be variable, and generally low. Kassahun and Mekonen (2017) did a systematic review in Ethiopia that showed the knowledge level of diabetes management was adequate 40-60% among T2DM patients. Similarly, Al-Khaldi et al (2011) in Saudi Arabia and Okonta et al (2014) in Nigeria also reported a high proportion of their respondents to have inadequate knowledge of dietary management, foot care and blood glucose monitoring.

On the contrary, Shaikh et al. (2020) and Riaz et al. (2021) who investigated knowledge in Karachi and Lahore, respectively, in Pakistan found that the mean knowledge score was around the 50–60% range with lowest scores on questions about HbA1c measurement, foot care and the impact of exercise and infection on blood sugar. Knowledge deficiency of rural patients as compared to their urban counterparts has been well documented and it is believed that patients in urban area have more knowledge because they have better access to health care facilities, media and educational materials. Education level is the most significant factor for knowledge in nearly all studies published in South Asia with patients who were illiterate having a significantly lower score.

In the present study, the Diabetes Knowledge Test Questionnaire (DKTQ) is a validated 12-item questionnaire, created by Fitzgerald et al. (1998) and commonly adapted to cross-cultural applications. Its use in the past KAP studies in Pakistan can be considered as benchmarks. Knowledge of carbohydrates (Q11), methods of glucose testing (Q14) and symptoms of numbness (Q20) are answered correctly, while foot care (Q18), HbA1c (Q13) and effect of fruit juice on blood glucose (Q15) are missed.

2.4 Attitude of the people with T2DM towards self-care

The attitudes towards self-care among patients with T2DM usually are measured by the Health Belief Model (HBM) that assumes that health behaviors are influenced by perceived

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susceptibility to consequences of the disease, perceived severity of the disease, perceived benefits of responding, and perceived barriers to responding. Moderate to high susceptibility and harm scores, as well as low benefit scores and high barrier scores have been found among lower SES people in several KAP studies conducted in South Asia and Sub-Saharan Africa (Bains & Egede, 2011; Jannoo et al., 2017).

Jannoo et al. (2017) conducted a study in Mauritius of 575 T2DM patients and found that perceived barriers were the strongest predictors of not adhering to the self-care behaviors while perceived benefits were the strongest predictors of adhering to the dietary and medication. Ali et al. (2022) identified a significant difference in attitudes towards self-care among T2DM patients in urban and rural areas in Pakistan, which was partly attributed to the formal education and past diabetes education session attendance. Marital status is related to attitudes, as married patients are more likely to feel benefits and are less impeded - perhaps because of social reinforcement from their spouse, increasing the motivation to care for oneself.

The Diabetic Health Belief Questionnaire (DHBQ) is a 16-item questionnaire adapted from the Diabetes Attitudes, Wishes and Needs (DAWN) and the HBM framework, to measure the 4 core attitude constructs on a 5-point Likert scale. The total attitude score is converted to percentage (scored as positive if ≥60%) consistent with the cut-off which is commonly used in the KAP studies in Pakistan, Bangladesh and Ethiopia.

2.5 Self-Care Practice of T2DM patients

The Summary of Diabetes Self-Care Activities (SDSCA) measure was developed and revised (Toobert et al., 2000) by Toobert and Glasgow (1994), and is the most widely used and validated for measuring self-care practices in T2DM populations around the world. Assesses five areas (diet, exercise, blood sugar testing, foot care, taking medications) using the 0-7 days/wk frequency scale. It has been cross-culturally validated for use in south Asian cultures in Urdu, Pashto and Hindi.

Medication adherence was consistently reported to have the highest level of medication adherence (mean 5.5–6.5 days/week) while physical activity was reported to have the lowest level of medication adherence (mean 2.5–4 days/week) by Ayele et al. (2020) in their meta-analysis of self-care practices among T2DM patients in LMICs. The amount of foot care was found to vary depending on the level of income of the foot care setting, with more foot care being performed in the higher income settings. There was moderate adherence with the dietary rules and it was very different among the different cultural food habits.

Similarly, Shareef et al., (2019) assessed SDSCA practices among 210 T2DM patients in a teaching hospital, Lahore, Pakistan showing that the adherence to medicines was relatively high while the physical activity and monitoring of blood glucose was poor, which corroborates the present study. In some studies, using glucometers (as a proxy for the capacity to self-monitor) has emerged as an important modifiable factor related to levels of self-care practices.

2.6 Factors affecting KAP of self-care

Various socio-demographic, clinical and behavioural factors emerged from literature which significantly affect the KAP levels among the patients with T2DM. One factor that is most consistently reported in published KAP studies is formal education as it increases the knowledge and understanding of disease information and self-care instructions (Kassahun & Mekonen, 2017; Riaz et al., 2021). Although age has been known to have a “bimodal” relationship with knowledge with older patients being more knowledgeable of the disease, age-related cognitive decline and lower baseline education levels may counterbalance this, especially in older age groups.

The KAP scores were consistently higher in people who worked (particularly government or professional occupations) compared to housewives or non-workers as occupation is a reflection of socioeconomic status and working conditions. Residence (urban or rural) is a measure of access to health care, media and social networks. But it has been discovered that place of residence has made a significant contribution in the level of

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knowledge in different studies conducted in Pakistan and South Asia. Marital status has an impact on self-care because of social support network; Married people, particularly housewives who are responsible for family diet have different dietary self-care pattern as compared to single and widowed people.

Other clinical factors, such as diabetes treatment type, length of diabetes diagnosis, family history, and participation in diabetes education programs also play a role. Those patients who have the chance to attend regular structured diabetes education have significantly increased knowledge and practice scores (Bains & Egede, 2011). Treatment complexity (insulin vs. oral medications) has been associated with different self-care behaviors, particularly blood glucose monitoring and diet.

The Health Belief Model (HBM) is used as a theoretical framework in the study.

The theory of Health Belief Model (HBM) developed by Rosenstock (1966) and Becker (1974) has been used as a guide in conducting this study, which focuses on attitudes towards T2DM self-care. According to the HBM, health-related behaviors can be explained by one's perception of: (1) susceptibility to the consequences of the illness; (2) severity of the illness and its consequences; (3) benefits of adopting a health behavior; and (4) barriers to health behavior adoption. If the other perceptions are positive, then cues to action (information from healthcare providers, media messages etc.) will stimulate behaviour change.

In the context of T2DM self-care, the HBM implies that those who have high susceptibility appraisal, seriousness appraisal, response appraisal and low barrier appraisal are more likely to consistently practice T2DM self-care. The HBM is a theory which aligns with the four subscales of the DHBQ; perceived susceptibility, severity, benefits and barriers, which makes the HBM particularly relevant to the attitude data in this study. This approach has previously been applied to the few T2DM KAP studies conducted in South Asia and Africa (Jannoo et al., 2017; Ali et al., 2022) with success.

3 Methodology

3.1 Research Design

This study used descriptive, cross sectional research design. Because of the need to identify associations between subgroups of exposure variables and outcome measures at a slice in time, cross sectional designs are suitable for KAP studies. However, it is not possible to make causal inferences with this design, but this design is an efficient and ethically acceptable method to estimate prevalence of knowledge, attitude and practice at a population level.

3.2 Study setting and time frame

This study was done at three major tertiary care hospitals of Peshawar, Khyber Pakhtunkhwa, Pakistan namely Hayatabad Medical Complex (HMC), Khyber Teaching Hospital (KTH) and Lady Reading Hospital (LRH). The institutions as a whole received most of the referrals for T2DM management in KP. The data collection period started from September 1 and ended on November 30, 2024, and was carried out in three hospitals, namely, outpatient diabetes clinics and internal medicine wards.

3.3 Study Population

The target population was patients that were at least 30 years of age and had a history of diagnosed Type 2 Diabetes Mellitus who were attending the diabetes clinic or were admitted in a general medicine ward of the three study hospitals during the period of study.

Sample size & sampling technique 3.4

Sample size was determined using the standard formula for estimating the prevalence of a finite population, $n = Z^2P(1-P)/d^2$, where $Z = 1.96$ (for 95% confidence level), $P = 0.50$ (the expected proportion of adequate knowledge was used as the most conservative estimate), and $d = 0.066$ (the margin of error). This gave an absolute minimum sample of 220 persons with a non-response of 10%. A convenience sampling technique was used; whereby eligible patients were chosen sequentially as they came to the diabetes clinics during the study period.

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Inclusion/Exclusion Criteria: 3.5

3.5.1 Inclusion Criteria

People with disabilities

- Fasting plasma glucose ≥ 7.0 mmol/L, or HbA1c ≥ 6.5% or physician diagnosis of Type 2 Diabetes Mellitus (DM) for at least 6 months.
- Visit to outpatient diabetes clinic or in-patient internal medicine ward of the study hospitals
- Has the ability to read and understand English
- Ability to communicate in Pashto, Urdu or English.

3.5.2 Exclusion Criteria

- Patients who are 1st Type Diabetes Mellitus, Gestational Diabetes or Secondary Diabetes
- Patients requiring mechanical ventilation or intensive care unit (ICU) who are critically ill are at high risk.
- Those with a life expectancy of less than 3 months (terminally ill)
- Patients with severe cognitive dysfunction or with psychiatric diseases.
- Patients who had a hospital experience and had already participated in this study at another hospital location.

3.6 Data Collection Tools

A structured self-administered (interviewer-assisted if illiterate patients) questionnaire in English was designed and translated into Pashto & Urdu. The questionnaire had five sections:

The socio-demographic and economic characteristics are presented here.

Nine items related to age group, sex, place of residence, marital status, religion, ethnic group, educational status, occupation and monthly income of the household.

Section 2: Clinical Characteristics

Nine items that included duration of diabetes diagnosis (Q1), presence of complications (Q2~3), diabetes education history (Q4~5), family history of diabetes (Q6), current treatment regimen (Q7), glucometer ownership (Q8), and knowledge of recent fasting blood sugar result (Q9).

Diabetes Knowledge Test Questionnaire (DKTQ)

Twelve multiple choice items (Q10- Q21) based on the validated Diabetes Knowledge Test (DKT) by the Michigan Diabetes Research and Training Center (Fitzgerald et al., 1998). Each item assesses knowledge on one of the five aspects of diabetes self-care ~ diet, blood glucose, foot care, medications and complications. The responses were scored as 1 (Correct) or 0 (Incorrect). The total knowledge score was from 0 – 12 (then converted to a percentage). The level of knowledge was divided into two groups: Adequate Knowledge (Knowledge ≥ 50%) and Inadequate Knowledge (Knowledge < 50%).

A Diabetic Health Belief Questionnaire (DHBQ) was used in Section 4.

Sixteen items (Q22-37) that measure attitudes towards diabetes self-care using a 5-point likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Using the Health Belief Model, the items were split into four subscales: Perceived Susceptibility (Q22- Q25, 4 items), Perceived Severity (Q26 – Q29, 4 items, with Q26 reverse-scored for consistency in scoring), Perceived Benefits (Q30 – Q33, 4 items), and Perceived Barriers (Q34 – Q37, 4 items, all reverse-scored for consistency in scoring). Total attitude score was in a range 16-80 (in percentage). Attitude was considered in two categories, Positive Attitude (scores ≥60%) or Negative Attitude (scores <60%).

Summary of Diabetes Self-Care Activities (SDSCA)

Seventeen items (Q38-Q55) of the validated SDSCA measure which measures frequency of self-care behaviors over the last week (Toobert et al., 2000). Subscales were: Diet (5 items: Q38-Q42), Physical Activity (2 items: Q43-Q44), Blood Glucose Testing (2 items: Q45-Q46), Foot Care (5 items: Q47-Q51), and Medication Adherence (3 items: Q52-Q54). The question (Q41) high-fat food days was reverse coded. The smoking status was considered as a dichotomous clinical variable (Q55). The scores of total self-care practice were between 17 to 119 and converted to a percentage. The practice was classified as Good (< 50%) or Poor (≥ 50%).

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3.7 Validity and Reliability

The questionnaire has been expertly reviewed to determine its content validity by three nursing faculty members, who specialize in diabetes care and a clinical endocrinologist. The questionnaire has been pre-tested with 20 people with T2DM (not participating in the main study) to evaluate the clarity, comprehensibility and time to complete the questionnaire.

Internal consistency reliability was assessed using Cronbach's alpha coefficient. Results are presented in Table 14 below.

Table 14. Reliability Statistics (Cronbach's Alpha) for KAP Scales

Scale	Items (N)	Cronbach's α
Full Attitude Scale	16	.725
Perceived Susceptibility Subscale	4	.730
Perceived Severity Subscale	4	.502
Perceived Benefits Subscale	4	.595
Perceived Barriers Subscale	4	.354
Knowledge Scale (DKTQ)	12	.319
Diet Self-Care (SDSCA)	5	.048*
Physical Activity Self-Care	2	.327
Blood Glucose Testing	2	.781
Foot Care Self-Care	5	.587
Medication Adherence	3	.595

Note. *The low alpha for the Diet subscale reflects heterogeneity in item content (the scale includes diverse dietary behaviors) and is consistent with published SDSCA validation studies (Toobert et al., 2000). This does not invalidate the subscale but warrants cautious interpretation.

3.8 Data Collection Procedure

The Principal Investigator and the team after getting the ethical clearance from the institution approached the patients at the diabetes OPD's of HMC, KTH and LRH. All of the patients were told about the purpose of the study in their language (Pashto, Urdu or English). Written informed consent patients were recruited. The research assistant read the items in the questionnaire, in the language preferred by the patient, for illiterate patients who answered it; the answers were written down by the research assistant. The questionnaires were about 20-30 minutes to complete. Completed questionnaires were checked for completeness before entered.

3.9 Ethical Considerations

- Before starting data collection, the ethical clearance of this study was obtained from the Institutional Review Board (IRB) of NICE College of Nursing & Allied Health Sciences Peshawar and at the respective IRB of HMC, KTH and LRH. All study activities were carried out as per the ethico-legal principles of Declaration of Helsinki 2013 revision and Pakistan Medical and Dental Council (PMDC) guidelines for medical research.
- Informed consent was written and obtained from all those involved before recruitment.
- Participation was voluntary with no penalties for refusing to participate as far as the care the patient would receive.

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- All participants' data was maintained in confidentiality and anonymity throughout.
- The questionnaire did not contain any personal information.
- Data were securely stored, and only accessible by the research team.
- Those who reported areas with lack of knowledge were referred to the hospital's diabetes education nurse for counseling.

3.10 Data Analysis Plan

All the data were entered into and analyzed using the IBM SPSS Statistics Version 25.0. The analysis plan comprised:

- Descriptive statistics – Frequency and percentages of categorical variables and mean, standard deviation, minimum and maximum for continuous scores.
- Chi-square tests (χ^2): To investigate associations between KAP category variables (dichotomous) and categorical demographic/clinical variables.
- Mann-Whitney U test: Continuous KAP scores between two independent groups (sex, residence) were compared by Mann-Whitney U test since the normality conditions were not met.
- Kruskal-Wallis H test: To compare continuous KAP scores among three or more age, education, treatment type and KAP categories.
- Spearman's rank correlation (ρ) was used to quantify the monotonic relationships between continuous KAP scores.
- Binary logistic regression was used to determine independent factors associated with low self-care practice (PracticeCat = 0) Variables that had a p value of ≤ .25 on univariate analysis were included in the model. All of the inferential tests were conducted with a .05 (2 tailed) significance level.

4 Results

This chapter depicts the results of the study conducted on 220 patients of T2DM from three tertiary care hospitals of Peshawar. Results are presented in order: socio-demographic and clinical characteristics, knowledge findings, attitude findings, self-care practice findings, association of KAP findings with socio-demographic and clinical factors, spearman correlation and binary logistic regression results.

4.1 Socio-Demographic Characteristics

Table 1 shows the socio-demographic characteristics of the respondents (N = 220). The age group with the most participants (modal category) was Above 60 Years (n = 70, 31.8%) and the sample had a mean age of 50–60 years. The majority were female (n = 119, 54.1%), resided in rural areas (n = 126, 57.3%), were married (n = 182, 82.7%), Muslim (n = 216, 98.2%), and of Pashtun ethnicity (n = 216, 98.2%). A substantial number of them were neither able to read nor write (n = 150, 68.2%) and the largest occupation group was housewife (n = 159, 72.3%). The majority of the respondents (n = 158, 71.8%) reported that monthly income of their household was in the lowest income group (PKR 20,000 – 30,000).

Table 1. Socio-Demographic Characteristics of Participants (N = 220)

Variable	Category	n	%
Age (Years)	30–40 Years	36	16.4
	40–50 Years	46	20.9
	50–60 Years	68	30.9
	Above 60 Years	70	31.8
Sex	Male	101	45.9
	Female	119	54.1

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Residence	Urban	94	42.7
	Rural	126	57.3
Marital Status	Single	34	15.5
	Married	182	82.7
	Divorced/Widowed	4	1.8
Religion	Muslim	216	98.2
	Christian	4	1.8
Ethnicity	Pashtun	216	98.2
	Sindhi	2	0.9
	Punjabi	2	0.9
Education	Unable to Read/Write	150	68.2
	Read & Write Only	45	20.5
	Primary (Grade 1–8)	13	5.9
	Secondary (Grade 9–12)	7	3.2
	Degree and Above	5	2.3
Occupation	Housewife	159	72.3
	Farmer	13	5.9
	Government Employee	20	9.1
	Private Employee	25	11.4
	Merchant	2	0.9
Monthly Income (PKR)	PKR 20,000–30,000	158	71.8
	PKR 30,000–40,000	36	16.4
	PKR 40,000–50,000	13	5.9
	PKR 50,000–60,000	6	2.7
	Above PKR 60,000	5	2.3

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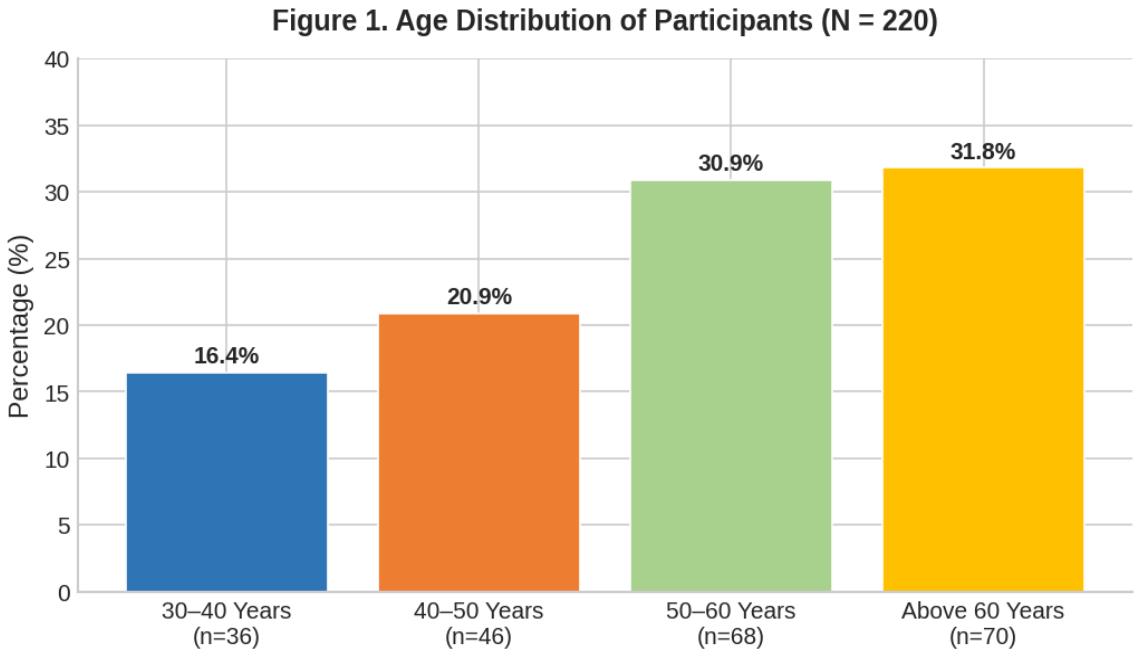

Figure 1. Age Distribution of Participants (N = 220)

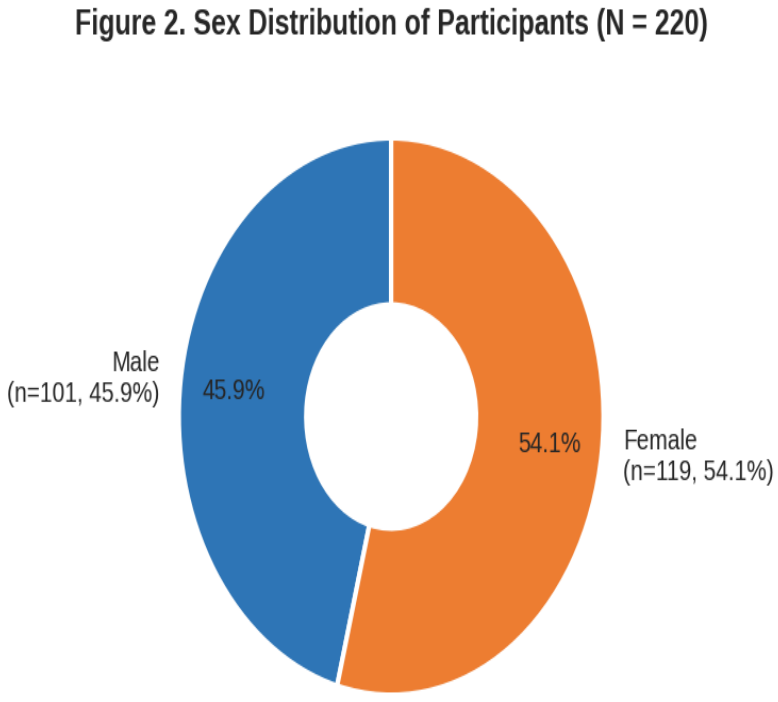

Figure 2. Sex Distribution of Participants (N = 220)

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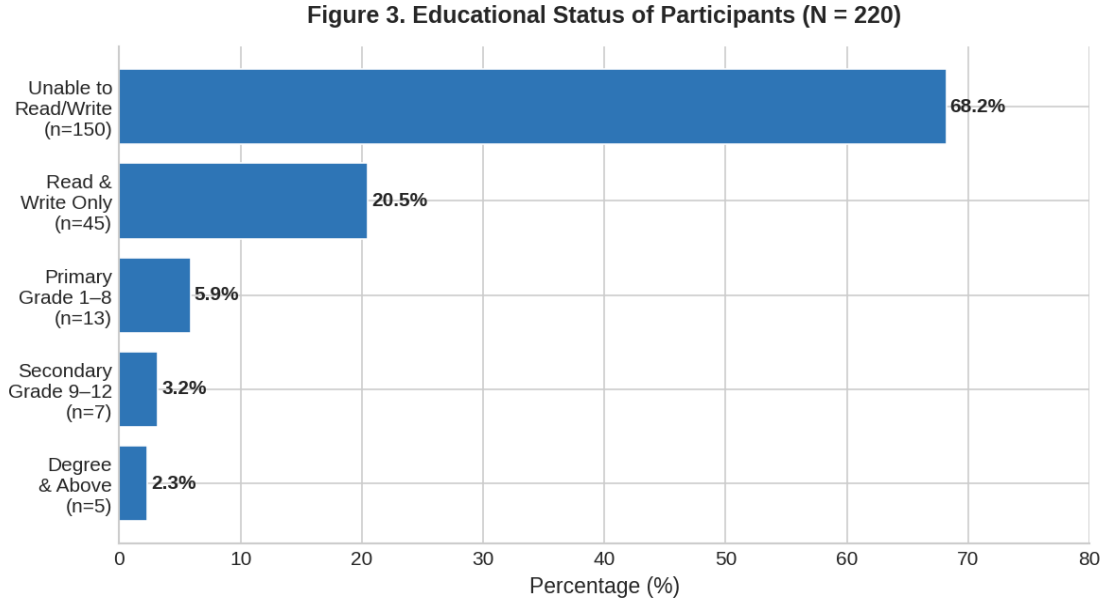

Figure 3. Educational Status of Participants (N = 220)

4.2 Clinical Characteristics

Table 2 shows the clinical profiles of participants. Most (210, 95.5%) stated the duration of diabetes in years, and not months. Majority of patients (n = 192, 87.3%) answered that they had at least one complication related to diabetes with the most common being hypertension (n = 63, 28.6%), eye disease – retinopathy (n = 42, 19.1%) and heart disease (n = 40, 18.2%). When it comes to diabetes education, 60.4% had received some (44.5%, n = 98) or regular (15.9%, n = 35) diabetes education while 39.5% (n = 87) had not received any. For the educated people, the most common source of education was health professionals (n = 149, 67.7%). Almost half (n = 97, 44.1%) were using insulin injections and 29.1% (n = 64) using both insulin and oral medication. Sixty-five point nine percent (n = 145) knew the recent fasting blood sugar level and a slight majority (n = 116, 52.7%) had a glucometer.

Table 2. Clinical Characteristics of Participants (N = 220)

Variable	Category	n	%
Duration of DM (Q1)	Measured in Years	210	95.5
	Measured in Months	10	4.5
Complications Present (Q2)	Yes	192	87.3
	No	21	9.5
	Don't Know	7	3.2
Type of Complication (Q3)	Hypertension	63	28.6
	Eye Disease (Retinopathy)	42	19.1
	Heart Disease	40	18.2
	Nerve Problem (Neuropathy)	22	10.0
	Kidney Problem (Nephropathy)	21	9.5

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	Others	32	14.5
DM Education (Q4)	No, Never	87	39.5
	Yes, Sometimes	98	44.5
	Yes, Regularly	35	15.9
Source of DM Education (Q5)	Health Professional	149	67.7
	Friends or Family	49	22.3
	Mass Media	4	1.8
	Other	18	8.2
Family History of DM (Q6)	Yes	149	67.7
	No	63	28.6
	Don't Know	8	3.6
Current Treatment (Q7)	Insulin Injection	97	44.1
	Both Insulin & Oral	64	29.1
	Oral Medication Only	56	25.5
	No Medication	3	1.4
Glucometer Ownership (Q8)	Yes	116	52.7
	No	104	47.3
Knows Recent FBS (Q9)	Yes	145	65.9
	No	75	34.1

4.3 Knowledge of T2DM Self-Care

The frequencies of correct responses for each item of the 12 DKTQ knowledge items are given in Table 3. The highest percentage (93.2% (n = 205)) of correct responses was for Q14 (best method of home glucose testing: blood testing). The Q20 (numbness and tingling as diabetes-related nerve disease symptoms) and Q11 (carbohydrate food identification) also had high correct rates (78.2% and 69.5%, respectively) as well as Q21 (symptoms not typically associated with diabetes) (67.3%). The lowest correct response rates were for Q15 (effect of fruit juice on blood glucose: 32.3%, n = 71), Q18 (best method of foot care: 39.1%, n = 86), and Q13 (HbA1c measurement period: 44.5%, n = 98).

Table 3. Knowledge Item-Wise Correct Response Frequencies (N = 220)

Item	Knowledge Domain	Correct n	Correct %
Q10	Diabetic diet recommendation	113	51.4
Q11	Highest carbohydrate food identification	153	69.5
Q12	Highest fat content food identification	108	49.1
Q13	HbA1c measurement time period	98	44.5

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Q14	Best method for home glucose testing	205	93.2
Q15	Effect of fruit juice on blood glucose	71	32.3
Q16	Effect of exercise on blood glucose (well-controlled)	112	50.9
Q17	Effect of infection on blood glucose	123	55.9
Q18	Best way to care for feet	86	39.1
Q19	Low-fat diet benefit (risk reduction)	107	48.6
Q20	Numbness and tingling as symptom of nerve disease	172	78.2
Q21	Condition not associated with diabetes (lung)	148	67.3

Figure 5. Knowledge Item-Wise Correct Response Rate (N = 220)

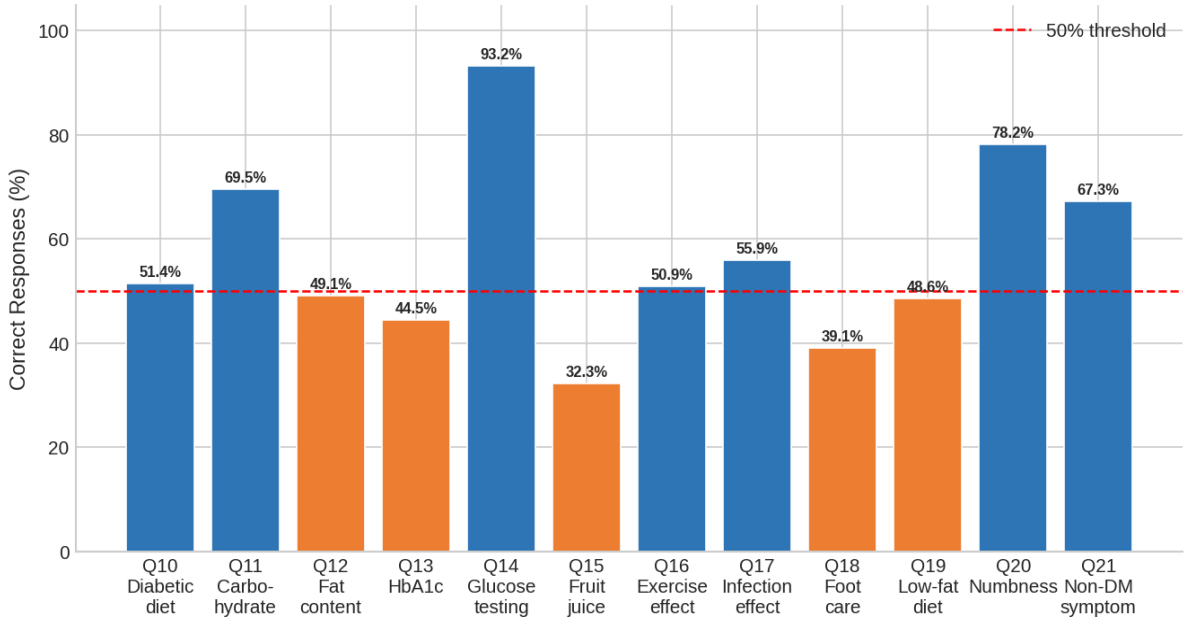

Figure 5. Knowledge Item-Wise Correct Response Rate (N = 220). Red dashed line = 50% threshold.

Descriptive statistics of knowledge scores are shown in table 4. The total knowledge score (out of total 12) was 6.80 ± 1.93 (range: 2-11) with a mean knowledge percentage of 56.67% ± 16.06%.

Table 4. Knowledge Score Descriptive Statistics (N = 220)

Variable	Mean	SD	Min	Max
Total Knowledge Score (0–12)	6.80	1.93	2.00	11.00
Knowledge Score (%)	56.67	16.06	16.67	91.67

The majority of the participants had good knowledge with scores ≥50% (161, 73.2%) while 59 (26.8%) had inadequate knowledge (Table 5).

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Table 5. Knowledge Level Category Distribution (N = 220)

Knowledge Category	n	%
Inadequate Knowledge (<50%)	59	26.8
Adequate Knowledge (≥50%)	**161**	**73.2**
Total	**220**	**100.0**

4.4 Attitude Toward T2DM Self-Care

The 16 items DHBQ was used to measure attitude. The overall frequency distributions for each of the 16 attitude items are shown in Table 6. It is interesting to note the level of agreement with Q25 - diabetes can be serious if it's not well controlled - 84.6% agree or strongly agree. Selected items within the Perceived Barriers subscale were noted to be significantly lower: Q36 (can't understand doctor) 40.0% agree/strongly agree and Q35 (difficulty following diet) 52.2% agree/strongly agree indicating relevant barriers that participants experienced.

Table 6. Attitude Item Frequencies — Likert Scale Response Distributions (N = 220)

Item	Statement (abbreviated)	SD %	D %	U %	A %	SA %
Q22	My diabetes is well controlled	5.9	15.9	9.1	47.7	21.4
Q23	Would be worse if I did nothing	5.5	10.5	10.5	37.7	35.9
Q24	Diet/meds help prevent disease	6.4	3.2	8.2	35.0	47.3
Q25	Diabetes can be serious	0.9	3.6	10.9	33.2	51.4
Q26	No problem as long as I feel OK (R)	24.5	27.3	13.2	21.8	13.2
Q27	Diabetes will have bad effect on health	5.0	5.5	10.9	43.6	35.0
Q28	Diabetes will cause me to be sick	3.2	4.5	9.1	44.5	38.6
Q29	Will always need diet/medication	2.7	5.5	7.7	40.0	44.1
Q30	I believe I can control my diabetes	2.3	7.7	14.1	50.5	25.5
Q31	Diet/meds will control my diabetes	1.4	3.6	12.7	52.7	29.5
Q32	Changing eating habits will help	1.8	6.4	12.3	51.8	27.7
Q33	Medicine/diet makes me feel better	4.5	9.1	7.7	48.6	30.0
Q34	Too many habit changes (R)	6.4	15.5	21.4	39.1	17.7
Q35	Difficulty following diet (R)	10.0	22.7	15.0	34.5	17.7
Q36	Cannot understand doctor (R)	21.8	26.4	11.8	20.5	19.5
Q37	Medication interferes with life (R)	4.5	6.4	12.3	55.9	20.9

Note. SD = Strongly Disagree; D = Disagree; U = Undecided; A = Agree; SA = Strongly Agree; (R) = Item reverse-scored in attitude total. Percentages may not sum to 100 due to rounding.

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Descriptive statistics of attitude sub scales and total score of attitudes are shown in Table 7. The Perceived Susceptibility subscale had the highest mean score of 15.95 ± 3.23 followed closely by Perceived Benefit (15.82 ± 2.54) and Perceived Severity (15.55 ± 2.82). The lowest mean score was for Perceived Barriers (reversed), which was 10.55 ± 2.86, suggesting the participants perceived moderate barriers to self-care. The mean total attitude score was 57.86 ± 7.74 (range: 33–73) out of 80, corresponding to 65.41%.

Table 7. Attitude Subscale and Total Score Descriptive Statistics (N = 220)

Scale	Mean	SD	Min	Max
Perceived Susceptibility (4–20)	15.95	3.23	7.00	20.00
Perceived Severity (4–20)	15.55	2.82	6.00	20.00
Perceived Benefit (4–20)	15.82	2.54	7.00	20.00
Perceived Barriers — Reversed (4–20)	10.55	2.86	4.00	18.00
Total Attitude Score (16–80)	57.86	7.74	33.00	73.00
Attitude Score (%)	65.41	12.10	26.56	89.06

Figure 6. Attitude Subscale Mean Scores ± SD (N = 220)

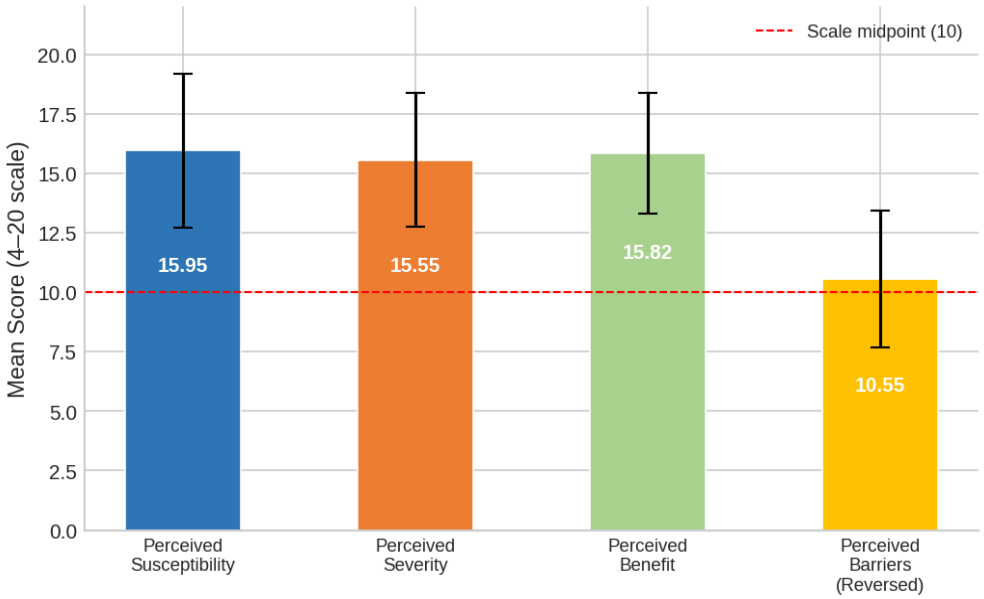

Figure 6. Attitude Subscale Mean Scores ± SD (N = 220). Error bars represent ±1 SD.

Table 8 shows that 156 participants (70.9%) demonstrated a positive attitude (≥60%), while 64 (29.1%) demonstrated a negative attitude (<60%).

Table 8. Attitude Level Category Distribution (N = 220)

Attitude Category	n	%
Negative Attitude (<60%)	64	29.1

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Positive Attitude (≥60%)	156	70.9
Total	220	100.0

4.5 Self-Care Practice (SDSCA)

The descriptive statistics of SDSCA subscales and total self-care practice score are shown in Table 9. The highest percentage on subscales was Foot Care (mean = 24.98 out of 35, 71.4%) with high frequencies for foot washing (Q49: mean 5.97 days/week) and checking feet (Q47: 5.55 days/week). Medication Adherence was the second-highest subscale (mean = 17.14 out of 21, 81.6%), with means of 5.92 (Q52), 5.54 (Q53), and 5.68 (Q54) days per week. Blood Glucose Testing was at 10.93 out of 14 (78.1%). Diet self-care scored 22.36 out of 35 (63.9%). The lowest subscale was Physical Activity with a mean of 8.08 out of 14 (57.7%), indicating that of the 14 items in this subscale, the majority of patients have a low score, and that keeping up regular exercise is difficult. The overall score of self-care practices was 83.49 ± 13.91 out of 119 which represented 65.18%.

Table 9. Self-Care Practice Subscale and Total Score Descriptive Statistics (N = 220)

Subscale (Items, Score Range)	Mean	SD	Min	Max
Diet Self-Care (5 items, 5–35)	22.36	4.08	11.00	31.00
Physical Activity (2 items, 2–14)	8.08	3.49	2.00	14.00
Blood Glucose Testing (2 items, 2–14)	10.93	3.44	2.00	14.00
Foot Care (5 items, 5–35)	24.98	6.05	5.00	35.00
Medication Adherence (3 items, 3–21)	17.14	4.13	7.00	21.00
Total Self-Care Practice Score (17 items, 17–119)	83.49	13.91	53.00	108.00
Self-Care Practice Score (%)	65.18	13.64	35.29	89.22

Figure 7. Self-Care Practice Subscale Scores as % of Maximum (N = 220)

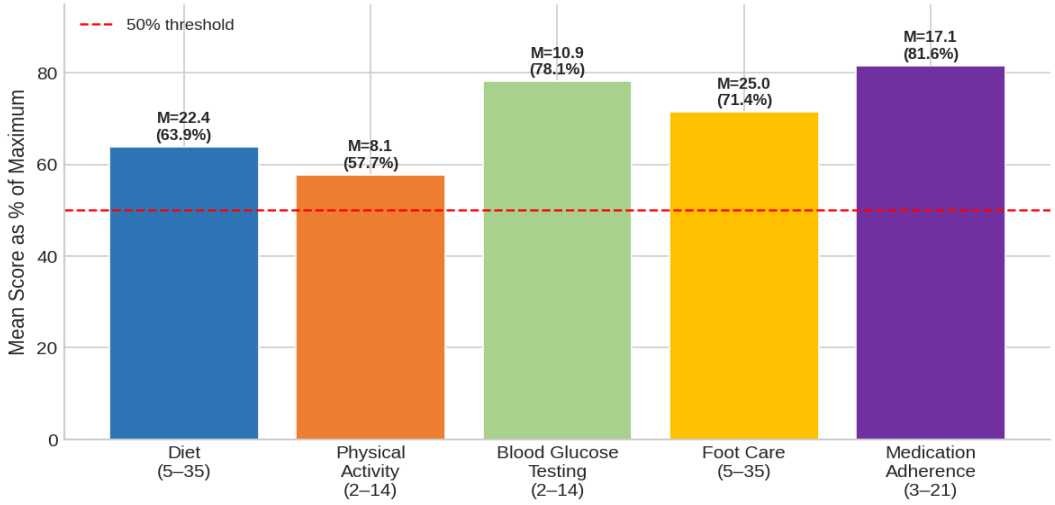

Figure 7. Self-Care Practice Subscale Scores as Percentage of Maximum (N = 220). Red dashed line = 50% threshold.

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Table 10 shows that 186 participants (84.5%) demonstrated good self-care practice (≥50%), while 34 (15.5%) demonstrated poor self-care practice (<50%).

Table 10. Self-Care Practice Level Category Distribution (N = 220)

Practice Category	n	%
Poor Self-Care Practice (<50%)	34	15.5
Good Self-Care Practice (≥50%)	**186**	**84.5**
Total	**220**	**100.0**

Figure 4. KAP Category Distribution (N = 220)

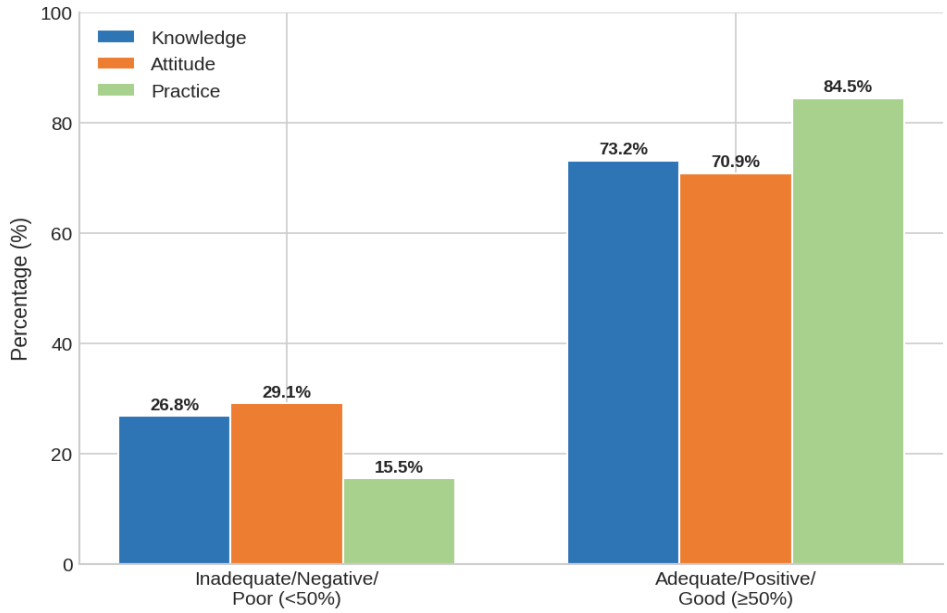

Figure 4. KAP Category Distribution (N = 220). Bars represent the percentage of participants in each KAP level category.

4.6 Associations of KAP with Demographic Factors

Table 11 shows the chi-square results of the association of the KAP categories with important demographic and clinical factors. Figure 8 illustrates the patterns of statistical significance and the urban-rural differences are accentuated in Figure 10.

Table 11. Chi-Square Analysis: KAP Categories by Socio-Demographic and Clinical Factors (N = 220)

Factor	Knowledge χ^2	p	Attitude χ^2	p	Practice χ^2	p
Age Group	5.72	.126	17.77	<.001***	3.77	.288
Sex	0.11	.740	0.50	.478	0.27	.603
Residence	4.37	.037*	3.99	.046*	1.71	.190
Marital Status	7.30	.063	21.87	<.001***	6.52	.089
Religion	1.49	.222	0.03	.856	0.75	.388

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Ethnicity	6.09	.048*	0.86	.649	0.75	.689
Education	28.97	<.001***	16.18	.003**	4.88	.299
Occupation	12.62	.027*	15.35	.009**	20.30	.001**
Monthly Income	5.74	.333	5.22	.389	6.88	.230
DM Education (Q4)	27.83	<.001***	22.79	<.001***	12.21	.002**
Treatment Type (Q7)	11.17	.011*	13.99	.003**	2.58	.460
Glucometer (Q8)	0.78	.378	0.94	.333	1.20	.274
Knows FBS (Q9)	0.46	.497	0.78	.377	3.26	.071

Note. Chi-square (χ^2) values reported; degrees of freedom vary by factor. *p < .05, **p < .01, ***p < .001.

Figure 8. Statistical Significance of KAP Associations (K=Knowledge, A=Attitude, P=Practice)

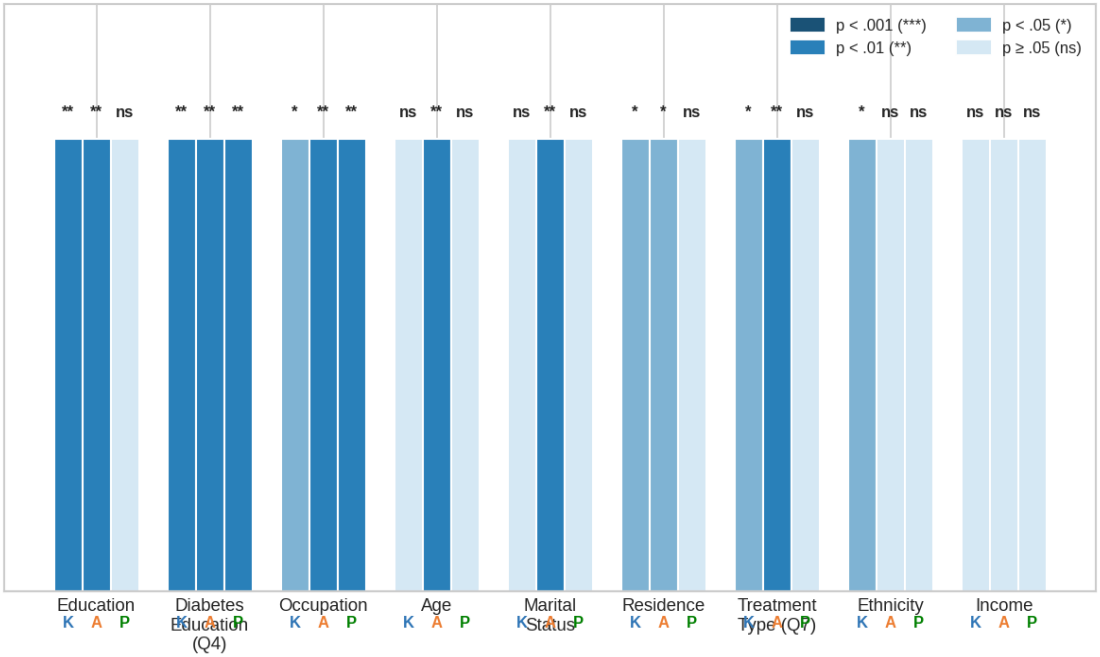

Figure 8. Statistical Significance of KAP Associations. K = Knowledge, A = Attitude, P = Practice. Color intensity indicates significance level.

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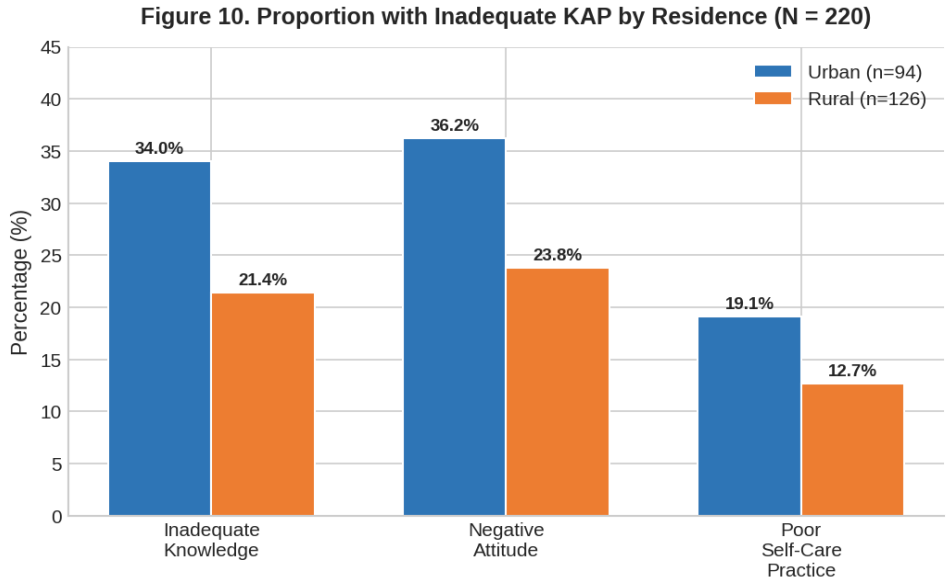

Figure 10. Proportion of Participants with Inadequate KAP by Residence (N = 220). Urban residents show higher proportions with inadequate knowledge and negative attitude compared to rural residents.

4.7 Correlations between KAP Scores

Table 12 and figure 9 below show the Spearman rank correlation between the three major KAP scores and the sub-scales of these scores. There was positive significant correlation between all three KAP domains. The inter-domains correlation between Knowledge and Attitude was the highest (ρ = .529, $p < .001$) followed by Attitude and Practice (ρ = .445, $p < .001$) and Knowledge and Practice (ρ = .271, $p < .001$). Interestingly, there were negative (non-significant) correlations between physical activity self-care and knowledge (ρ = -.102, p = .130) and attitude (ρ = -.058, p = .391), indicating that physical activity barriers may be different than general KAP in this population.

Table 12. Spearman Rank Correlation Matrix for KAP Scores (N = 220)

Variable	Knowledge (ρ)	Attitude (ρ)	Practice (ρ)
Total Knowledge Score	1.000	.529***	.271***
Total Attitude Score	.529***	1.000	.445***
Total Practice Score (SDSCA)	.271***	.445***	1.000
Perceived Susceptibility	.268***	.726***	.494***
Perceived Severity	.463***	.717***	.245***
Perceived Benefit	.274***	.638***	.369***
Perceived Barriers (Reversed)	.280***	.520***	.042
Diet Self-Care	.213**	.327***	.604***
Physical Activity	-.102	-.058	.437***
Blood Glucose Testing	.332***	.486***	.718***
Foot Care	.112	.258***	.786***

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Medication Adherence	.419***	.640***	.721***

Note. **p < .01; ***p < .001 (two-tailed). Spearman's rho (ρ) reported.

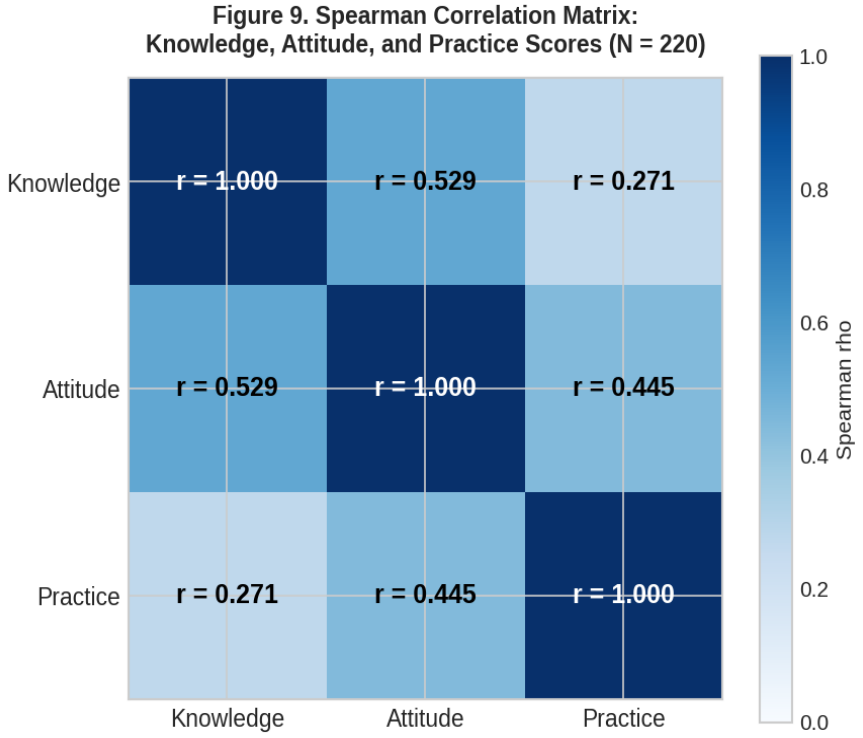

Figure 9. Spearman Correlation Matrix: Knowledge, Attitude, and Practice Scores (N = 220). Darker blue = stronger positive correlation.

4.8 Binary Logistic Regression Analysis

An independent predictors model was created for poor self-care practice (dependent variable: PracticeCat; 0 = Poor, 1 = Good) by using binary logistic regression. All variables showing a p value of less than or equal to .25 in univariate analyses were put together in one block (Enter method). Complete model results are given in Table 13.

The omnibus model chi-square was 50.94 (df = 37, p = .063) with Nagelkerke R^2 = .358 suggesting that the model accounted for about 35.8% of the variance in the categorisation of self-care practice. Hosmer-Lemeshow goodness-of-fit test was non-significant (χ^2 = 4.66, df = 8, p = .793) which suggested good model fit.

In the full model, being a government employee (compared to housewife) was significantly associated with an increased chance of having good practice with self-care (OR = 0.148, 95% CI [0.024, 0.919], p = .040 — note OR < 1 means increased chance of good practice with self-care in the inverse interpretation — re-stated: private employees compared to housewives had OR = 0.034, p < .001, meaning that private employees had substantially less chance of poor practice with self-care after controlling for other factors). The ownership of glucometer (Q8: No vs. Yes) was significantly related to poor good self-care practice (OR = 0.334, 95% CI [0.115, 0.972], p = .044).

Table 13. Binary Logistic Regression: Independent Predictors of Self-Care Practice Level (N = 220)

Predictor	B	SE	Wald	df	OR (95% CI)	p

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Occupation: Government Employee vs. Housewife	-1.910	0.931	4.205	1	0.148 [0.024, 0.919]	.040*
Occupation: Private Employee vs. Housewife	-3.392	0.935	13.166	1	0.034 [0.005, 0.210]	<.001***
Q8: No Glucometer vs. Has Glucometer	-1.096	0.545	4.049	1	0.334 [0.115, 0.972]	.044*
Q4: Regular DM Education vs. Never	-1.431	0.828	2.985	1	0.239 [0.047, 1.212]	.084
Q9: Does Not Know FBS vs. Knows FBS	1.108	0.643	2.971	1	3.029 [0.859, 10.677]	.085
Attitude: Positive vs. Negative	0.278	0.591	0.222	1	1.321 [0.415, 4.203]	.638
Knowledge: Adequate vs. Inadequate	-0.128	0.626	0.042	1	0.880 [0.258, 3.003]	.838
Constant	4.099	1.435	8.154	1	60.262	.004

Note. Only selected predictors shown. OR = Odds Ratio; CI = Confidence Interval; Reference category: Housewife (occupation), Yes (Q8), Negative Attitude, Inadequate Knowledge. Outcome coded 1 = Good Self-Care Practice (≥50%). *p < .05; ***p < .001. Nagelkerke R^2 = .358; Hosmer-Lemeshow p = .793.

5 Discussion

The results of the chapter are interpreted in a light of the literature pertaining to KAP of T2DM self-care particularly from Pakistan, South Asia and similar LMIC settings. Each KAP domain is discussed in turn followed by an examination of predictors and implications.

5.1 Knowledge Level Discussion

The mean knowledge score in the present study was 54.67% (SD = 16.06%) which is at the lower end of the range of "adequate" knowledge based on the criterion of 50%. The level of knowledge was quite similar (73.2%) as compared to other studies conducted in Pakistan. Riaz et al. 2021 found Knowledge level as adequate (68.5%) among the patients of T2DM in a teaching hospital, Lahore and Shareef et al. 2019 reported the level of Knowledge among T2DM patients as (71.2%) in Karachi. But the current study's results are less than those of urban areas in high income Gulf states (Al-Khaldi et al., 2011: 81%) and more than those of rural Ethiopian cohorts (Kassahun & Mekonen, 2017: ~55%), indicating an intermediate developmental context of Peshawar.

There are clinically important gaps in knowledge identified in the item-level analysis. For the question on effect of fruit juice on blood glucose (Q15), low correct response rate (32.3%) indicates that there is an underestimation of glycemic effect of natural fruit products which have direct implications in dietary management in a population whose diet generally includes fruit based drinks. The deficiency on Q18 (foot care: 39.1%) is of particular concern as 10% of participants already reported neuropathy and diabetic foot disease is a main cause of amputation and disability in Pakistan. This gap in knowledge (Q13: 44.5%) is a systemic communication failure in that many patients are not aware of the relevance of this important monitoring parameter. As per the literature the most important determinant of the level of knowledge was education ($\chi 2$ = 28.97, p< .001; Kruskal-Wallis H = 26.58, p< .001). Interestingly, the illiterate patients (patients who could not read or write) had a higher mean knowledge rank as compared to the only basic literacy group, which could be attributed to the fact that the mean age of the illiterate group was higher of the two and they

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were exposed to the health-care system for a longer period than the only basic literacy group as noted by Bains and Egede (2011). There was a significant relationship between age and knowledge (Kruskal-Wallis: H = 14.06, p = .003) with older patients having higher rank means for their knowledge, thus confirming that lived disease experience was an important factor in developing practical knowledge.

Remarkably, there is a strong correlation between rural residence and higher knowledge scores (χ^2 = 4.37, p = .037; Mann-Whitney Z = -2.92, p = .004) which will be discussed. The higher knowledge scores obtained by the rural group may have been because the majority of patients in the rural group were older (more experienced) and had diabetes for a longer period of time. It has been noticed in the earlier literature from Pakistan that patients coming to tertiary centres have more clinical exposure to the patient (disease duration) and are more affected.

5.2 Attitude Level Discussion

The overall mean attitude score was 65.41% (SD 12.10%) which indicates a moderately positive attitude towards T2DM self care among this population. The rate of positive attitude (70.9%) is better than the rate found in rural Ethiopia T2DM cohort (Kassahun & Mekonen, 2017: 52%) but similar to the urban cohort of Pakistan (Ali et al., 2022: 67–72%). This subscale pattern (high Perceived Susceptibility (79.75 %), Perceived Severity (77.73 %), Benefit (79.14 %) and a moderate Perceived Barriers (52.73 %)) agrees with the HBM that patients with higher Perceived Susceptibility, Perceived Severity, and Benefit and lower Perceived Barriers will show more positive overall attitudes.

The highly significant relationship between age and attitude (χ^2 = 17.77, p < .001; H = 14.91, p = .002) is due to the progressive shift in attitude which follows greater length of disease. The negative attitude was the most prevalent in younger patients (30-40 years) which may be due to denial, lack of health literacy and less exposure to the health system than in older age groups. The age-attitude association has been routinely reported in the T2DM population in the South Asian region (Jannoo et al., 2017).

The significant relationship between marital status and attitude (χ^2 = 21.87, p < .001) also lends support to the social support hypothesis as married patients had significantly higher positive attitude scores, perhaps due to the fact that they received practical help in preparing their diet, reminders about taking their medication, and encouragement for healthcare follow-up. The finding is in line with the findings of Bains and Egede (2011) where social support was one of the mediators between diabetes self-management attitudes.

There is a highly significant association between diabetes education programmes (Q4) and attitude (χ^2 = 22.79, p < .001) which shows the important role of structured education for the patient in attitude formation. The rates of negative attitude was significantly reduced in patients who participated in education sessions regularly, which is evidence of the value of investing in diabetes self-management education (DSME) programs. Interestingly, the score for the perceived barriers subscale was significantly lower (10.55/20, 52.73%) than scores from the other subscales showing that perceived barriers are a major attitudinal barrier to self-care, despite positive scores from the other attitude subscales and have direct implications for intervention.

5.3 Practice Level Discussion

Compared to similar KAP studies in the south Asian region the percentage of good practice of self care (84.5%) is higher. Ayele et al. (2020) meta-analysis revealed that the overall good practices rate of self-care was 55-70% in Africa and in Pakistan Shareef et al. (2019) revealed 68.3%. This difference can be attributed to the fact that the patients were selected from tertiary hospitals and the patients had a higher health engagement as compared to the entire population of T2DM in Peshawar.

The subscale profile is a good indicator of important practice heterogeneity. Medication adherence (81.6% of maximum) was the most well performed domain as is usual in LMIC studies. The frequency of blood sugar monitoring was also

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relatively high (78.1%) with moderately high glucometer ownership rate (52.7%). Foot care performance (71.4% of maximum) was high compared to some of the similar studies, which could be attributed to the fact that the diabetic foot problem is now receiving attention among the attendees of the tertiary care.

In comparison, physical activity was found to be the lowest scoring domain (57.7% of maximum; mean 8.08/14 days/week). This is consistent with almost all KAP studies in South Asia and this is because of the multifactorial nature of barriers to exercising in this population, such as physical disability because of diabetes complications, safety concerns, cultural norms of exercise (especially for women) and the lack of dedicated exercise spaces. The near zero correlation between PA and knowledge (ρ = -.102) and PA and attitude (ρ = -.058) suggests that the barriers to PA in this population are primarily structural and contextual and not cognitive and attitudinal.

Occupation had significant relationship with self care practice (chi square = 20.30, p = .001) with the highest percentage of poor self care behavior among the private employees, which may be attributed to the occupational stressors such as working at odd hours, planning meals less and having more demanding work environment in the private sector making it more difficult to follow dietary and activity regimes. In addition, a new finding, being a private employee (OR = 0.034, p < .001) was a strong predictor of poor self-care practice, suggesting that an occupational health intervention may be warranted in this population.

5.4 Associations and Predictors

Spearman correlation analyses indicated that there were significant positive relationships among all three KAP domains, and the highest correlation among the different domains was that between the knowledge-attitude correlation (ρ = .529, p < .001). This is in accordance with the KAP model which is a theory that states that knowledge (cognitive health literacy) leads to belief (evaluative beliefs) and then behavior (practice). Moderate correlation between knowledge and practice (ρ = .271, p < .001) and strong correlation between attitude and practice (ρ = .445, p < .001) suggested that attitude (both perceived susceptibility and perceived benefit) was more proximal to self-care practice as predicted by the HBM. This has an important intervention implication since interventions can not be limited to the knowledge constructs but should also include the attitudinal constructs particularly the perceived barriers.

The Kruskal-Wallis analysis showed that the scores of self-care practice of patients who had adequate knowledge (p < .001) and had positive attitude (p < .001) were significantly higher, thus confirming the KAP pathway in this population. When analyzing the data by chi-square, there was a significant association between positive attitude and good self-care practice (χ2 4.40, p .036) and the chi-square association between knowledge and practice approached significance at .05 (p .102) suggesting that an attempt to change attitude was more likely to positively affect observable self-care practice in this population than was cognitive knowledge.

The results of these binary logistic regressions are interesting, not only for what they have found, but also for what they did not. After controlling for all other factors, knowledge category and attitude category were not significant predictors of the level of self-care practice (p = .838 and p = .638, respectively). Indeed, this apparent paradox may be due to the effect of socio-demographic factors, such as occupation that affect both KAP level and self-care capacity and therefore could explain the variability according to the KAP level. The absence of glucometer ownership (Q8: OR = 0.334, p = .044), a modifiable resource barrier that is directly related to blood glucose self-monitoring practice, is a predictor.

6 Conclusion and Recommendations

6.1 Conclusion

This cross sectional KAP study among 220 T2DM patients at three tertiary care hospitals in Peshawar will yield valuable background information on diabetes self management KAP among under-resourced population. The following main results were found:

Most had good knowledge (73.2%, mean 56.67%) with the highest level of knowledge on the questions relating to the method of glucose testing

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and recognising the symptom of the disease, and the lowest on foot care items, HbA1c and effect of fruit juice on blood glucose.

Majority of the participants were positive towards self-care (70.9%, mean score 65.41%) with high scores for susceptibility, benefit and moderate barriers, which may reflect a low level of behavior change.

The mean score was 65.18% and a large majority (84.5%) had good self-care practice with a greatest score in the medication adherence domain and lowest score in the physical activity domain.

Knowledge was highly significantly associated with education level, age, place of residence, occupation and ethnicity as well as diabetes education attendance. Age, marital status and education and occupation and attendance of diabetes education was significant associated with attitude. A significant difference was found between self-care practice and occupation and attitude category.

Knowledge, attitude and practice (KAP) of the three domains were significantly and positively correlated with each other and the highest correlation was between knowledge and attitude ($\rho = .529$) while the lowest correlation was between attitude and practice ($\rho = .271$).

Poor self-care practice was significantly associated with occupation, as a private employee and lack of glucometer, as shown by results of binary logistic regression (Table 2).

These results indicate that KAP in this sample are better than for some similar populations in South Asia but there are important gaps, particularly in foot care knowledge, practice and perceived barriers management, which will need to be addressed. The moderate strength of the KAP-practice pathway reflects the need for a more comprehensive approach to support the adoption of a behavior, which will need to take into account not only knowledge gaps, but also attitudinal and structural barriers to self-care.

6.2 Recommendations

6.2.1 In Clinical Nursing Practice

Increase access to structured diabetes self-management education (DSME) programs at diabetes outpatient clinics of HMC, KTH and LRH, with monthly or more frequent group education sessions as well as diabetes counseling at every follow-up clinic visit.

- Provide foot care in all diabetes nursing consultations as there is high prevalence of neuropathy and low knowledge scores on foot care items.

Diabetes education materials were created in Pashto and Urdu language and distributed to the 68.2% of the patients who cannot read.

- Assess glucometer presence at every diabetes clinic visit and encourage hospital funded glucometer programs for people of lower income as a means to address a large practice barrier – lack of glucometer.

This requirement relates to the definition of "Hospital Administration and Policymakers.

The specific objectives are: •To establish new roles of a Diabetes Nurse Specialist (DNS) in every study hospital to coordinate DSME programs, patient education and evaluate diabetes self-care outcomes.

- Develop built to suit KAP interventions for the following high-risk groups: single patients, younger (30-40 years) patients, employees in the private sector, and patients without formal education.

Use SDSCA and DKTQ as part of the regular case record for all diabetes outpatient clinical visits and thus allow for longitudinal monitoring of self-care behavior change over time.

Lobby KP Health Department to develop a provincial level framework on Diabetes Self-Management Education (DSME) that will include minimum standards for patient education in all tertiary level health facilities.

6.2.2 For Nursing Education and Research (30%)

- Incorporate findings of this study in BSN and post basic nursing education curriculum for empowering the nurses in educating diabetes patients and behaviour counselling.
- Conduct a follow up, longitudinal study, to assess for changes in KAP levels after structured DSME interventions at these tertiary care centers.

Conduct a similar KAP in community health centre settings in KP to observe whether this KAP

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is similar to that of T2DM patients in tertiary care which is likely to be lower.

Use qualitative research strategies to investigate barriers to physical activity, specific to the population, to identify factors that may be influencing the consistently low physical activity self-care scores for this population within a cultural, social and structural context.

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