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Measurement of Quality Improvement in Family Practice over Two-year Period Using Electronic Database Quality Indicators: Retrospective Cohort Study from Israel

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Aim To investigate the associations between family physicians' characteristics and the change in quality of health care indicators (QI) over a two-year period.

Methods The retrospective cohort study included 161 (60.5%) of 266 family physicians who worked for the Clalit health fund in Israel in the period from January 2003 until December 2005. Family physicians' background characteristics included seniority, location of the clinic (urban or rural), workload, sex, managerial responsibilities, and board certification. The performance in 11 QIs, including indicators of diabetes follow-up (n=4) and control (n=2), hospitalization for chronic obstructive pulmonary disease and congestive heart failure (n=2), and preventive medicine measures (influenza immunization for high risk patients and mammography) was evaluated at the end of 2003 and 2005.

Results There was an improvement in all the QIs except mammography. The improvement was significant for 8/10 QIs, the greatest being in achieving low-density lipoprotein cholesterol (+18.2%) and HbA1c (+5.9%) targets in diabetic patients. Multivariate regression model showed that the most significant factor associated with better QIs in December 2003 was board certification, while 2 years later it was female sex and having a managerial position. Being a board-certified physician remained positively associated with high QIs for diabetes control.

Conclusion There was an improvement in most QIs in the period of 2 years. Initially, board certification was significantly associated with high QIs, but clinic managers and female physicians showed the ability to improve their scores. Research should continue to find ways to make all physicians responsive to their QIs.

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The use of quality of health care indicators (QI) has become increasingly common since the 1990s. Several factors have led to an increased interest in this method of assessment. Evidence based medicine allowed the best methods of treatment to be evaluated (1), while at the same time it acknowledged the variance in patient care (2). Social changes gave patients the right to question their health status, the quality of care they receive, or the performance of health care providers (3). In addition, health care providers and governments wanted to evaluate the services they paid for and find ways of improving the quality of health care. This all incited health service providers throughout the world – such as National Health Services in the UK (4) and the Health Plan Employer Data Information Set (HEDIS) (5), to start measuring QIs.

Clalit Health Services (CHS), the largest health fund in Israel, began to measure QIs in 2001. The aim was to allow managers, physicians, and clinics to compare their performance among themselves and with targets set by the health fund and then to work on improving areas where they performed poorly (6). In March 2004, the Health Ministry in Israel published the first report on a national health care improvement project, using QIs as its basis. The data were collected from all 4 health care providers in Israel, covering the population of the entire state. The results from 2001-2003 showed a clear improvement in all the QIs. In 2004, the trend continued to be positive, although the improvement in some of the indicators was slow (7). It has to be noted that in Israel, unlike the UK, there is no monetary incentive for physicians to improve their quality of health care scores.

The aim of this study was to identify primary care physicians' (PCP) characteristics associated with their QI scores over 2 years.

METHODS

The study was conducted in the Central District primary care clinics of CHS. CHS is the largest health maintenance organization in Israel, covering more than 50% of Israel's population, with over 70% of the elderly patients (65 years and above) (8). The average income of persons insured by CHS is lower than of those insured by other large health funds. CHS has a nationwide framework consisting of 8 districts; the Central district population is representative of the CHS's overall population according to its socio-demographic characteristics (unpublished data). Every person insured by CHS is allocated to a PCP, either a family physician or a pediatrician. Patients only visit the PCP to whom they are allocated (except when their physician is on vacation, when patients are out of town, or in cases of emergency). For each visit to a different PCP, a special administrative certificate of approval is needed and the peer physician is instructed to give only "first aid."

The present study covered 161 (60.5%) of 266 PCPs employed in the Central District, who worked in the same clinic throughout the study period from January 2003 or before and throughout 2004-2005. Pediatricians, specialists in internal medicine and in geriatrics (due to their small number as primary care physicians), group practices (where physicians do not have individual patient lists), PCPs not working exclusively with CHS (due to inconsistent infrastructure in their clinics), and PCPs treating fewer than 300 patients (due to the expected small number of patients in the denominator of the QIs) were excluded.

PCPs' background data: age, sex, board certification in family medicine, managerial position held in clinic (medical manager or not), years in practice, and clinic location (urban or rural), were derived from the employment and administrative database of the district. The age-adjusted number of patients allocated to each PCP was taken from the health maintenance organization registry. Of the 266 PCPs in CHS central district, 161 qualified for the study.

The visit to a PCP in CHS is free of charge. Since we did not know the time spent with each patient or the number of PCP visits, we used the age-adjusted number of patients as a marker of the PCP's workload. The age-adjusted number of patients allocated to each PCP was calculated according to the number of allocated patients, age distribution, and the capitation formula of the National Insurance Institute of Israel, which gives a different weight for each age group according to its utilization of health services (9).

The QIs for each PCP were measured at the end of 2003 and the end of 2005, based on the CHS computerized database for QIs. All QIs that were measured by CHS at both time periods were included in the study. The QIs were classified into 3 main sub groups: follow-up of the chronic patient, control of the chronic patient, and preventive care.

Follow up of the chronic patients included:

1. Diabetic eye examination – the percentage of diabetic patients who had an eye test at an eye clinic at least once in the previous year.

2. HbA_1c measurement in the diabetic patient – the percentage of diabetes patients with an HbA_1c measurement at least once in the previous year. This definition is based on the minimum frequency for testing.

3. Urine microalbumin measurement in the diabetic patient – the percentage of diabetic patients who had a urine microalbumin or albumin test at least once in the previous year.

4. Low density lipoprotein (LDL) measurement in the diabetic patient – the percentage of diabetic patients who had at least one LDL measurement in the previous year.

Control of chronic disease:

5. Target HbA_1c measurement in the diabetic patient – the percentage of diabetic patients with HbA_1c lower than 7% on the most recent test in the measurement year.

6. Target LDL measurement in the diabetic patient – the percentage of diabetes patients with LDL cholesterol levels in the minimal range of below 100 mg/dL on the most recent test in the measurement year.

7. Admissions of chronic obstructive pulmonary disease patients – the percentage of patients with chronic obstructive pulmonary disease admitted in the last year to internal medicine, acute geriatric, and intensive care wards.

8. Admissions of congestive heart failure patients – the percentage of patients with congestive heart failure admitted in the last year to internal medicine, acute geriatric, and intensive care wards.

9. Repeat admissions of congestive heart failure patients – the percentage of patients with congestive heart failure admitted in the last year more than once to internal medicine, acute geriatric, and intensive care wards.

Preventive medicine:

10. Mammography – the percentage of women aged 52-74 who had at least 1 mammography screening in the course of the past 2 years.

11. Influenza immunizations – the percentage of high risk patients immunized for influenza (7).

Calculation of performance

The scales of performance in each QI were different (Table 1). The performance of each physician on each QI was ranked and then divided into quartiles. According to the quartile, the physicians' performance was ranked as 1 for those with QI performance score in the first quartile, 2 for the second, 3 for the third, and 4 for the fourth quartile.

Total score was the total of new quartile ranks for all QIs together. Diabetes score was the sum of quartile ranks for QI 1-6, diabetes patient control score was the sum of quartile ranks for QI 5 and 6, admissions score was the sum of quar-

TABLE 1. Comparison of primary care physicians (n=161) performance indicators in 2003 and 2005*

Quality indicator	% patients (mean+/- standard deviation) 2003	2005	Change in performance 2003-2005 (%, 95% confidence interval)	*P*†
Tests performed in diabetes mellitus:				
Fundus examination	55.1 ± 11.4	59.6 ± 9.1	4.5 (2.7-6.2)	<0.001
HbA1	82.7 ± 8.8	87.0 ± 6.5	4.3 (3.0-5.5)	<0.001
Microalbumin	65.5 ± 16.1	72.8 ± 12.7	7.3 (4.9-9.6)	<0.001
LDL cholesterol	81.0 ± 10.1	84.7 ± 9.6	3.7 (2.1-5.4)	<0.001
Diabetic control (percentage of patients with diabetes mellitus):				
HbA1C<7 mg%	38.2 ± 9.4	44.1 ± 8.6	5.9 (4.4-7.4)	<0.001
LDL<100 mg/dL	31.5 ± 9.4	49.7 ± 10.7	18.2 (16.7-19.7)	<0.001
Percentage of known COPD patients admitted to hospital	9.0 ± 5.6	6.8 ± 5.2	-2.2 (-1.3 to -3.1)	<0.001
Percentage of known CHF patients admitted to hospital	25.9 ± 15.6	23.6 ± 14.2	-2.3 (-0.9-5.4)	0.190
Percentage of known CHF patients with repeat admissions to hospital	4.8 ± 5.8	4.0 ± 4.9	-0.8 (-0.4-2.0)	0.141
Percentage of high risk patients immunized for influenza	38.2 ± 9.7	43.4 ± 11.8	5.2 (3.5-6.9)	<0.001
Percentage of women (52-74 y) undergoing mammography	58.3 ± 13.1	56.8 ± 11.6	-1.5% (-0.3 to -2.7)‡	0.018

*Abbreviations: LDL – low density lipoprotein; COPD – chronic obstructive pulmonary disease; CHF – congestive heart failure.
†Paired *t*-test.
‡Performance deteriorated.

tile ranks for QI 7-9, and preventive medicine score was the sum of quartile ranks for QI 10 and 11.

Statistical analysis

The data were analyzed using SPSS for Windows, version 13.0 (SPSS Inc., Chicago, IL, USA). The continuous PCPs' background variables had normal distribution (age, years in practice, number of patients on list) (Table 2). The paired ***t***-test was used for testing the change of PCPs' QI scores between 2003 and 2005.

The QIs, total score, diabetes scores, admission score, and preventive medicine score had normal distributions. The association between the PCPs' background data and their QI scores was examined using a multivariate linear regression model. The model was generated to examine the effect of independent background and clinic variables on QI scores. Variables that were found to be insignificant, such as work experience and age, were not included in the final regression model. There was no co-linearity between the other variables in the model. QI scores were treated as continuous variables. A *P* level of 0.05 was considered significant.

RESULTS

Demographic and professional characteristics of the PCPs included in the study are summarized in Table 2. Most of the PCPs worked in an urban setting (90.7%) and did not have managerial responsibilities (82.0%).

In the period between 2 measurements, there was an improvement in all the QIs, except mammography (Table 1). This improvement was significant for all the QIs, except admissions and repeated admissions of patients with congestive heart failure.

At the beginning of the study, board-certified PCPs showed significantly better results in the overall QI score and the overall score for diabetes care and control (Table 3). Preventive medicine scores were significantly better for PCPs working in rural clinics, larger clinics, and for those with managerial responsibilities.

Table 4 shows the associations between PCPs' characteristics and their QI scores after 2 years. Characteristics associated with good scores were sex (female physicians performing better) and having a management role at the

TABLE 2. Demographic and professional characteristics of primary care physicians

	All (n = 161)	Male physicians (n = 77)	Female physicians (n = 84)	*P*
Age (mean ± standard deviation)	51.2 ± 7.8	50.6 ± 8.2	51.9 ± 7.4	NS*
Years in practice (mean ± standard deviation)	20.8 ± 9.2	19.8 ± 9.1	21.8 ± 9.3	NS
Number of patients (age-adjusted) on list (mean ± standard deviation)	1742.1 ± 605.5	1696.9 ± 626.6	1783.6 ± 586.1	NS
Managerial position (%)	18.0	20.8	15.5	NS
Practice (urban, %)	90.7	84.4	96.4	<0.05
Board-certified in family medicine (%)	45.3	46.8	44.0	NS

*Not significant.

TABLE 3. Multivariate regression coefficient for primary care physicians' characteristics and performance in quality of care indicators 2003

	Total	Diabetic care	Diabetic control	Hospitalization of chronic patients	Preventive medicine
N	159	160	160	159	160
R^2	0.085	0.068	0.071	0.057	0.160
Significance of model	<0.050	<0.050	<0.050	0.100	<0.001
Sex (female > male)	0.166*	0.141	0.151	0.073	0.115
Managerial responsibilities (manager > others)	0.133	0.108	0.037	-0.000	0.195*
Location (rural > urban)	0.135	-0.014	0.152	0.022	0.379†
Number of patients	0.015	0.041	0.042	-0.180*	0.227†
Board certification (board-certified > non certified)	0.181*	0.185*	0.196*	0.108	0.040

*The regression coefficient was significant at $P < 0.05$.
†The regression coefficient was significant at $P < 0.01$.

TABLE 4. Multivariate regression coefficient for primary care physicians' characteristics and performance in quality of care indicators 2005

	Total	Diabetic care	Diabetic control	Hospitalization of chronic patients	Preventive medicine
N	155	160	160	159	156
R^2	0.107	0.066	0.154	0.054	0.182
Significance of model	<0.01	0.058	<0.001	0.128	<0.001
Sex (female > male)	0.243*	0.145	0.163†	0.195†	0.199†
Managerial responsibilities (manager > others)	0.186†	0.155	0.079	0.019	0.222*
Location (rural > urban)	0.139	0.024	0.024	0.060	0.405*
Number of patients	0.037	0.066	0.065	-0.084	0.079
Board certification (board-certified > non certified	0.126	0.129	0.348*	0.067	0.046

*The regression coefficient is significant at $P < 0.01$.
†The regression coefficient is significant at $P < 0.05$.

clinic. At the end of the study, only board certification remained associated with improved diabetic control. Working in rural clinics remained significant only in preventive medicine scores.

The number of years in practice and age were not associated with the QIs and were therefore removed from the regression model.

DISCUSSION

We found a significant improvement in 8 out of 11 QIs in two-year period for primary care physicians in Israel. In the UK, Sutton et al (10) evaluated the changes in physicians' performance after the initiation of the innovative pay-for-performance scheme for general practices in 2004. They found significant improvement in the annual rates of recording of blood pressure, smoking status, cholesterol, body mass index, and alcohol consumption. Moreover, provider responses were greater for those indicators for which more stringent standards were set and greater rewards offered. They concluded that financial incentives could improve performance. As opposed to the UK, our health maintenance organization seems to have found ways to motivate physicians without direct pay for performance.

In the first period evaluated (December 2003), the factor that was most strongly associated with high QI scores was board certification. Two years later (December 2005), the difference between board-certified physicians and other PCPs was only significant for diabetes control. Tamblyn et al (11) examined the association between licensing examination scores and aspects of quality of care in primary care practice. They found that physicians with higher scores prescribed more disease-specific medications relative to symptom-relief medications and referred more women aged 50 to 69 years for mammography screening.

It appears that the QI program led to a reduction of the gap between board-certified and non-board certified physicians was the result of poorer skills and knowledge among non-board-certified PCPs (12).

At the end of the study, the PCPs with managerial responsibility had significantly better total QI scores than those with no managerial responsibilities. This is probably because PCPs with managerial responsibility are given frequent updates on their own and their clinic's performance and are stimulated to improve their quality of care indicator measures. However, they have been less successful in demonstrating the importance of these measures to other PCP's among their staff.

After 2 years, female physicians improved their QIs scores and performed better than male physicians in the total QI score, as well as in preventive medicine, hospitalization of chronic patients, and diabetes control QIs. Female physicians' retained its significance in multivariate analysis, so it is unlikely to be explained by smaller patient lists. Since we did not measure the actual global workload of the physicians, it is possible that female PCPs do less work in addition to their main salaried position than their male counterparts. It is interesting that in a previous study (13) we found that female PCPs sent more laboratory tests than male PCPs. This is similar to the results by Franks et al (14), who found that female physicians made more referrals often than male physicians. It is possible that such increased use of laboratory tests or referrals is translat-

ed into improvement in QIs. The difference between male and female PCPs' QIs and its underlying reasons require additional research.

Ashworth et al (12) evaluated the relationship between general practice characteristics and quality of care in the UK Quality and Outcomes Framework (QOF). Three characteristics were independently associated with higher QOF scores: training practices, group practices, and practices in less socially deprived areas. We found a significant difference in QIs between individual physicians, while Campbell et al (15) found it between clinics. The size of the physicians list had a negligible effect on the QIs in our study, which may be due to teamwork and work practices among the clinic staff (16).

During the two-year study period, many interventions were made by the management of CHS to improve QIs. Our study is unable to distinguish between improvements made due to managerial interventions and physicians' individual initiatives. This presents a limitation in every quality improvement program, as interventions are not blind and there are no control groups. A second limitation, both of the study and of the evaluation of quality improvement programs in general, is that we do not know if the improvements in QIs were made at the expense of overuse of laboratory investigations or paying less attention to other patients and treatments.

The main strengths of the study are the large number of PCPs included in the study and the fact that they were treating the same patients in the same clinics throughout the study period.

In conclusion, it is encouraging to see the overall improvement in most of the quality of care indicators that were measured. While clearly they represent only some of the factors that make up true quality of care, this improvement should not be belittled. Previous studies have found variability in QI scores among clinics. We found that changes in QI scores were associated with PCP's characteristics, the most significant being managerial responsibilities and sex. To achieve continued improvement in QI scores, all PCPs should take responsibility for their QI scores as those with managerial role have done.

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