Efficiency, quality, and management practices in multidisciplinary and traditional diabetes healthcare services in Mexico

Carlos Chivardi[1] · Alejandro Zamudio Sosa[2] · Omar Galárraga[3] · Sandra G. Sosa-Rubí[4]

Abstract

Diabetes is a major health issue in middle-income countries like Mexico. Multidisciplinary healthcare (MHC) models aim to improve diabetes care and reduce costs. However, the relationship between management practices, efficiency, and quality of care in MHC and traditional healthcare (THC) models is unclear. This study evaluates the efficiency and quality of diabetes healthcare models in Mexico, identifying associated management practices. Methodology. Data from a retrospective longitudinal analysis were used to compare 20 THC and 20 MHC. Technical efficiency (TE) scores were estimated using data envelopment analysis (DEA), quality scores were calculated based on provider competence and patient performance. The relationship between efficiency, quality, and management practices was analyzed using positive deviance regression. Results. DEA analysis indicate higher TE in MHC units (mean score: 65, SD = 19) compared to THC units (mean score: 24, SD = 23). MHC units scored 78.55 (SD = 18.71) in performance score, while THC units scored 37.7 (SD = 18.97). MHC units also outperformed THC units in competence scores (mean: 68.71, SD = 18.31 vs. 49.97, SD = 23.31). Several management practices were associated with best performance in terms of both efficiency and quality strategic thinking, human resource management, financial management, operations management, performance management, and governance. Conclusion. This study highlights the higher efficiency of MHC models in diabetes care compared to THC models in Mexico. However, both models require improvement in quality. Understanding the relationship between management practices, efficiency, and quality can guide policymakers in enhancing diabetes care in low- and middle-income countries.

Keywords Efficiency · Quality · Management · Multidisciplinary care · Diabetes

Sandra G. Sosa-Rubí: Deceased.

Extended author information available on the last page of the article

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1 Introduction

Around 536 million people lived with diabetes worldwide in 2021, and the greatest increase in prevalence in the next 25 years (21%) will occur in middle-income countries (Sun et al. 2022). In Mexico, diabetes is a rapidly growing public health problem (Bello-Chavolla et al. 2017), declared a national emergency by the Mexican government (Secretaría de Salud 2016). The prevalence of this disease has grown 50% in the last three decades, from 6.7% to 1993 to 10.3% in 2018 (INEGI et al. 2018; Olaiz-Fernández et al. 2007; Villalpando et al. 2010). Developing and implementing cost-effective, efficient, and high-quality models based on primary care for individuals with diabetes can improve the management of this condition, ameliorate associated complications, and reduce health system costs (Sosa-Rubí et al. 2020).

To mitigate this epidemic, the Mexican Ministry of Health started implementing multi-disciplinary healthcare (MHC) for uninsured patients with diabetes, as a complement to the traditional model (CENAPRECE: Secretaria de Salud, 2011). Briefly, MHC links patients with diabetes with a team of health professionals (including physicians, nurses, psychologists, nutritionists, social workers, and physical therapists) working together to achieve optimal management (McGill et al. 2017). In contrast to MHC, traditional healthcare (THC) engages physicians and nurses only (CENAPRECE: Secretaría de Salud; Instituto Mexicano del Seguro Social 2014). MHC has been shown to be cost-effective when compared with traditional healthcare models, but only a few studies have been conducted in low-resource settings (Escobar and Arredondo 2019; Siaw et al. 2018; Tao et al. 2015). In Mexico, the average annual cost per patient with type-2 diabetes (T2D) was USD $63.60 for THC and USD $217.88 for MHC; yet taking into account the clinical outcomes (Contreras-Loya et al. 2013), the MHC model was cost-effective in comparison with THC (Sosa-Rubí et al. 2020).

The relationship between cost and quality of MHC and THC is complex and remains poorly understood. The efficiency with which care is delivered may reflect higher or lower quality processes that influence health outcomes (Clement et al. 2008). Earlier research explored the potential endogeneity in this relationship (Gertler and Waldman 1992); other studies, focused on benchmarking, treated efficiency and quality as independent dimensions of performance (Sherman and Zhu 2006). Some aspects of the health system, such as management, organization, and resources work together to impact efficiency of services, quality of care, and health outcomes (Aday and Andersen 1974; Andersen and Newman, 2005). In particular, facility-level management practices can affect the provision of services through a variety of pathways. Staff managers can motivate performance and improve quality through a combination of positive and negative incentives (Kabene et al. 2006). Management can catalyze good performance by optimizing processes through supply chain management and financial planning (Gapenski and Pink 2007).

Several managerial characteristics have been associated with positive health outcomes, such as meetings aimed at supervising and reviewing clinical cases (Bradley 2012), the promotion of an organizational culture that prioritizes leadership, communication, and problem-solving (Shortell et al. 1994), and directors with specialized training (Dorgan et al. 2010). To the best of our knowledge, no studies have examined the management practices of primary health care (PHC) and mobile health care (MHC) models in Mexico in the context of diabetes care. It is worth noting, however, that the presence or absence of certain management practices is subject to various economic, political, and administrative

factors within each unit, ultimately at the discretion of the unit director. Our study defines management practices as the organizational strategies and practices implemented by health personnel to ensure high-quality care. Following Donabedian (2005), we utilized six conceptual dimensions - strategic thinking and problem-solving, human resource management, financial management, operations management, performance management and accountability, governance and leadership - to identify the primary management strategies employed in health services in Mexico.

Several studies have described diabetes service readiness of health systems in low- and middle-income countries (LMICs) (Biswas et al. 2018; Elias et al. 2018; Gabert et al. 2017; Jacobs et al. 2015; Moucheraud 2018; Nuche-Berenguer and Kupfer 2018). Yet, an important gap in the literature is the study of how organizational strategies and management practices may be correlated to efficiency and quality of medical care. Given that primary care is the front-line of diabetes management (Davidson 2010) a and a key piece to achieve universal and effective health coverage (Collet et al. 2011), identifying predictors of diabetes service performance at the level of primary care can help guide policies and steer investment to areas of greatest need of improvement in LMICs. Therefore, in this study, we: (1) determine the efficiency of two different diabetes healthcare models; (2) estimate the levels of quality; and (3) identify the management practices associated with better quality and efficiency of competing models in Mexico, as a relevant case study for diabetes care in LMICs.

2 Methods

We used data from the retrospective longitudinal analysis of the project entitled "Cost-effectiveness analysis of the UNEMES-EC model for multidisciplinary care of patients with type 2 diabetes mellitus" (Sosa-Rubí et al. 2020). Random sampling was carried out to select 40 units: 20 units that provide traditional healthcare (doctor-nurse), and 20 units that offer multidisciplinary healthcare services (doctor, nurse, psychologist, nutritionist and physical trainer).

Our analysis plan was informed by previous related work (Sosa-Rubí et al. 2021); and we conducted our analysis in 4 stages. First, we estimated a technical efficiency score for THC and MHC in relation to patient care using data envelopment analysis (Ramanathan 2003). Second, we calculated the quality score (performance and competence) for each type of model. Third, we mapped the relationship between the efficiency and quality scores, and we studied the managerial determinants of best performance in terms of both efficiency and quality using a positive deviance regression approach (Pascale et al. 2010).

2.1 Main variables

2.1.1 Technical efficiency

We estimated the technical efficiency of the different healthcare models using data envelopment analysis (DEA). DEA is a nonparametric linear programming technique used to measure technical efficiency in a sample of homogeneous decision-making units such as health facilities (Charnes et al. 1978). In such cases, DEA measures the extent to which a healthcare unit achieves a given level of multi-dimensional output relative to its consumption of

multi-dimensional inputs (Sherman and Zhu 2006). Specifically, DEA identifies the most efficient units, and it pinpoints those susceptible to improvement. We calculated efficiency scores in percentage terms, defined as the distance between the efficient and the susceptible units, where 100% means that within the sample, the unit is the most effective; and 0% means that the unit is the least effective (or most susceptible). Therefore, the scores provided an efficiency ranking of healthcare units (Kirigia and Asbu 2013).

We interpreted efficiency as the ratio of outputs to inputs. In a healthcare context, these outputs are frequently measured as a count of patients treated or procedures performed, while inputs commonly refer to money expenditures or staff full-time equivalents (McGlynn and Shekelle 2008). As suggested in the literature, we considered the total number of T2D patients as an output variable (Jacobs et al. 2006). We collected data on costs of medications, staff, equipment, general services and training from previous work, as inputs (Sosa-Rubí et al. 2020).

In the context of healthcare in Mexico, the process of hiring health personnel presents challenges in effecting short- or medium-term changes to the workforce. Consequently, it is deemed more fitting to propose a policy objective that aims to enhance the coverage, accessibility, and quality of services provided to individuals with diabetes, without the intention of reducing resources. The adoption of data envelopment analysis (DEA) output oriented models are employed to optimize results given a set of inputs. Based on the foregoing, we implemented output-oriented DEA model (Banker et al. 1984) (Jacobs et al. 2006).

In order to measure the efficiency of health units regardless of their size or scale of operation, we employ a data envelopment analysis (DEA) model with variable returns to scale. This model acknowledges that efficiency levels may differ depending on the level of production, such that health units may be efficient at certain production levels but not at others. Additionally, models with variable returns to scale provide insight into the relationship between inputs and outputs at varying levels of production, which can facilitate informed decision-making regarding efforts to enhance efficiency across different levels of production.

Thus, the resulting efficiency scores represent the proportional increases in outputs (number of patients with T2D) that each healthcare unit could achieve using the same level of inputs (at the same costs) if it were at the frontier of efficient production. The model was as follows:

$$\theta_n = \max \sum_{j=1}^{q} u_{jn} y_{jn} - w_n, \forall n \epsilon \left\{ 1,2,\ldots,k \right\} \tag{1}$$

$$s.t. \sum_{i=1}^{r} v_{in} x_{in} \leq 1$$

$$\sum_{j=1}^{q} u_{jn} y_{jn} - w_n - \sum_{i=1}^{r} v_{in} x_{in} \geq 0, \forall n \epsilon \left\{ 1,2,\ldots,k \right\}$$

$$u_{jn} \geq 0, v_{in} \geq 0 \forall i \epsilon \left\{ 1,2,\ldots,r \right\}; \forall j \epsilon \left\{ 1,2,\ldots,q \right\}.$$

$$w_n \in \mathbb{R}$$

where θ_n is the technical efficiency score of the nth unit; u_{jn} and v_{in} are the relative weights of the ith input and the jth product of the nth unit. The values of outputs (y_{jn}) and inputs (x_{in}) are constrained to be positive or equal to zero; and u and v are positive vectors. The sum of inputs is normalized to the unit. Lastly, the term w_n indicated the returns to scale. We found efficiency scores that identified the best practice frontier by solving the optimization problem presented in Eq. (1). We used bootstrapping due to the deterministic nature of the DEA method, and the fact that the distribution of the estimators of interest was unknown (Banker, 1996; Simar and Wilson 2007). The resampling was generated using an estimate of the data generating process (Löthgren and Tambour 1996). We used R software for all DEA analyses (Bogetoft and Otto 2011).

2.2 Quality of care

We computed two indices to measure quality of care at the facility level – both of which were measures of process quality (Das and Gertler 2007). First, to measure the physicians' ability to manage patient care, we calculated a provider competence index based on responses to vignette instruments (Das and Hammer 2005). We used this method to assess the extent to which providers followed existing national guidelines to screening and treating diabetes patients. We selected providers for each different healthcare model. The vignettes presented respondents with hypothetical scenarios describing typical diabetes patients. Each respondent was then asked a series of questions on how they would deal with the clients in these hypothetical scenarios. This method allowed us to measure the gap between the procedures that should be followed, according to the national guidelines, and the procedures that the medical staff mentioned they would perform in a hypothetical case (see details about these vignettes in Appendix Table A1).

Second, and following previous studies (Rannan-Eliya et al. 2015) we estimated a provider performance index based on responses to patient exit interviews. The exit interview module was directed at randomly selected diabetes patients at each facility. The exit interviews were designed to collect information on the process quality of the visit from the perspective of the patient, following the same structure and including the same components as the provider vignettes (see details about these exit interviews in Appendix Table A2). This quality indicator allowed us to measure the gap between all medical procedures that patients should have received during their visit to the health facility, based on what the national guidelines recommend, and what the patients actually received during their visit (Hutchinson et al. 2011). We used principal component analysis (Rencher 2003) to construct provider competence and provider performance indices from the responses to the provider vignettes and patient exit interviews (Jolliffe 2002). We retained the first principal component of each measure and rescaled it to be bounded between zero and one hundred. We confirmed the viability and relevance of the index through different statistical tests (Appendix Table A3). For all quality analyses we used STATA software version 15 (StataCorp 2017).

2.3 Best performance

Based on the technical efficiency and quality of care metrics, we graphically displayed the bias corrected efficiency scores against our two quality scores (performance and competence). We identified the healthcare units with the best performance in diabetes care as

those located in the upper right-hand quadrants: High Efficiency and High Performance (HE & HP), and the High Efficiency and High Competence (HE & HC). In each analysis, we defined "high performance" as performance above the median for all healthcare facilities.

2.4 Management practice covariates

We derived the management variables from responses to questions on facility-level management practices. The managerial processes were used as predictors of the differences between the healthcare models. Indirect predictors of the quality of care were measured through proxy questions on key dimensions, based on the literature (Bradley et al. 2015; Sosa-Rubí et al. 2021). The management variables were dichotomous and the proportions of each variable were taken into account for both care models. We include: (a) existence of evening shift; (b) state supervision of patient care; (c) modifications to treatment due to shortage of medicines; (d) learning management practices through courses by the state; (e) medical license review; (f) state supervision of diabetes-related services; (g) rotation by services or offices among staff; and (h) staff performance evaluation. (Appendix table A4 and table A5).

2.5 Analysis

We identified management characteristics associated with an increase in the probability (Y) of the nth health facility being classified in the high quadrants described above, (HE & HP) or (HE & HC), as follows:

$$Pr\left(Y_n = y | X_n\right) = X_n\beta + \epsilon_n \tag{4}$$

where X_n includes binary and count variables that characterize management practices described above.

3 Results

Table 1 shows the means, medians and standard deviations of the output and five input variables, by type of diabetes healthcare unit, and the associated mean difference significance. The output, number of patients with diabetes cared for, differed significantly by type of unit, with traditional care serving more patients (on average 2296.45) compared to multidisciplinary care (on average 433.05). On the other hand, in terms of inputs, all the cost variables, with the exception of training, were significantly different by type of healthcare unit. Specifically, the cost of staff exhibited the most differences, with an average of USD $152.3 for MHC and $52.1 for THC. The equipment cost averaged $46.7 for MHC and $5.3 for THC. Average cost of medicines was $12.4 for MHC and $1.2 for THC. Average cost in utilities was $6.2 for MHC compared to $4.8 for THC. Finally, the average cost of training for MHC was $0.3 and for THC it was $ 0.2; the difference was not statistically significant.

Figure 1 shows that efficiency was higher in multidisciplinary diabetes healthcare units. The bias-corrected efficiency density graph exhibits a greater difference between traditional and multidisciplinary healthcare. Regarding the efficiency score, the average of THC units was 42, with a median of 17 and a standard deviation of 42. For MHC units, the average

Table 1 Main variables at the facility level: inputs and outputs for diabetes care

	All (n=40)			Multidisciplinary health-care (n=20)			Traditional healthcare (n=20)			*p-value*
	Mean	Median	Sd	Mean	Median	Sd	Mean	Median	Sd	
OUTPUT										
Number of patients with diabetes	1364.8	541.5	2906.8	433.1	442.5	168.9	2296.5	966.5	3935.5	<0.001
INPUTS Unit cost ($ dolars)										
Staff	102.2	77.3	112.3	152.3	122.9	130.1	52.1	34.4	60.7	<0.001
Equipment	26.0	1.1	68.7	46.7	2.8	92.1	5.3	0.7	17.0	<0.001
Drugs	6.8	2.3	10.1	12.4	9.4	11.7	1.2	0.3	2.1	<0.001
Utilities	5.5	4.2	4.9	6.2	4.7	4.6	4.8	3.3	5.2	<0.001
Training	0.2	0.0	0.6	0.3	0.0	0.9	0.2	0.0	0.3	0.28

Note: The table presents inputs and outputs for 40 diabetes healthcare facilities: 20 providing multidisciplinary healthcare (MHC) and 20 providing traditional healthcare (THC). The last column tests the differences between MHC and THC with statistical significance level<0.05. *Mann–Whitney–Wilcoxon tests for continuous variables. Exchange rate: 1 US$ =18.89 MXN (Bank of Mexico, 2019). Staff: health-care employees who had contact with T2D patients, namely general practitioners, medical specialists, nurses, nurse specialists, administrative employees, psychologists, nutritionists and physical therapists. Utilities includes all services provided including water, gas, electricity and telephone. Medicines included: Metformin, Fast-acting and Intermediate Insulin, Lispro, Glargine, Acarbose and Linagliptin. Equipment included: Cobas equipment, impedance cardiogram equipment, microalbumin equipment, centrifuge, weighing machine, examination tables, electro-cardiogram, glucometer and clinical devices. Training: workshops, courses and other activities related to the care of patients with T2D
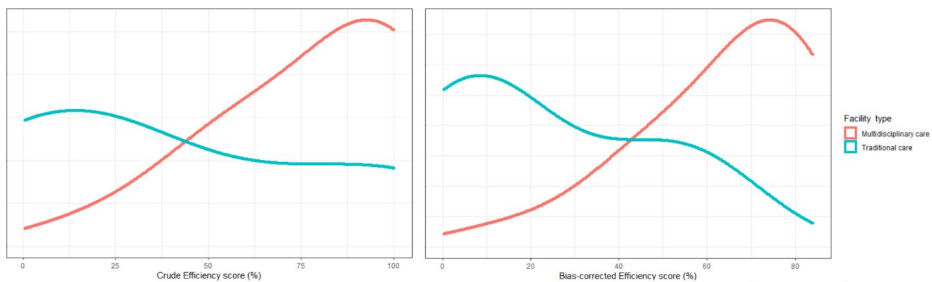

Fig. 1 Distribution of bias-corrected technical efficiency scores by type of diabetes healthcare facility
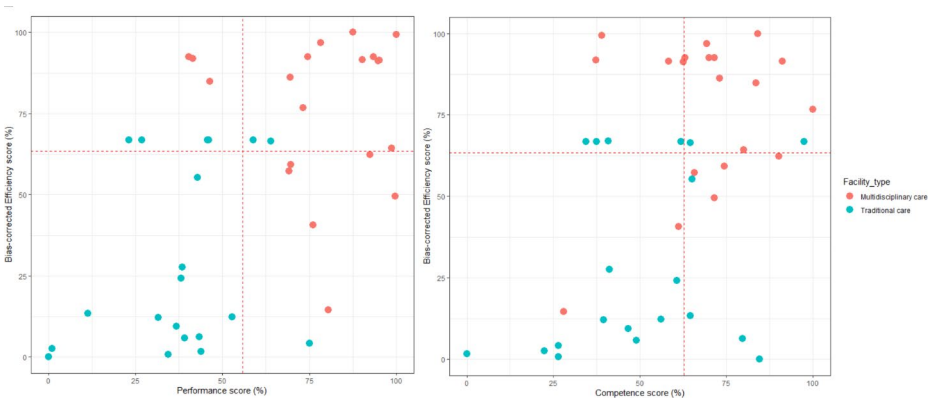
was 78, with a median of 88 and a standard deviation of 25. For the bias-corrected efficiency score, the mean for THC was 24, with a median of 10 and a standard deviation of 23. On the other hand, for MHC units, the mean of the bias-corrected efficiency score was 65, with a median of 74 and a standard deviation of 19. The bias size (difference between the mean of the bias-corrected score and the raw score) for the THC units was − 18, and for the MHC units it was − 14.

Figure 2 shows the distributions of performance and competence scores, in descending order, for the two types of healthcare units. In the performance scores, the majority of units above 50 points were MHC (of the 21 units above 50 points, 17 were MHC). On the other hand, in the competence scores, there was a more homogeneous distribution between the MHC and THC units (of the 26 units above 50 points, 17 were MHC). The mean MHC
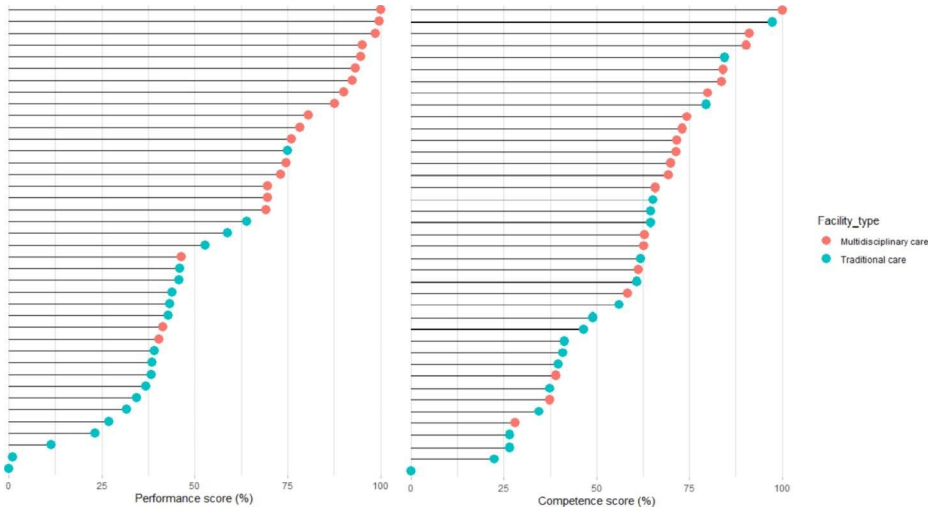
Fig. 2 Distribution of performance and competence score by type of healthcare facility

Fig. 3 Correlation between bias-corrected efficiency score and performance score

performance score was 78.55 with a median of 79.43 and a standard deviation of 18.71. Meanwhile, THC had a mean of 37.7, with a median of 38.83 and a standard deviation of 18.97. For competence score, the MHC units had a mean of 68.71 with a median of 70.77 and a standard deviation of 18.31; THC units, on the other hand, had a mean of 49.97 with a median of 47.78 and a standard deviation of 23.31.

Figure 3 shows the correlations between the bias-corrected efficiency and the performance and competence scores. For both performance and competence scores, MHC units were mostly located in the upper right quadrants (that is, HE & HP as well as HE & HC). Specifically, 55% of the MHC units, versus only three (15%) THC units, were located in HE & HP quadrant. On the other hand, 50% of the MHC units were located in the HE & HC quadrant, but only two (10%) of the THC units were located in this quadrant.

Table 2 shows results from a linear probability regression model. It presents two separate models with the marginal changes in the probability of belonging to the HE & HP or the HE & HC quadrants. The first model examined the management practices associated with the likelihood of being in the best-performing group of facilities (HE & HC). It showed that state supervision of patient care, learning management practices through courses by the state, rotation by services or offices among staff, and state supervision of diabetes related services were all significant determinant for HE & HC. The state supervision of patient care decreased the probability that a unit would be categorized as HE & HC by 37% points (p.p.). Learning management practices through courses by the state increased the probability that a unit belonged to the HE & HC group by 42 p.p. State supervision of diabetes-related services increased the probability that a unit would be in this group by 28 p.p. Finally, rotation by services or offices among staff decreased the probability that a unit would be categorized as HE & HC by 43 p.p. The second model examined the management practices associated with the likelihood of being in the best-performing group of facilities (HE & HP). Medical license reviews significantly increased the probability that a unit will be in the HE & HP category by 29 p.p. Conversely, rotation by services or offices among staff significantly lowered the likelihood of falling into this category by 46 p.p.

Table 2 Results from a linear probability regression model

Management practices	HE & HC (1)	HE & HP (2)
Existence of evening shift	0.1710	0.0308
	[-0.159–0.501]	[-0.313–0.3749]
State supervision of patient care	-0.3732*	-0.137
	[-0.678 - -0.079]	[-0.569–0.294]
Modifications to treatment due to shortages of medicines	-0.1004	-0.388
	[-0.493–0.292]	[-0.893–0.117]
Learning management practices through courses by the state	0.4245*	0.2433
	[0.071–0.777]	[-0.133–0.620]
Medical license review	0.1138	0.2907+
	[-0.181–0.409]	[-0.0213–0.602]
State supervision of diabetes-related services	0.2826+	0.0983
	[-0.064–0.636]	[-0.310–0.507]
Rotation by services or offices among staff	-0.4340*	-0.4625*
	[-0.781 - -0.086]	[-0.847 - -0.078]
Staff performance evaluation	-0.0587	0.1393
	[-0.329–0.446]	[-0.204–1.177]
Observations	40	40
R-squared	0.386	0.323

Notes: The table presents coefficients from linear probability models where the dependent variable is an indicator of whether the healthcare unit was classified as high efficiency and high competence in column (1), or as high efficiency and high performance in column (2). HE & HC=High efficiency & High Competence; HE & HP=High Efficiency & High Performance. 95% confidence intervals in brackets, ** $p<0.01$, * $p<0.05$, + $p<0.10$

4 Discussion

We found the efficiency in multidisciplinary healthcare units was higher than in traditional healthcare units. In particular, THC units scored very low in terms of efficiency. Likewise, regarding the different quality metrics, MHC units were much better evaluated than THC units. Nevertheless, both in terms of efficiency and quality, MHC units achieved levels below 70%, which is worrying. We found important differences in both quality scores for the different healthcare models. For example, the mean performance score for the MHC units was 68%, while for the THC it was 50%. In contrast, the competence score in MHC was 78% while in THC units it was 38%. This indicates that patients have a really much better perception for MHC than for THC units. However, when we evaluate the competencies of the clinical staff for each type of healthcare, the differences are much smaller, although in general terms the scores remain low for the two models of care. These levels of efficiency and quality of care are consistent with those found in other studies (Codispoti et al. 2004; Tan et al. 2020), where they find greater efficiency and quality in multidisciplinary teams compared to traditional teams in the context of caring for diabetic patients.

When mapping the technical efficiency scores with the different quality scores, we found just over two-thirds of the mapped MHC units in the best-performing group (i.e., efficiency above the median, and performance above the median), and almost half of them were mapped in the high competence quadrant. On the other hand, only 10% of the THC units manage to position themselves in the best performance quadrant, under any quality metric.

The results of our analysis of managerial characteristics help explain some of the variation in service delivery performance for diabetes care. Some managerial characteristics are positively correlated with the probability of belonging to the highest performing group (HE & HC); and there are other characteristics that reduce the probability of belonging to this high performing group. For example, we find that, units with learning management practices through courses, medical license review, and state oversight of diabetes-related services increased the likelihood of being in the best performing group. Whereas, state supervision of patient care and staff rotation decreased the probability of a unit belonging to the highest performing group. Similarly, managerial characteristics that decreased the probability of belonging to the highest performing group (HE & HP) included: medical license review and staff rotation. The reason why only two characteristics turned out to be significant under the performance score may be because we measure quality through the patients' perspective, so it is a subjective metric; and management processes may not translate directly to patient satisfaction.

4.1 Strengths and limitations

The most relevant result of this study is the relationship of some managerial characteristics with the quality of care for patients with diabetes. We found that there are managerial characteristics that differently affect the two models of diabetes care (MHC & THC), and that have a specific impact on the efficiency and quality of diabetes care. Our study is consistent with the previous literature that has studied the relationship between managerial characteristics and quality in healthcare (Bradley 2012; Dorgan et al. 2010; Shortell et al. 1994). Likewise, our study reports for the first time on the management processes and practices that influence the performance of the multidisciplinary care model, and more specifically

the quality and efficiency of diabetes care in Mexico. Moreover, our study contributes to literature by providing novel evidence on the relationship of management processes in two types of care models (MHC vs. THC) for patients with diabetes. It does so measuring efficiency and quality of care through scores built from managerial characteristics (Bloom et al. 2009; McConnell et al. 2014, 2016). Identifying these characteristics (which were distinctive between MHC and THC) can help administrators, clinicians, policy- and decision-makers understand the types of organizational changes that are feasible in healthcare units and that could benefit healthcare and management practices to improve care for patients with diabetes (Conron and Denton 2016; Reiss-Brennan et al. 2016; Wranik et al. 2019).

Among the limitations of the study, we highlight the relatively small size of the sample, which limits the exploration of intermediate effects, as well as the heterogeneity of the relationships found through stratification. When the effect of the management variables was analyzed with the performance score, only two variables were statistically significant. The workload and the density of patients who attend the THC units could be affecting patient satisfaction, and the perspectives they have on the processes carried out. To find variables that are significantly related to performance scores, subsequent studies should focus on factors that influence access to medical procedures and laboratory tests, as well as patients' knowledge and disease self-management. In general, managerial aspects do not seem to modify patients' knowledge and self-management of the disease, yet some managerial characteristics do have an important influence on the quality of care.

5 Conclusion

Our findings indicate that multidisciplinary healthcare provides better performance for patients with diabetes compared to traditional healthcare. We found important differences in technical efficiency and in quality measured through competence and performance scores. In general, there is a substantial opportunity to improve efficiency and quality levels. The traditional healthcare model, in particular, could have substantial improvement since fewer than three units were in a best performing group, in either of the two best-performing groups built. In addition, several management practices are associated with the best performance in terms of efficiency and quality for both models of care. Namely, review of medical licenses is associated with better levels of efficiency and quality in either of the two metrics analyzed. Likewise, staff rotation is a characteristic that under any quality metric affects the performance of health units. As the federal government joins efforts with local and state governments to improve the delivery of diabetes care services, it is critical that they understand the relationship between management characteristics and efficiency and quality, so that they can identify practices to improve performance in Mexico. This experience can be informative in other similar LMIC settings.

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Declarations

Competing interests The authors declare no competing interests.

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Authors and Affiliations

Carlos Chivardi[1] · Alejandro Zamudio Sosa[2] · Omar Galárraga[3] · Sandra G. Sosa-Rubí[4]

✉ Carlos Chivardi
carlos.chivardi@york.ac.uk

[1] Center for Health Economics (CHE), University of York, York, UK

[2] School of Psychology, National Autonomous University of Mexico (UNAM), Mexico City, Mexico

[3] Department of Health Services, Policy and Practice; and International Health Institute, Brown University School of Public Health, Providence, RI, USA

[4] Health Economics Division, National Institute of Public Health (INSP), Cuernavaca, Mexico