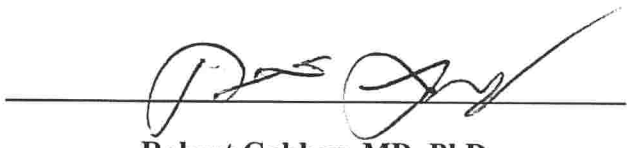
This Thesis, A Cross Sectional Study of the JOINT DQ Program Participants (Joslin Online Intensive Training Program in Diabetes and Quality Improvement for Primary Care Providers) knowledge and attitudes in the fields of Diabetes Care, presented by Nuha Ali El Sayed and Submitted to the Faculty of The Harvard Medical School in Partial Fulfillment of the Requirements for the Master of Medical Sciences in Medical Education has been read and approved by:



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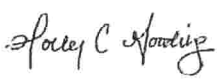

Holly Gooding, MD, MSc

Professor Glenn Matfin, MD

Date: 4/17/19

A Cross-Sectional Study of the JOINT DQ Program Participants' (Joslin Online Intensive Training Program in Diabetes and Quality Improvement for Primary Care Providers) Baseline Knowledge and Attitudes in the Field of Diabetes Care

Nuha Ali El Sayed, MD

A Thesis Submitted to the Faculty of

The Harvard Medical School

in Partial Fulfillment of the Requirements

for the Degree of Master of Medical Sciences in Medical Education

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Thesis Mentor(s): Raveendhara Bannuru, MD, PhD, FAGE & Richard Beaser, MD

Nuha Ali El Sayed, MD

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Abstract

Background:

Diabetes affects 3.85 million in the Kingdom of Saudi Arabia (KSA). Physicians providing care for diabetes patient in the primary care setting (PCPs) are at the forefront of the battle against diabetes at the Ministry of Health (MOH) of KSA, but their knowledge, attitudes, and beliefs towards their knowledge of diabetes and access to supportive educational and expert guidance have not been adequately studied.

Objectives:

Assess PCPs' 1) knowledge of the various diabetes domains from diagnosis to management of complications; 2) self-efficacy; 3) sense of burden and anxiety when caring for patients with diabetes; 4) professional satisfaction; 5) professional isolation; 6) satisfaction with access to continuing medical education (CME) and expert opinion; 7) transfer of knowledge; and 8) perceived patient and clinic benefit/ referral to endocrine /diabetes clinics from current participation in CME.

Design:

An online self-administered open book case-based validated and timed multiple-choice exam and survey of PCPs.

Participants:

249 PCPs currently employed and caring for diabetes patients at the MOH of KSA sampled from 19 primary locations and 11 diabetes units across KSA.

Main measures:

Descriptive analyses of exam results, survey questions on self-efficacy, sense of burden/anxiety when caring for diabetes patients, professional isolation, professional satisfaction, satisfaction with access to CME/expert opinion, transfer of knowledge, and perceived benefit to patients and reduction of referral to endocrine or diabetes clinics. Various tests of statistical association between the survey domains and knowledge scores were performed.

Key results:

Participants scored an average of 55% on the knowledge score exam and only 12% achieved a passing score of at least 70%. Around 50% reported a self-efficacy of competent, very competent, or expert in diabetes. More than 30% of participants reported moderate to severe levels of burden/stress when caring for patients with diabetes in all clinical domains of diabetes and more than 50% reported the same levels of burden in diabetes emergencies or inpatient diabetes care.

Conclusions:

These findings suggest that alignment between quality improvement initiatives and targeted CME activities is warranted. Furthermore, a wider needs assessment is required to explore the high levels of stress burden in this group.

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Chapter 1

1.1 Background

Diabetes, an unabating epidemic:

Diabetes has reached epidemic proportions. The International Diabetes Federation (IDF) estimates that 425 million people have diabetes. An estimated 1 in 11 individuals have diabetes, with an additional 1 in 2 adults whose diabetes remains undiagnosed (212 million people). Around 12% of the global health expenditure is spent on diabetes ($727 billion) [(1)].

The Kingdom of Saudi Arabia (KSA) has undergone major social and economic changes including rapid economic growth and urbanization resulting in longer life expectancy, as well as higher levels of obesity and diabetes [(1)]. IDF estimates that the prevalence of diabetes in KSA is a staggering 18.5%, representing the highest age-adjusted comparative diabetes prevalence in the Middle East and North Africa region (MENA), with a total diabetes case load of 3.85 million adults. Local studies conducted in Saudi Arabia have shown even higher rates of type 2 diabetes. Prevalence rates were found to be between 18.2- 31.6 %, in a meta-analysis by Alotaibi, et al [(5)]. Others have reported rates around 25.4%, of which 40% affected are unaware of their disease [(6)]. Alotaibi, et al. also demonstrated that impaired fasting glucose affected 25.5% of their studied population [(5)].

Adding another dimension to this burden, diabetes control in KSA is a challenge. Ninety percent of those above 40 years old were found to be overweight or obese by Al-Rowais, et al. at King Khalid University. Sixty percent of the same population did not meet their HbA1C goal and 50% did not meet systolic blood pressure goals [(7)]. Another study reported the rate of uncontrolled diabetes as 59.3% [(8)].

The Ministry of Health of Saudi Arabia (MOH) in KSA is the main government agency charged with health care of the entire Saudi population and its expats. It owns and operates 60%

of all clinics and hospitals within the Kingdom. These clinics and hospitals provide basic healthcare services as well as specialized facility centers (Figure 1) [2,3,4].

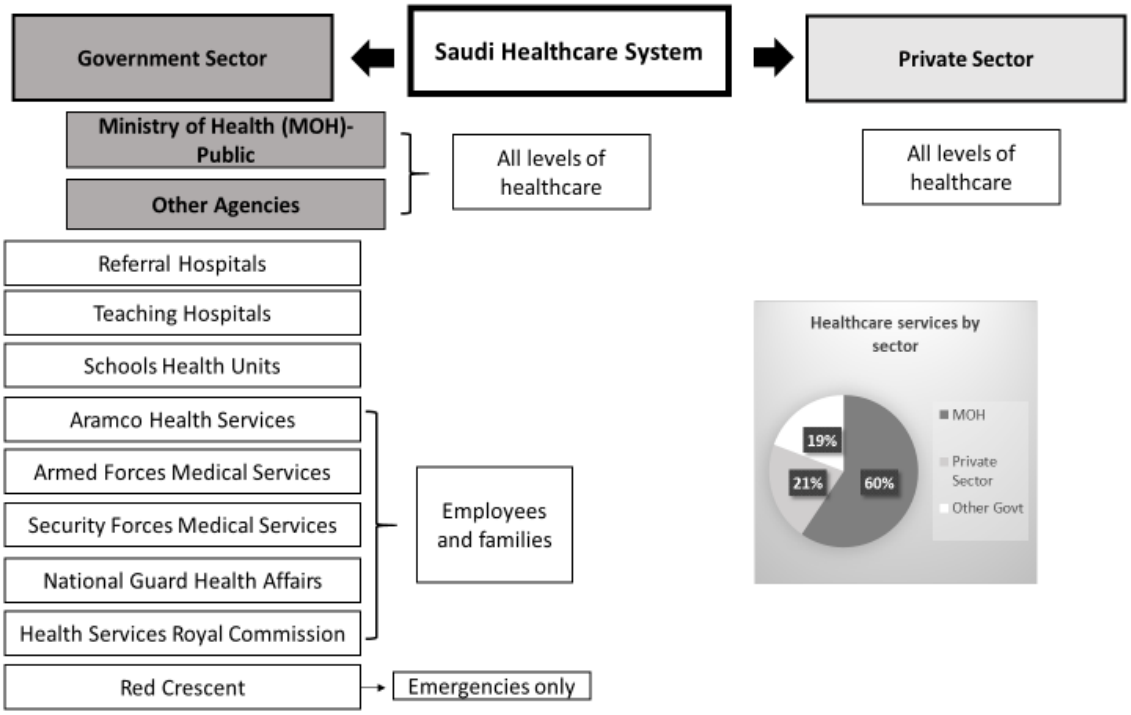


Figure 1- Structure of Healthcare in KSA (Reproduced with permission from the primary author and WHO's Eastern Mediterranean Health Journal- EMHJ) [4]

A workforce to combat the battle against diabetes:

A disease like diabetes requires a large and competent healthcare workforce to combat the complex needs of diabetes patients. The number of graduates from Saudi medical schools is not adequate to supply sufficient primary care providers to care for patients with diabetes [3]. Therefore, MOH resorts to recruiting foreign trained physicians to fill this gap [3]. Based on Joslin Diabetes Center preliminary unpublished data, it was clear that these foreign trained physicians come with a heterogeneous educational and training background. However, to our knowledge, the knowledge base, sense of self efficacy/competence, professional satisfaction, and

other attitudes towards diabetes and diabetes professional education in this physician population has been not studied.

Diabetes- a fast-evolving field:

The field of diabetes is rapidly changing. Guidelines in the past few years have been subject to fast-paced updates. To cater to this change, for example, the American Diabetes Association is moving from the model of guidelines update every year or few years to a "*Living Standards of Care"* update model because of the urgent need to update physicians on new data evolving from various clinical trials especially trials in areas that are high impact in diabetes care as cardiovascular and renal clinical trials [(16)].

These changes stem from updated clinical trials of older medications and from advances in new medications. New medication agents are proving to provide benefits that are of critical importance to the lives of patients with diabetes like medications with cardiovascular and/or renal benefits [(16)]. Medications that provide significant benefits are often associated with complicated pharmacodynamics and kinetics, and can result in serious adverse events if not used appropriately. This renders a heavy load on practicing physicians caring for diabetes patients. Physicians are expected to quickly and efficiently learn about those changes and medications and adopt them safely in their practices.

Physician credentialing/licensure in KSA:

The Saudi Commission for Health Specialties [(9)] regulates medical licensure for all physicians practicing in KSA. The continuing medical education model has been adopted to ascertain physicians' credentialing and maintenance thereof [(9)].

In continuing medical education (CME) around the world, physicians are expected to self-assess for gaps in knowledge and source new knowledge in their field to both satisfy the

CME requirement and to update their knowledge in their field of clinical practice. Physicians do so while protecting their time and responsibilities, with or without attention to institutional priorities [44]. The correct matching of gaps of knowledge and access to good quality CME is an assumption in this CME credentialing process in KSA and around the world.

Based on specialist shortage and cost constraints, experts at the MOH have emphasized that diabetes care should be primarily undertaken by PCPs and that excessive referral to specialized centers should be reduced, and experts in diabetes agree [11]. Therefore, MOH has collaborated with Joslin Diabetes Center to provide training to this workforce, and this analysis is a part of an educational program conducted in collaboration with the MOH.

Chapter 2: Data and Methods

2.1 Short Introduction

As a part of a collaboration between Joslin Diabetes Center and the MOH of KSA to train and capacity build the MOH workforce, this needs assessment was performed to help assess the ministry's education and training needs. This assessment was performed on the participants in the JOINT DQ program, a cluster randomized study comparing the impact of an online program in quality improvement and diabetes (intervention group) to traditional CME practices coupled with access and recommendations to utilize guidelines (control group) on knowledge scores, survey scores, and their patients' quality metrics (HbA1C, systolic blood pressure, and LDL cholesterol).

This study was approved by the Harvard Medical School IRB, Ministry of Health of Saudi Arabia IRB/ Ethics committee, and Joslin Diabetes Center IRB.

2.2 Materials and Methods

Survey

Physicians providing care at the primary care level from the MOH of KSA were surveyed prior to the initiation of a cluster randomized trial comparing an online educational intervention in diabetes and quality improvement (JOINT DQ Program: Joslin Online Intensive Training in Diabetes and Quality Improvement) to usual CME practices coupled with access to guidelines (American Diabetes Association Standards of Care 2018, then updated to 2019) [35]. The JOINT DQ program adopts evidence-based learning theory to the online environment as a means of knowledge sharing between experts in the field of diabetes between Joslin Diabetes Center and Harvard Medical School and PCPs to capacity build the MOH's healthcare workforce.

The survey is a validated tool and was utilized with permission from the Project ECHO group, New Mexico [10]. The survey was adapted to diabetes, and questions about access to CME/expert opinion were added and validated prior to survey implementation by the principle investigator.

The survey domains included demographic information, self-efficacy (divided by clinical topic domains in diabetes), sense of burden/anxiety when caring for diabetes patients (divided by clinical topic domains in diabetes), satisfaction with access to CME and expert opinion, professional isolation, professional satisfaction, transfer of knowledge to other clinic members, perceived patient and clinical benefit from CME in the areas of safety, and reduction of referrals to diabetes units and endocrine specialists [10].

Exam

To evaluate the PCPs' knowledge, we utilized a multiple-choice question (MCQ) questionnaire which was mostly case-based. The exam was developed by experts in diabetes using a set of pre-determined learning objectives guided by the standards of care of both the American Diabetes Association [35] and the Ministry of Health of Saudi Arabia. The exam

domains included 24 basic clinical domains in diabetes (Table 1), and these domains were aligned with the domains covered in the survey tool.

The exam was validated by Integrity Castle Rock Research, Ontario, Canada. There were no reports of collusion in this exam [34].

The Exam was hosted on StudyTRAX research portal. Participants completed this open book exam remotely.

Clinical Domains:
The role of practicing physicians in quality improvement
Prediabetes
Pathophysiology of type 1 diabetes
Pathophysiology of type 2 diabetes
Diabetes diagnosis, goals and barriers to achieving clinical care goals
Comprehensive assessment of patient with diabetes
Role of diabetes education
Insulin therapy
Non-insulin medication therapy
Inpatient diabetes management
Diabetes emergencies
Dyslipidemia in diabetes
Hypertension in diabetes
Obesity management
Diabetic kidney disease
Retinopathy
Neuropathy
Diabetes and male sexual health
Diabetes in the elderly
Preconception care in diabetes
Diabetes foot care
Diabetes and mental health
Transitions in care in diabetes.

Table 1- Clinical domains of diabetes covered in this assessment

Statistical Analysis:

All data were initially examined visually and statistically for normality of distribution, and values are presented as means ± standard deviation (SD) unless otherwise stated. Pearson's correlation was performed to assess relationships between the survey scores and knowledge exam scores.

2.3 Results

Physician characteristics

Characteristics of the participating physicians are shown in Table 2. The majority of the study participants (95%) were between the ages of 30 and 60 years old and 64% were male. Most of these physicians (97%) graduated from school over 5 years ago and 70% graduated over 10 years ago. The majority (92%) had over 5 years of experience and 56% had over 10 years of experience.

About 10% had completed a fellowship in diabetes or endocrinology, and 58% had completed a residency in family medicine or internal medicine. Interestingly, 31% had no formal training in internal medicine, family medicine, diabetes/endocrinology, or other fields. Lastly, 0.8% of physicians were currently in training (residency).

Training experience of the participating physicians is depicted in Figure 2. Training was associated with better self-efficacy ($p<0.01$) (Figure 3) and higher knowledge scores ($p<0.01$) (Figure 4). Furthermore, more clinical experience was associated with better self-efficacy ($r=0.263$, $p<0.001$) (Figure 5).

Table 2: Characteristics of Participants (N=249)

Characteristic	N (%)
Age Group	
Age 20-29	7 (2.8)
Age 30-39	128 (51.4)
Age 40-49	77 (30.9)
Age 50-59	35 (14.1)
Age ≥60	2 (0.8)
Gender	
Male	159 (63.9)
Female	90 (36.1)
Years Since Medical School Graduation	
<5 years	8 (3.2)
5-10 years	66 (26.5)
>10 years	175 (70.3)
Years of Practice	
<5 years	21 (8.4)
5-10 years	89 (35.7)
>10 years	139 (55.8)

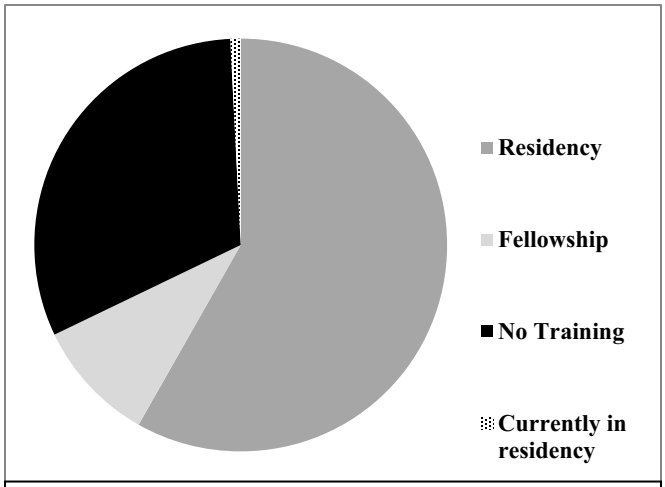


Figure 2: Training Experience of Participants

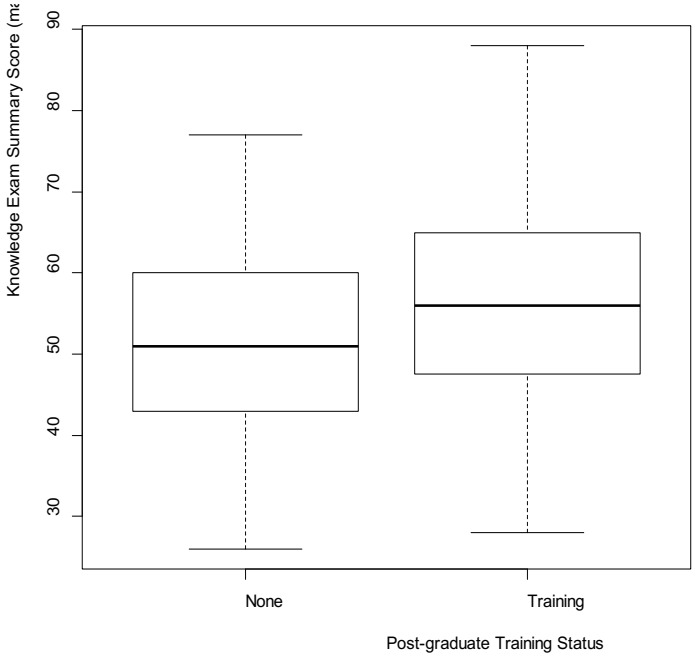


Figure 3: Relationship between Training and Self-Efficacy Score

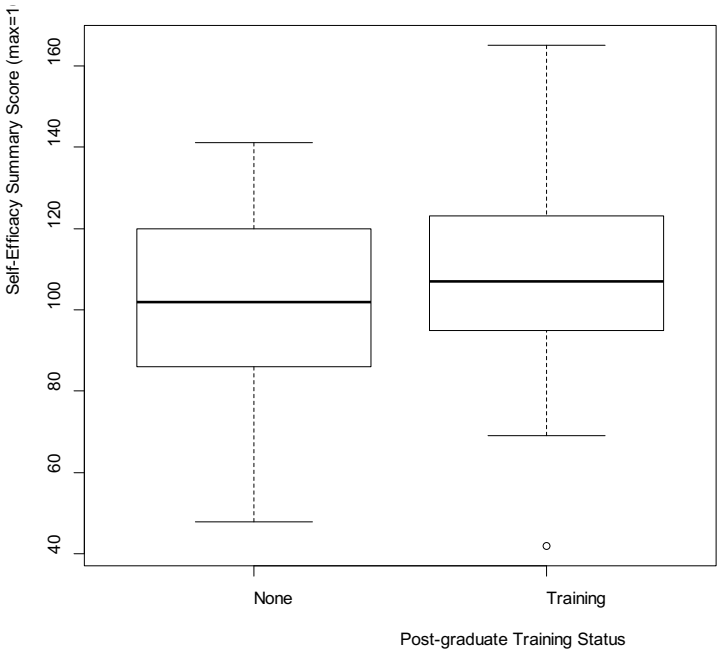


Figure 4: Relationship between Training and Knowledge Exam Score

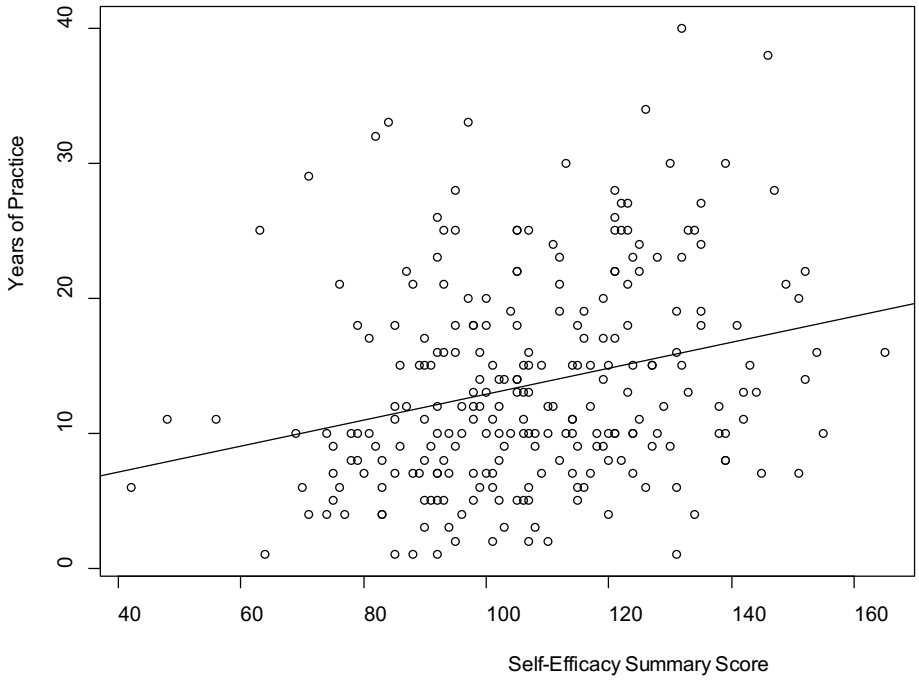


Figure 5: Relationship between Years of Practice and Self-Efficacy Score

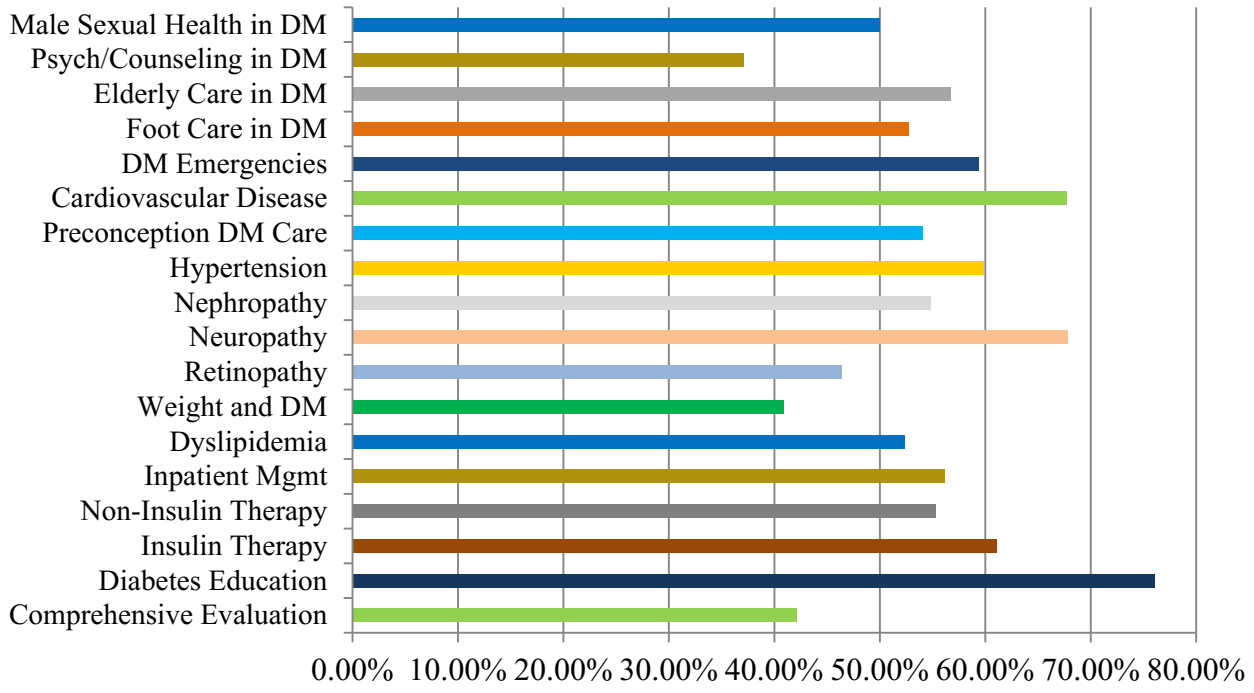
Knowledge scores

Physicians in this cohort achieved an average of 55% (SD 12) overall correct answer rates. The percentage of physicians achieving a correct score on at least 70% of questions on the knowledge exam (KE1) was 12% and the percentage of those achieving a score of at least 65% was 23%.

Assessment of exam scores by domain revealed that the participants achieved a score of at least 65% in the following domains: role of physician in quality improvement, type 1 diabetes pathophysiology, the role of diabetes education, neuropathy, and cardiovascular disease. They scored between 51-64% in areas of diabetes diagnosis/diabetes goals, insulin therapy, non-insulin therapy, inpatient diabetes management, dyslipidemia, nephropathy, hypertension, preconception care in diabetes, diabetes emergencies, foot care in diabetes, diabetes in the elderly, and male sexual dysfunction in diabetes (Figure 6). Lastly, they scored less than or equal to 50% in domains of pre-diabetes, type 2 diabetes pathophysiology, the comprehensive evaluation of a patient with diabetes, transitions of care, retinopathy, weight management and lifestyle medicine in diabetes and mental health in diabetes.

The mean (SD) score of KE1 for individuals with no training was 51.6 (12.1), while individuals with training scored a mean (SD) of 56.1 (12.1). Knowledge scores for centers by geographical site and type varied considerably. Overall, diabetes units/centers (DU) scored higher on average than primary care centers (PC) (see appendix Tables 1 and 2).

Figure 6: Percentage of Correct Answers by Clinical Domain



Self-efficacy

Perceived competence, or self-efficacy, and its relation to objective measures of competency has been a field of study in many clinical training and professional medical settings [36-39]. The JOINT DQ participants were asked to rate themselves on a Likert scale of 1-7 (1= no knowledge or skill to 7= perceiving self as expert and teaches others). An average of 50% of these participants reported high levels of self-efficacy by selecting a value of 5, 6, or 7 on this Likert scale (reporting that they are competent, very competent, or experts in diabetes).

When examining self-efficacy by domain, they reported competent or higher scores over 50% of the time in the following domains: prediabetes, type 2 diabetes pathophysiology, type 1 diabetes pathophysiology, diabetes goals and barriers to achieving these goals, diabetes diagnosis, caring for the elderly with diabetes, diabetes education, insulin therapy, non-insulin therapy, dyslipidemia in diabetes, obesity, and hypertension (Figure 7). Of those domains, diabetes diagnosis (87%) was reported with the highest rates of self-efficacy, followed by prediabetes (69%) and hypertension (62%).

Conversely, an average of 18% of the cohort reported lower levels of self-efficacy overall, by selecting values ranging from 1-3 on the same Likert scale (1= no knowledge or skill, 2= vague knowledge or skill, or 3= slight knowledge and skill).

More than 30% of this physician population reported low levels of self-efficacy in the domains of inpatient care, mental health/counseling in diabetes, and transitional care. Additionally, over 20% of physicians stated low levels of self-efficacy in cardiovascular disease, male sexual dysfunction in diabetes, retinopathy, and neuropathy (Figure 8).

The relationship between self-efficacy and the objective measure of competency (knowledge exam score) was tested, and better self-efficacy was associated with higher performance on the knowledge exam ($r=0.228$, $p<0.001$).

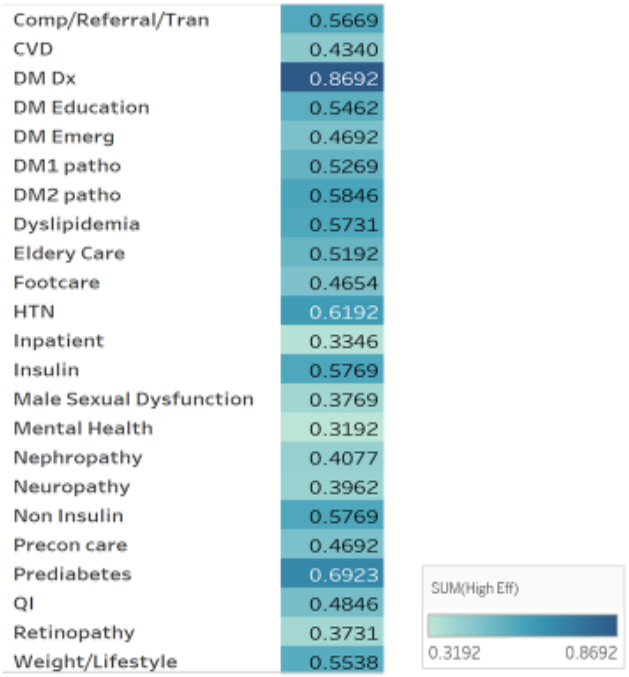


Figure 7: Proportion of Physicians Reporting High Levels of Competency by Clinical Domain

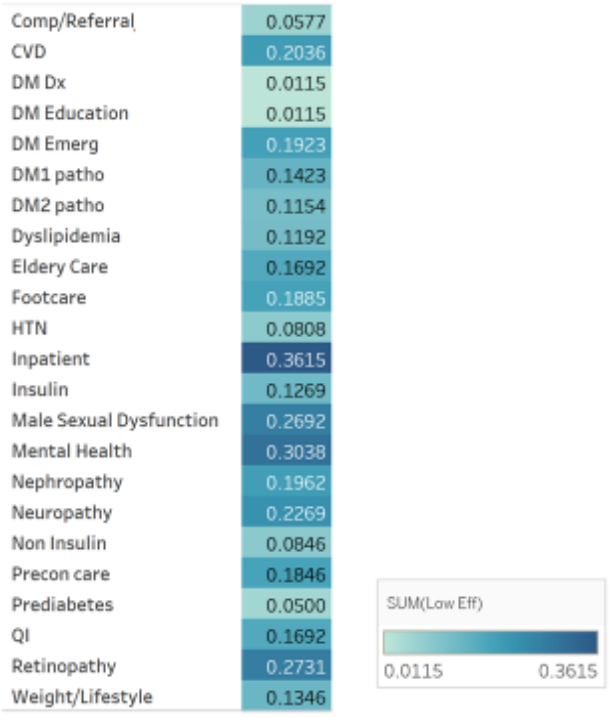


Figure 8: Proportion of Physicians Reporting Low Levels of Self-efficacy by Clinical Domain

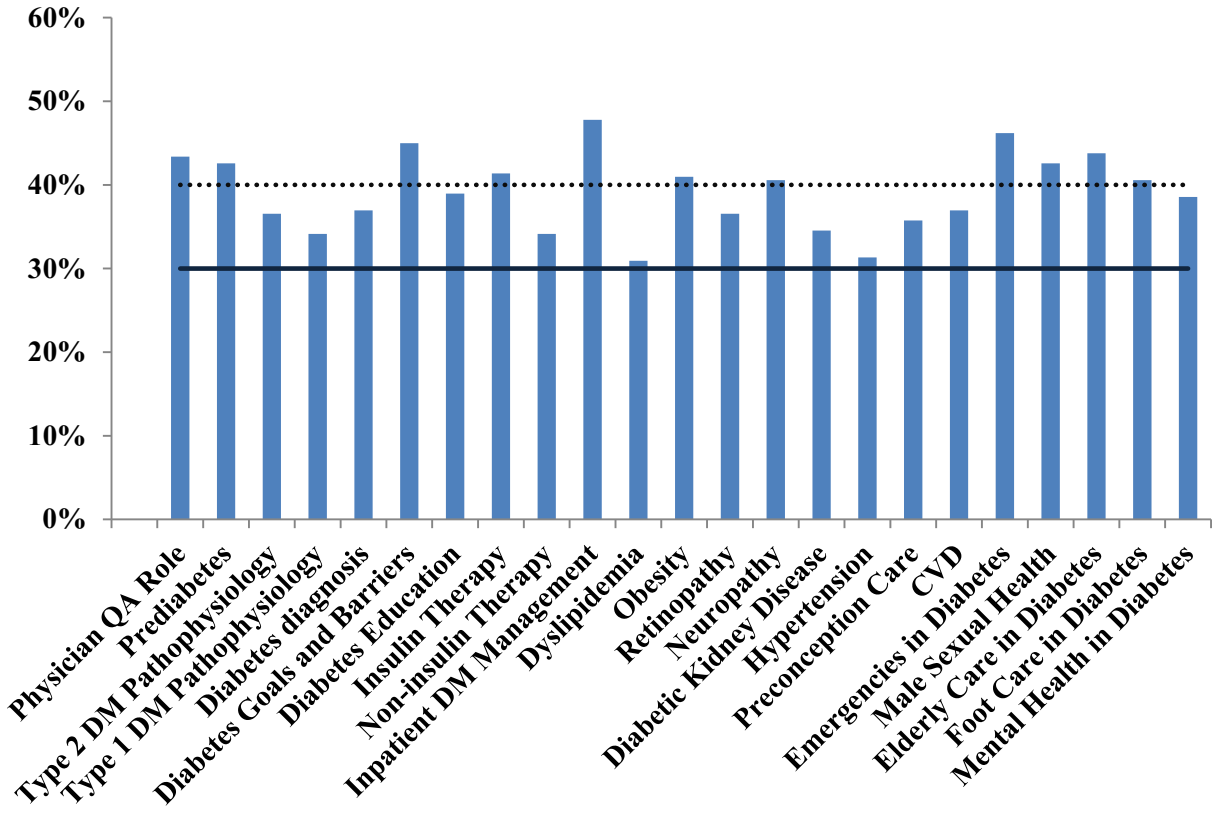
Sense of Burden and Stress caring for diabetes patients

The survey asked physicians to report their level of burden/ stress when caring for patients with diabetes on a Likert scale 1-5 (1= not at all, 5= to a large degree).

When the data was analyzed using clinical domains, over 30% of this physician population reported moderate to high levels of burden/stress in all 24 clinical domains of diabetes and over 40% of them reported moderate to high levels in 12 clinical domains of diabetes (Figure 9). The highest level of burden and stress reported (50%) was in the field of inpatient diabetes care.

We found no association between the sense of burden and training status, knowledge scores, gender or years of experience (Table 3).

Figure 9: Percentage of Respondents Reporting Moderate to High Burden by Domain



Professional Satisfaction

More than half of the participants reported moderate to high levels of professional satisfaction; 56% reported that they are satisfied professionally to either a moderate or a large degree. The mean score of professional satisfaction was 3.5 (SD 0.9) on a 1-5 Likert scale.

To help the MOH in future planning, we examined our data by geographical location and were able to find particular areas reporting low levels of professional satisfaction. 25% of participants in the following regions reported low levels of professional satisfaction: primary care centers (PC) in AlQassim, Aseer, and Jeddah and diabetes units (DU) in Aljoof, AlQassim,

and Qonfoda. Furthermore, 50% of participants in the following regions reported low levels of professional satisfaction: Mecca-PC and Jeddah- DU.

Professional Isolation

Professional isolation rates were reported as moderate to high in 27% of participants and were found to be low in 50%. The mean score of professional isolation was low, at 2.6 (SD 1.2) on a 1-5 Likert scale.

We found that the highest levels of professional isolation were in AlHail-PC, Aljoof-PC, Ihsa-PC and AlSharqia-DU (>/50% or participants) (see appendix).

Satisfaction with access to CME and Expert opinion

Our participants reported high levels of satisfaction with CME access. Participants reported a mean of 3.8 (SD 1.2) on a 1-5 Likert scale and 64 % of participants reported a moderate or large degree of satisfaction with access to CME. On the other hand, 16% reported that they were not satisfied at all, or to a limited degree.

As for access to expert opinion when needed for clinical decision making, a similar pattern was noted. Participants reported a mean of 3.7 (SD 1.3) on a 1-5 Likert scale and 60 % reported when asked if they are satisfied with access to expert opinion that they are satisfied to a moderate to a large degree. 23% reported that they were not satisfied at all, or to a limited degree.

No association was found between physicians' satisfaction levels with CME access and/or access to expert opinion and their knowledge scores ($p=0.37$ and $p= 0.41$, respectively) (Table 3).

Areas with the lowest reported access to CME were Abha-PC, Aseer-PC, AlSharqiah-PC, Jeddah- DU, and Mecca-PC, with over30% of physicians in these regions reporting no or low levels of CME access. Areas with the lowest reported access to experts were Abha-PC, AlHail-PC, AlSharqia-PC, Aseer-PC, Jeddah-PC, Mecca-PC, and Jeddah-DU (>30% reported no or low levels of access to experts).

Perceived benefit from CME in patient safety and referral reduction in diabetes care

Participants reported high levels of benefit from participating in CME with respect to its effect on patient safety and resulting reduction in the need to refer to diabetes units and endocrinology. The majority of participants (83%) reported a 4 or 5 (agree to a moderate or large degree) when asked if they agree that their CME access results in greater patient safety. 78% reported that CME access resulted in reduction of the need for referral in diabetes to specialty care (reporting a 4 or 5 on the same scale).

Table 3: Relevant Relationships between Variables (N=249)	
Relationship	**p value**
Gender and Years of Practice*	p=0.2524
Gender and ECHO Self-Efficacy Summary Score†	p=0.1469
Gender and ECHO Burden & Stress Summary Score†	p=0.2317
Gender and Knowledge Exam 1 Summary Score†	p=0.4282
Training and ECHO Self-Efficacy Summary Score†	**p=0.0062**
Training and ECHO Burden & Stress Summary Score†	p=0.0693
Training and Knowledge Exam 1 Summary Score†	**p=0.0067**
Years of Practice and ECHO Self-Efficacy Summary Score‡	**r=0.263, p=0.00003**
Years of Practice and ECHO Burden & Stress Summary Score‡	r=-0.048, p=0.4515
Years of Practice and Knowledge Exam 1 Summary Score‡	r=0.108, p=0.08891
Self-Efficacy Summary Score and Knowledge Exam 1 Summary Score‡	**r=0.228, p=0.0003**
Burden & Stress Summary Score and Knowledge Exam 1 Summary Score‡	r=-0.097, p=0.1281
Access to Continuous Medical Education (CME) and Knowledge Exam 1 Summary Score§	p=0.3665
Access to Expert Opinion and Knowledge Exam 1 Summary Score§	p= 0.4133
* Wilcoxon rank sum test; †Two independent sample t-test; ‡ Pearson correlation; §Kruskal-Wallis test	

2.4 Discussion

Our physician population has many unique characteristics, but the most unexpected of them was that around 30% of this workforce reported receiving no formal clinical training in the form of residency (or beyond). Many of the participants are graduates of a traditional 5 or 6 year medical school program and one rotating multidiscipline internship. This internship is not a part of a structured residency program. However, the majority (around 92%) of the group are quite experienced. They have a work experience of over 5 years and around 56% have over 10 years of experience, indicating that this physician population's training started "on the job" rather than in a traditional structured training fashion.

Our associations have shown what one would intuitively expect- training was associated with higher self-efficacy scores and knowledge scores. This finding prompts the need for further studying of this group of physicians. Further study would shed light on their needs (educational and other), and would clarify the impact of their educational background on current knowledge and patient care.

Physicians are known to be lifelong learners, but can physicians perform accurate self-assessments? There are some studies in the literature [36-39] exploring this and we set to explore this question further in this needs assessment.

Physicians are expected to effectively learn and incorporate the new information they learn to benefit patients and reduce their burden of disease and its complications [13]. Medical boards and various credentialing bodies worldwide use CME as a measure of adequate participation in ongoing learning, but enforcement of targeted CME (e.g. specifically in a clinical domain of diabetes based on patient outcomes or quality metrics) is not currently feasible on a national level.

The concept of CME as it stands assumes that physicians and other health care providers can determine their learning needs and their gaps of knowledge and easily and readily find sources to remediate this gap. However, studies conducted to assess physicians' ability to identify their learning gaps/needs and to locate resources to meet those needs have suggested that physicians have a limited ability to assess their own competency and seek the needed resources to remediate their knowledge or competency gaps [13, 14, 15]. Furthermore, after graduate training and joining medical practices, very little feedback is provided to physicians. They make decisions about what to learn and where to learn in the context of their time constraints and responsibilities, with or without attention to their institutional needs [44].

The results of our assessments are in line with previous data, but shed more light on how our physician sample assess themselves on a scale ranging from novice to expert specific to the field of diabetes care. Our participants' overall self-assessment revealed that 50% classify themselves as competent, very competent, or expert in diabetes and 32% assessed themselves to be average among their peers. Contrasting that with a mean score on the knowledge exam of 55% (SD 12) raises the question again if physicians are good self-assessors.

We tested the association between self-efficacy and knowledge scores and only found a weak correlation between self-efficacy and knowledge scores ($r=0.228$, $p=0.0003$), a result that is again in alignment with questioning self-assessing abilities of physicians. These results bring into question the impact that adequate self-assessment may have on patient care and quality improvement efforts (QI), an area where further research is needed.

Diabetes distress [24, 25] has been a common area of study in diabetes patients. Today, physician burn out and distress is a very critical issue for physicians in healthcare worldwide [18-22]. Diabetes is a demanding chronic disease and patients' medical care and

psychological needs are often complicated. The role of a physician in diabetes care demands a considerable amount of knowledge and effort from treating physicians. This demand does not stand alone. It is but one part of complex medical systems where physicians need to be highly productive seeing scores of patients in limited time windows as well as face challenges in the work place and their personal lives. Recently, Craven, et al.'s [33] work explored the topic qualitatively and showed that healthcare providers caring for diabetes patients (9 physicians in training, 7 diabetes educators, and 2 pharmacists) reported experiencing negative emotions including exhaustion, anxiety, and hopelessness. Furthermore, Beverly, et al. [29, 33] qualitatively reported on the difficulty felt by physicians in dealing with social and emotional issues in diabetes patients.

To our knowledge, no quantitative or qualitative assessment of primary care physician's burden sense/stress when dealing with diabetes patients has been published. We also could not locate any data about burnout or the level of burden/stress experienced by physicians in the Middle East, Saudi Arabia, or the ministry of health. Therefore, we decided to explore the level of burden and stress in this physician population to further inform the education and training process. We are also currently studying the impact of JOINT DQ online intervention on their knowledge, attitudes and burden levels when caring for patients with diabetes. Furthermore, our results can inform the MOH's planned wellness efforts for its employees.

Our needs assessment inquired about physician stress or sense of burden while caring for diabetes patient as a starting point to explore physician distress. Our questions were listed by clinical domains of diabetes to help target any further future investigation and interventions and were also analyzed in a summative manner. This physician population reported high levels of

burden in caring for diabetes patients in all domains of diabetes, the highest reports of which were in the fields of inpatient diabetes care and diabetes emergencies (Figure 9).

Although we did not find any association between the burden and stress experienced by the diabetes care providers and their demographic characteristics or their knowledge, we feel that this is only a starting point. High levels of burden alone are of great concern and warrant a follow up study to investigate more broadly (e.g. system factors, patient factors, and others) why these physicians are experiencing such high levels of distress, as well as how stress levels impact patient care.

The high access to CME satisfaction rates (> 60 % reported moderate to high levels of satisfaction based on a Likert scale of 1-5) probably means adequate availability of CME and expert opinion to most of those physicians. However, while the availability of CME is a positive attribute, there needs to be further investigation into those who have reported much lower rates of satisfaction (e.g. see our results by location or practice type) to better inform future decisions and allocation of CME/ resources at the ministry. We explored physician satisfaction with expert availability, and generally participants reported high levels of satisfaction, reflecting another positive attribute. However, this high satisfaction level needs to be studied further to ascertain that this phenomenon does not translate into excessive referrals to specialty centers at the ministry.

Our survey also explored the perceived benefit of participation in CME activities to patient safety and reduction of diabetes referrals to diabetes units and endocrine clinics. The participants reported a moderate to high level of agreement that their participation in current CME activities improve patient safety and reduce referrals to diabetes specialists. Further studies

in the appropriateness of those patterns of referrals are warranted to ascertain patient safety and quality of clinical care.

There is room for improvement in these physicians' knowledge scores. It is now clear that in a disease like diabetes that is fast-changing, knowledge gaps will occur. Knowledge gaps are not unique to our physician population. Only 6% of US primary care providers correctly identified all 11 risk factors that qualify a patient for pre-diabetes screening on a survey of 140 physicians [40].

A critical area of process examination for the ministry is to understand the causes of contradiction between reports from most of the participants that CME is accessible and low corresponding knowledge scores. It may be prudent to investigate things as current CME quality, alignments of content with clinical goals and domains and the correct dissemination practices of available CME programs. We also feel that further studies are needed in areas where low rates of access were reported geographically.

We believe we have unearthed an indication of powerful commitment to medical education in the MOH physicians. This physician population reported high levels of agreement when asked about the transfer of knowledge from CME to their clinics. This is a powerful tool that the healthcare system can utilize in updates of knowledge and mentorship of clinic members. A stronger knowledge base for these physicians is likely to make this education process more effective and fruitful.

Professional satisfaction has been a field of study to combat physician burnout and improve patient care [41-43]. We felt it was vital to investigate professional satisfaction in this physician population. Our results show that over 50% of the participants report moderate to high levels of professional satisfaction. despite the high levels of burden and stress and gaps in

knowledge. They also reported low professional isolation. This current state of satisfaction and low isolation rates may reflect a positive work environment, fair compensation, positive cultural environment, or other factors.

We also focused on those reporting low rates of satisfaction and high rates of isolation and classified them by geographical location and center type to help direct further studies and interventions within the ministry.

While this study was conducted in KSA, our physicians in this cohort came from 22 different countries of origin with respect to their medical school system and training. We feel that this makes our results generalizable to primary care settings in the Middle East, North Africa, and Asia, as well as many other parts of the world.

We agree with McMahon [44] and believe CME and professional education is beyond a number of hours to be collected for credentialing. CME is not an unengaging act of "pretend learning in dark rooms" where experts of the world teach [44]. Healthcare institutions and healthcare systems with ongoing evaluations and assessments of their clinical and non-clinical quality metrics can identify areas of improvement. A strategic alignment between leaders in education and leaders in quality improvement at the MOH for the mutual benefit of the healthcare system needs to occur.

Targeted CME or non-CME professional training programs that are curricula based with ongoing updates to stay in line with MOH overall strategy and priority QI areas is a critical step towards effective training, education, capacity building, and provider behavior change. Targeted programs like JOINT DQ can provide easy to access actionable evidence-based learning resources, corrective feedback, a learning community, and tool kits to support better practices and support decision making in the field of diabetes.

Conclusion:

In this study, we demonstrated that this physician population has low scores on the baseline knowledge exam, moderate to high levels of self-efficacy, and reported adequate access to supportive educational and expert help. Based on this mismatch between the objective and subjective assessment results, there is a need to assess the quality and allocation of current CME provided, establishing a new alignment between QI initiatives (clinical metrics based assessments) and targeted CME activities where knowledge gaps exist. Lastly, a wider needs assessment is required to explore the high levels of stress and burden reported in this group.

Chapter 3:

3.1 Limitations

Although our study was focused on one physician group at the MOH of KSA, this physician population came from different ethnic and educational/training backgrounds, and we feel one can still draw parallels from our experience for use in similar settings. Our data is self-reported by physicians, and therefore is inherently subject to response bias. To mitigate this bias, we used a validated tool that has unearthed valuable information that has not yet been reported.

Our knowledge scores (though crafted by experts and validated) still have inherent limitations. Over 90% of the exam utilized a case-based MCQ approach to assess physicians with the aim of providing the most authentic testing experience possible. However, that is still not equivalent to direct observation of physicians in clinic. We are currently studying this data in relation to patient outcomes in collaboration with the MOH.

3.2 Future Research

In conjunction with the MOH, the JOINT DQ program has been launched to help improve knowledge scores, physician scores on the survey as well as patient quality outcomes.

The JOINT DQ program is the intervention arm of a cluster randomized trial comparing the online program to conventional/currently available CME combined with access to guidelines. We are hoping to help the ministry find a CME activity that is targeted and sensitive to their physician education needs. Additionally, qualitative studies are planned to further understand the moderate to high burden/stress levels as well as other areas of need in field as professional isolation, professional satisfaction. Lastly, the investigator is planning a US-based diabetes distress study in primary care physicians to help shed the light on where efforts can be focused to alleviate that burden on healthcare providers.

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Appendix:

Appendix Table 1: Summary of Results for Primary Care Centers, by Site							
	Low Self-Efficacy	**High Self-Efficacy**	**Low Access CME**	**Low Access Expert**	**Professionally Isolated**	**Dissatisfied Professionally**	**KE1**
Abha	11%	6%	100%	100%	0%	0%	77%
AlBaha	2%	30%	21%	32%	26%	11%	48.89%
AlHail	0%	47%	0%	50%	50%	0%	71.50%
Aljoof-PC	1%	42%	0%	0%	50%	0%	60.25%
AlQassim-PC	6%	22%	25%	25%	35%	35%	47.20%
AlSharqia-PC	2%	27%	33%	44%	17%	17%	56.67%
AlTaif-PC	3%	23%	23%	38%	31%	15%	57.54%
Aseer-PC	4%	18%	36%	41%	23%	36%	52.41%
Besha	1%	24%	20%	0%	40%	20%	46.20%
Hafr AlBaten	2%	30%	13%	25%	25%	13%	55.13%
Ihsa-PC	1%	10%	0%	0%	50%	0%	53.75%
Jazzan/Jizzan-PC	3%	26%	0%	12%	35%	12%	54.50%
Jeddah-PC	4%	25%	18%	36%	27%	27%	54.91%
Meccah	6%	5%	33%	67%	33%	67%	53.67%
Medinah	0%	29%	0%	0%	33%	0%	51.00%
Najjran	0%	39%	0%	0%	25%	0%	61.75%
Northern Border	3%	28%	12%	6%	24%	24%	47.94%
Qonfoda-PC	0%	22%	20%	20%	40%	20%	50.80%
Riyadh-PC	4%	22%	6%	19%	25%	13%	53.75%

Appendix Table 2: Summary of Results for Diabetes Centers, by Site							
	Low Self-Efficacy	**High Self-Efficacy**	**Low Access CME**	**Low Access Expert**	**Professionally Isolated**	**Dissatisfied Professionally**	**KE1**
Aljoof-DC	1.63%	36.96%	25.00%	25.00%	25.00%	25.00%	62.50%
AlQassim-DC	0.31%	27.64%	0.00%	14.29%	14.29%	0.00%	60.57%
AlSharqia-DC	3.26%	25.54%	0.00%	0.00%	50.00%	25.00%	59%
AlTaif-DC	5.43%	19.02%	0.00%	25.00%	25.00%	0.00%	59.75%
Aseer-DC	0.00%	36.96%	0.00%	0.00%	0.00%	0.00%	57%
Ihsa-DC	1.09%	25.00%	0.00%	25.00%	37.50%	0.00%	56.75%
Jazzan/Jizzan-DC	1.24%	39.13%	0.00%	0.00%	14.29%	0.00%	67.50%
Jeddah-DC	2.17%	21.01%	33.33%	33.33%	33.33%	66.67%	42.67%
Qonfoda-DC	3.26%	25.00%	25.00%	0.00%	25.00%	25.00%	66.75%
Riyadh-DC	2.64%	32.30%	14.29%	14.29%	21.43%	0.00%	60.86%