Does starting an electronic medical record (EMR) affect family physicians' billings or payments?

BACKGROUND

Canadian primary care physicians lag in the adoption of information technology, ranking last out of eleven industrialized countries in their use of electronic medical records (EMRs).[1] Several barriers to the adoption of EMRs within primary care have been identified including confusion with the array of products available in the market, lack of expertise with EMR, security and privacy concerns, costs of implementation, impact of work flow and loss of productivity.[2-5] Some of these barriers have been addressed through programs such as OntarioMD, where financial support and coaching is provided to physicians to assist with converting from paper charts/records to EMRs.[6]

Converting paper records into to an EMR requires additional non-clinical work for family physicians (FPs) and their staff.[4,5] However, the impact of starting an EMR on productivity and income has been examined in very few studies. A case study using qualitative data for an electronic health record (EHR) implementation in California found the costs of EHR were recovered by a practice within about 2.5 years after implementation after which they continued to see improvements in their clinic profits.[7] Another American study which measured the

effect of EHR implementation by examining episodic treatment groups based on case-mix adjusted payments to providers found no impact on short-term cost per episode.[8] While concern persists that starting an EMR will affect productivity and potentially income, no studies have evaluated changes in billings or physician income related to starting an EMR in Canada.

For many FPs in Ontario EMR adoption coincided with primary care reform.[9] In the past decade, the Ontario Ministry of Health and Long Term Care (MOHLTC) introduced a number of new primary care enrolment models starting with Family Health Networks (FHNs) which include a base payment per patient for the provision of comprehensive care (capitation) plus incentives, premiums and bonuses for preventive care and some chronic disease management.[10] Family Health Groups (FHGs) were then introduced and they are an enhanced fee-for-service model. The FHGs offer fee-for-service (FFS) payments plus bonuses and incentives for achieving targets, such as the proportion of patients receiving preventive care. Family Health Organization (FHOs) were developed later also based on capitation based physician payments. Finally Family Health Teams (FHTs) were funded which expanded interdisciplinary care within a family practice. The introduction of these new payment models has had a significant impact on FP incomes since 2005.[11]

We wanted to examine changes to FP's billings and payments after they started their EMR. However, both primary care delivery model change and starting an EMR have the potential to impact FP billings. Therefore, our overall objectives were to separately examine the impact of primary care model change versus starting an EMR on FP billings and payments.

METHODS

We conducted a retrospective before and after study of FP office visit billings and payments using the date they started using the EMR or the date they changed from a fee-for-service (FFS) type payment model, (traditional FFS or FHG) to a capitation-based model (FHN, FHO, FHT) as the index dates.

The Electronic Medical Record Administrative data Linked Database (EMRALD)

The EMR-related information used in this study came from a linkage of EMR data from enrolled physicians to Ontario health administrative data (EMRALD).[12] EMRALD was developed using a mechanism to extract and securely transfer data from Practice Solutions® EMR and linking it to the health administrative data held at the Institute for Clinical Evaluative Sciences (ICES). Practice Solutions® EMR is used by community-based Ontario FPs and it is the most frequently adopted government supported EMR software vendor in Ontario[13]. There are currently 183 community-based FPs contributing their primary care data to EMRALD.

For this study the EMRALD database was linked to the Ontario Health Insurance Plan (OHIP) database of physician fee-for-service billings and shadow billings. Physicians were linked by encrypted OHIP billing numbers and patients were linked by ICES key numbers which is an encrypted form of health card number. No identifying information was used.

Study Cohorts

To be included in the pre-post analysis EMRALD FPs had to be eligible to bill OHIP at least 18 months prior to and after the date they started their EMR. The OHIP Corporate Provider Database (CPDB) was used to determine OHIP billing eligibility. As well, all follow up was terminated at March 31, 2011, so EMRALD physicians who did not start their EMR 18 months prior to this date were also excluded. Of the 183 physicians currently in EMRALD, 68 FPs did not meet the inclusion criteria: 14 FPs had less than 18 months of billings after their EMR start date, 39 were not eligible because they did not have 18 months prior to their EMR start date and 15 had both insufficient look back and follow up time.

Model change cohort

The analysis of the effect of changing from FFS to a blended capitation model was limited to physicians who first switched to a capitated model more than 18 months prior to going on an EMR

(N=42). This ensured that their 18 month follow up period after switching models did not include their EMR start date.

Stable model, EMR change cohort

To get the most accurate estimate of the effect of an EMR on billings we constructed a cohort of physicians whose payment model did not change during the 18 months prior to and the 18 months following their EMR start date. This cohort included the 42 physicians in the model change cohort (because their model change occurred more than 18 months prior to their EMR date) plus 22 physicians whose model did not change in the data or changed more than 18 months following the EMR start date (N=64).

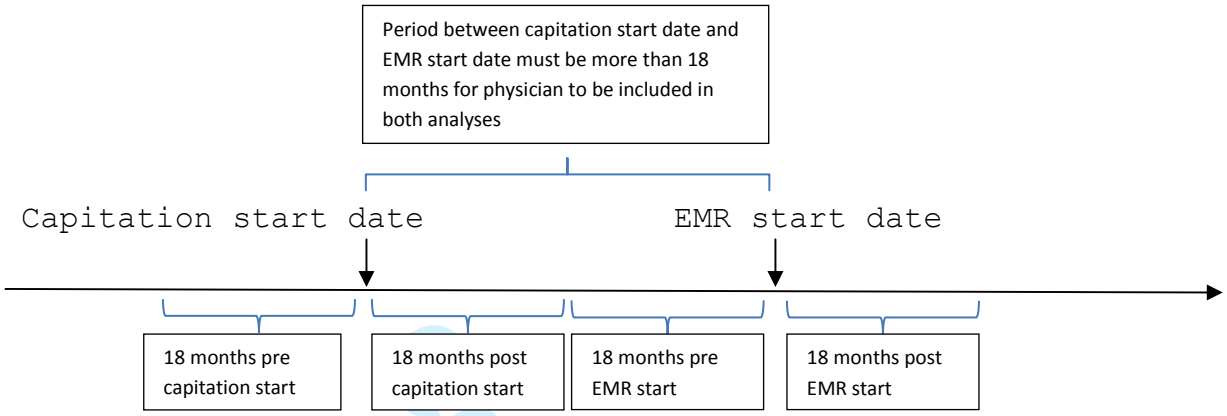
Time frames

Two time frames were used. For the study examining the effect of changing from FFS to capitation, the date on which the physician switched from FFS to capitation had to be more than 18 months prior to his/her EMR start date. The look back and follow up periods were 18 months prior to and 18 months after the capitation start date.

For the pre-post EMR analyses maximum follow up date was March 31, 2011, thus the latest EMR start date included in the study was 18 months prior to March 31, 2011. EMR start date was defined as the day in which there were at least five progress notes with billings in the FPs EMR record. Look back and follow

up periods were 18 months prior and 18 months after each EMR start date.

See diagram below.



Note: Post capitation and pre-EMR periods can and do overlap.

Definition of Office Visit Billings and Payments

Office visits included all OHIP billings by EMRALD FPs for assessments and consultations, excluding those which took place in the emergency department, hospital, long-term care facility or the patient's home. Billings for procedures were also excluded. Office visit payment is simply the sum of all OHIP FFS payments made for office visits as defined above.

To estimate the impact of switching models or starting an EMR on overall MOHLTC payments, not just FFS payments, we used data generated for the report "Payments to Ontario Physicians from Ministry of Health and Long Term Care Sources"[11]. This data includes FFS payments plus payments from a number of other sources and mechanisms such as alternate payment plans, capitation and a variety of incentives, bonuses and premiums.

This data is calculated for individual physicians, but only available for an entire fiscal year. Thus, the pre-capitation or pre-EMR year is defined as the full fiscal year prior to, but not including, the capitation or EMR start dates. Similarly, the post-capitation or post-EMR year is the first full fiscal year after the year containing the capitation or EMR start date.

Generalizability

To examine the generalizability of results using the EMRALD database we compared all EMRALD physicians (N=183) to all other active general practitioners (GPs) and FPs in Ontario in 2010/11 (N=11,385) with respect to their age, sex, location of undergraduate medical training, practice rurality[14], proportion of their billed visits located in the emergency department and full time affiliation with a Patient Enrolment Model[9,10]. We also compared the patients who visited EMRALD physicians (N=286,177) to all other FPs in primary care models with rostered patients (N=9,728,198) and who had used health services in Ontario in the past seven years with respect to patient age, sex, socioeconomic status (SES)[15], rurality[14] and comorbidity[16]. We then examined practice characteristics such as the proportion of patients with diabetes, hypertension, chronic obstructive pulmonary disease (COPD), asthma, congestive heart failure (CHF) and mental health issues.

Pre-post analyses

The number of office visit billings was summed by physician for each month. Then the monthly average was calculated across all physicians in a given study cohort. Recognizing that situations such as maternity, illness or parental leave could result in a drop in billings erroneously attributed to either model change or EMR start, the average for each month only included physicians who had at least 50 billings during the month.

The average number of office visit billings was estimated before and after either the EMR start date or the model change date. Means pre and post were calculated and a t-test was undertaken to determine statistical significance[17]. Also, the slope pre and post dates were calculated and tested to determine whether they were significantly different from null[17].

For the payments from all MOHLTC sources, the outcome measures are the mean annual payments from all sources pre and post capitation or EMR start.

RESULTS

Generalizability of EMRALD Family Physicians

A comparison of EMRALD FPs and to all Ontario GP/FPs in 2011 is provided in Table 1. EMRALD FPs were younger, more likely to be female, not be an international medical graduate and more likely to participate in a patient enrolment model. There was a higher proportion of EMRALD FPs from rural and suburban locations.

Generalizability of EMRALD Patients and Practices

A comparison of EMRALD patients to all Ontario rostered patients in 2011 is provided in Table 2. There were no significant differences in distribution by patient age and sex between EMRALD patients and all Ontario rostered patients. There was a higher proportion of EMRALD patients in the highest SES income quintile and EMRALD patients were more likely to live in rural and suburban regions. There were slightly more EMRALD with no or lower comorbidity and lower proportions with diabetes or hypertension. We did not find any difference between EMRALD patients and all other rostered Ontario patients with respect to the proportion with a previous acute myocardial infarction, asthma, congestive heart failure, chronic obstructive pulmonary disease or mental health issues.

Starting an EMR for FPs who did not change their primary care delivery model

For EMRALD FPs who did not change their primary care model during the 18 months prior to or after starting an EMR (N=64), the average number of office visit billings and payments per month before and after starting an EMR is provided in Figure 1. The average number of office billings and payments declined significantly prior to the implementation of the EMR ($p<0.01$). However, after EMR implementation the average number of billings and payments per month stabilized ($p>0.1$).

The effect of switching from FFS to a blended capitation payment model

The average number of monthly office visit billings and payments for EMRALD FPs who were in a capitation model 18 months before their EMR start date, but prior to this changed from a FFS to capitation payment model (N=42) is provided in Figure 2.While there was a decline in monthly office billings prior to changing payment models, it was not statistically significant ($p>0.05$). However, the decline in office billings after changing payment models was highly significant ($p<0.0001$), with a decline in monthly payments to about 25% of their pre-capitation level.

Total payments

The total payments from all MOHLTC sources increased after starting an EMR by 20.9% for the FPs who did not change their primary care model within 18 months of starting an EMR. There was a larger percentage increase of 44% in total MOHLTC payments for FPs who changed from a FFS to capitation model.

We compared the pre-post mean annual payments from all MOHLTC sources amongst the EMRALD FPs to all other Ontario GP/FPs in Table 3. There was an increase in the annual payments in all instances for both EMRALD FPs and GP/FPs in Ontario. The EMRALD FPs had a larger increase in payments after starting an EMR compared with all other Ontario GP/FPs in the same time interval, except in2007 and 2009. The overall weighted mean

payment for all MOHLTC sources increased after starting an EMR for EMRALD FPs.

INTERPRETATION

We found that when FPs changed from a FFS to capitation payment model, there was decline with their office based billings and payments after this change. However, there was an increase in the MOHLTC payments from all sources after changing to a capitation model. While there was a decline in office based billings and payments prior to starting an EMR, this stabilized after starting an EMR. After starting an EMR, there was an increase in MOHLTC payments from all sources, similar to the increase seen amongst all Ontario FPs.

FPs participating in capitation models are supposed to submit their claims (shadow bill). In an effort to encourage the submission of shadow billing, the MOHLTC provides a small proportion of the payment for these claims as an incentive. [18,19] However, there is work associated with submitting billing information and FPs may not bother to submit claims for all their patient encounters. The decline prior to starting an EMR is likely a continuation of the decline in billings after switching models. In other words, this decline is happening prior to our 18 month stable model cut-off. Total payments from all MOHLTC sources increased after starting an EMR, but this was generally true for all FPs in Ontario over time[11]. One

possibility for this plateau of billings after starting an EMR is that using the EMR-provided billing features making submitting claims easier. Also, during this time more billing options were introduced for FPs participating in the newer primary care models and this stabilization may reflect uptake of these new codes.

For FPs in Ontario, billings or claims do not equal income. Many physicians now receive the majority of their payments from capitation for rostered patients. Additional sources of revenue for FPs include bonus payments, rural practice incentive payments, and other global payments. Physicians may also receive payments made for services not covered by the MOHLTC, such as cosmetic procedures and block fee payments directly from patients and which are not included in these analyses. However, it is not likely these payments are related to FP EMR use. Payments to FPs also do not include the costs associated with running a practice, including the costs associated with converting to an EMR. Financial help was available to FPs via OntarioMD for the start up costs. Nevertheless, there is still much non-clinical work and time taken by FPs and their staff when they adopt an EMR and we did not estimate the costs associated with this learning curve.

A systematic review of FPs or primary care practices on the potential benefits and limitations of EMRs found healthcare

system structural benefits demonstrated through the conversion from paper records to EMRs, with improved legibility, encouraging patient questions and completeness of encounters, keeping medical records up to date and improving the quality of the medical record overall.[20] Another systematic review revealed some, but limited positive EMR impact on physician's practices in certain areas including prescribing support, disease management, work practice and preventive care.[21] A recommendation from this review is for studies to demonstrate value for money.

Limitations

Our study includes a convenience sample of FPs in Ontario who are different on some characteristics from other FPs in Ontario. We include a higher proportion of rural FPs and this may have some independent influence on billings. Currently data about EMR use for all Ontario GP/FPs is not available. For the total MOHLTC payment analysis, the comparison with all other GP/FPs in Ontario included physicians who also started and use an EMR. This is not a comparison to non-EMR users. We also only included one EMR vendor.

Conclusions

We found that FPs billings and payments did not decrease after starting an EMR. There was a decline in billings when FPs changed from FFS to a capitation model, but no decline in their MOHLTC payments. The overall weighted mean payment for all

MOHLTC sources increased after starting an EMR for EMRALD FPs, as it did for all Ontario GP/FPs. Further economic analyses which include measures of productivity and the costs of starting an EMR, including the costs of non-clinical work by FP and their staff are needed to fully describe the impact on EMR implementation at a practice level.

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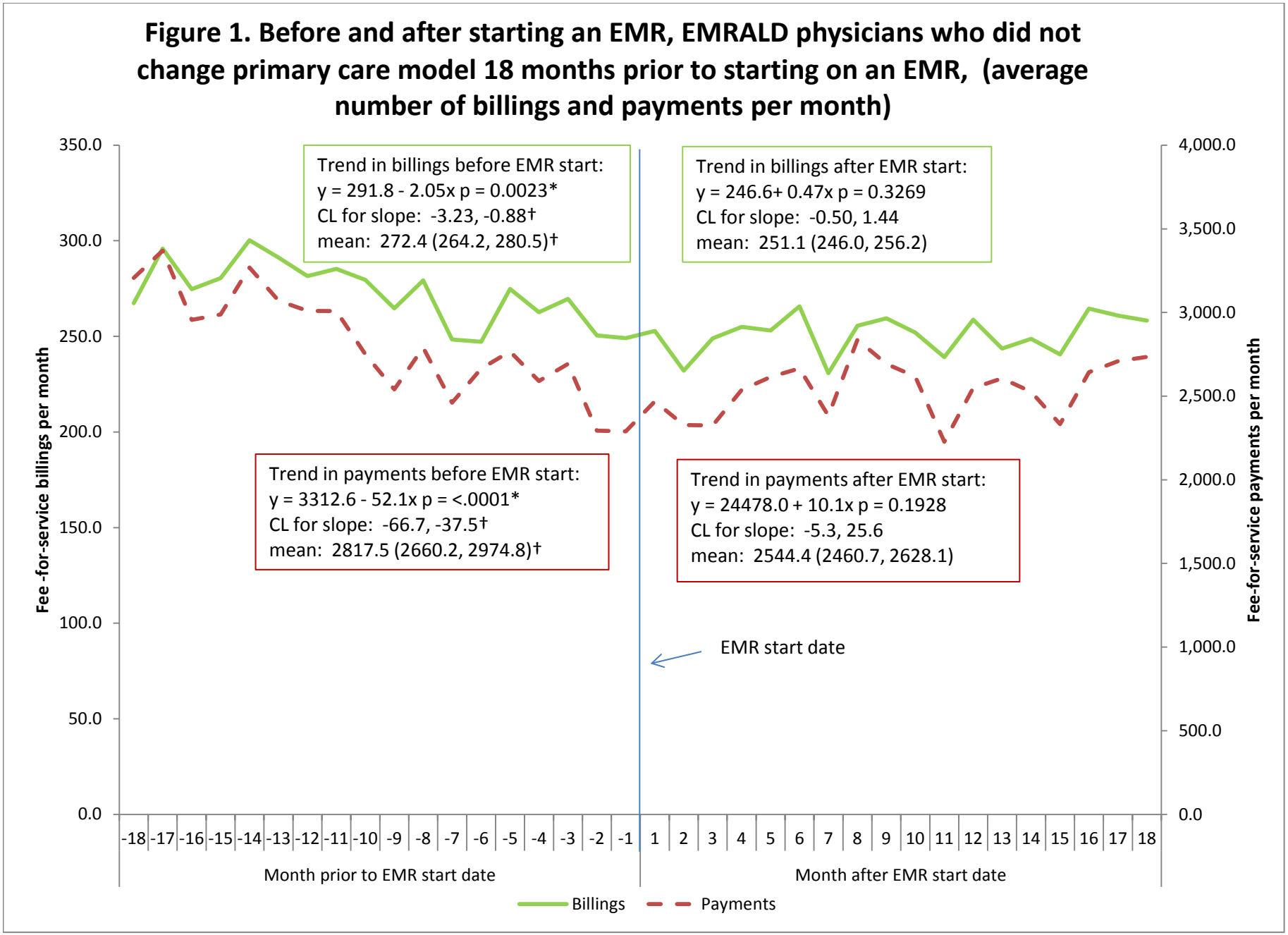
Table 1 Comparison of EMRALD family physicians with all other General Practitioners/Family Physicians in Ontario in 2011

Characteristic	EMRALD Physicians		All Other Ontario GP/FPs	
	N	%	N	%
Total	183	100.0	11,385	100.0
Sex				
Male	85	46.4	6,833	60.0
Female	98	53.6	4,552	40.0
missing	0	0.0		0.0
Total	157	100.0	11,385	100.0
Age group				
Under 35 years	35	19.1	1,094	9.6
35-44 years	63	34.4	2,617	23.0
45-54 years	38	20.8	3,312	29.1
55+	47	25.7	4,362	38.3
Mean age (years)	44.9		50.6	
Medical training location				
Canada	157	86.6	8,731	76.7
US and International	16	8.3	2,647	23.2
missing	10	5.1	7	0.1
Average number years in practice	14.0		17.0	
Rurality				
Rural	35	19.1	850	7.5
Suburban	40	21.9	1,871	16.4
Urban	108	59.0	8,664	76.1
More than 25% of visits in the Emergency Department (%)		15.3		13.7
Full time affiliation with a Patient Enrolment Model group on March 31, 2011	173	94.5	6,866	60.3

Table 2 Comparison of EMRALD patients to patients of all other Ontario General Practitioners/Family Physicians in 2011

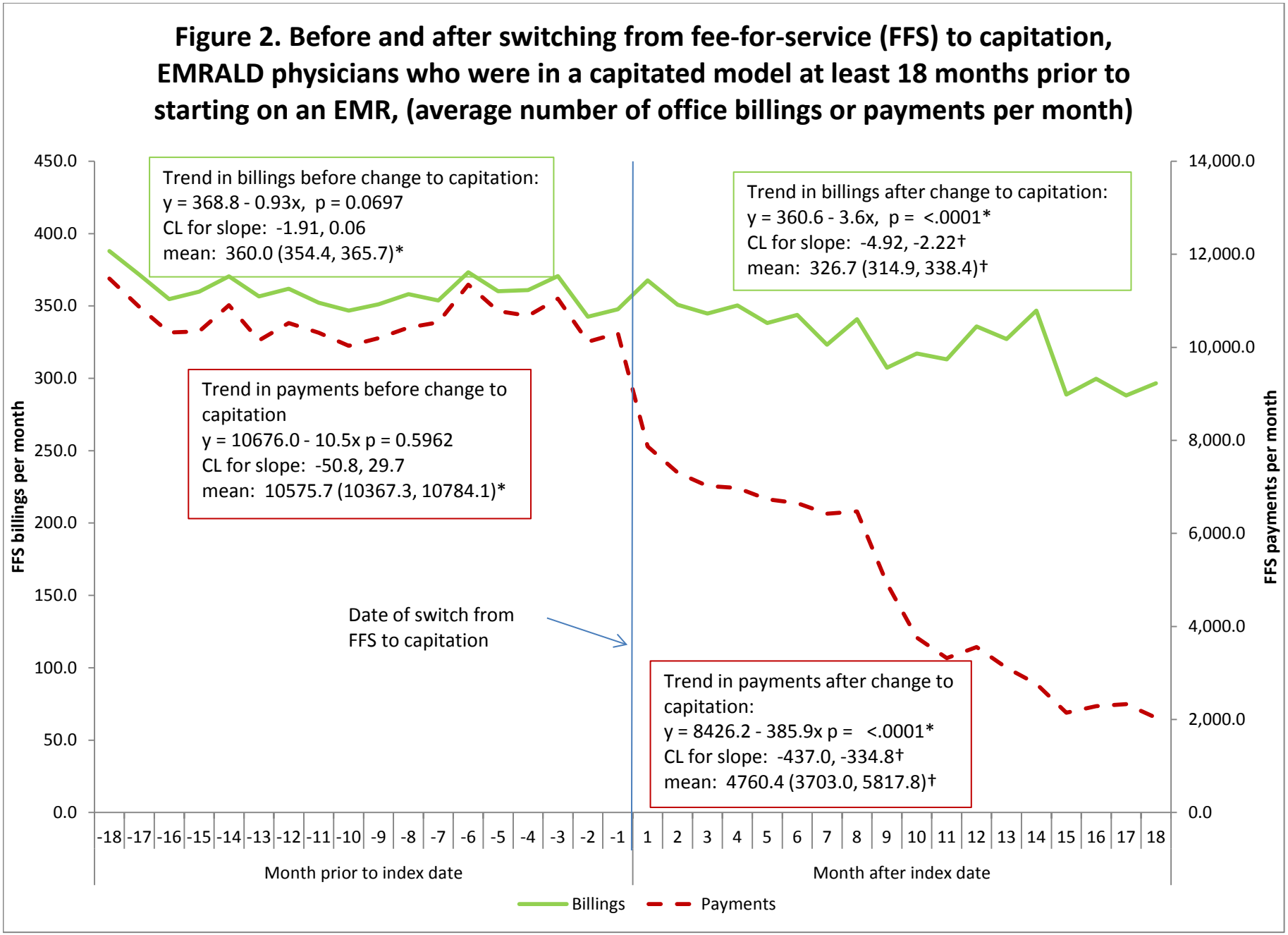
	EMRALD patients (%)	Patients of other Ontario GP/FPs (%)
Male	45.4	47.4
Female	54.6	52.6
Age group		
0-4	6.3	4.0
5-17	13.4	14.6
18-29	14.9	15.1
30-44	21.6	20.5
45-64	28.3	30.2
65-74	7.7	8.3
75-84	5.3	5.3
85+	2.5	2.0
Mean age	40.1	40.8
SES Income Quintile		
1 - Lowest	16.8	17.7
2	17.7	19.3
3	18.9	20.3
4	21.0	21.7
5 - Highest	23.9	20.7
Unknown/missing	1.8	0.3
Rurality		
Rural	14.9	5.5
Suburban	20.0	17.6
Urban	65.0	76.9
Number of Adjusted Clinical Groups (Comorbidity)		
0-no comorbidty	7.6	6.2
1-5	48.0	45.7
6-9	35.9	39.4
10+-high comorbidty	8.5	8.6
Chronic Conditions (%)		
Previous AMI	1.3	1.3
Asthma	14.0	14.7
CHF	2.1	1.8
COPD	6.3	6.3
Diabetes	8.3	9.7
Hypertension	20.7	22.9
Mental health issue	21.4	20.8
Chronic condition	46.5	50.4

Figure 1. Before and after starting an EMR, EMRALD physicians who did not change primary care model 18 months prior to starting on an EMR, (average number of billings and payments per month)



* , p <= 0.05; † - before and after measures significantly different, p<= p.05; CL=confidence limits

Figure 2. Before and after switching from fee-for-service (FFS) to capitation, EMRALD physicians who were in a capitated model at least 18 months prior to starting on an EMR, (average number of office billings or payments per month)



* , p <= 0.05; † - before and after measures significantly different, p<= p.05; CL=confidence limits

Table 3 Comparison of mean annual payments from all sources pre-post EMRALD family physicians (FPs) compared with all Ontario general practitioners/family physicians (GP/FPs)

	EMRALD FPs				All Ontario FP/GPs				
EMR start year	Number of physicians who started on EMR this year	Mean total payments from all sources for pre-EMR year - EMRALD FPs	Mean total payments from all sources for post-EMR year - EMRALD FPs	Percentage Change	N (all other GP/FPs)	Mean total payments from all sources for same year as pre EMR year - all other Ontario GP/FPs	N (all other GP/FPs)	Mean total payments from all sources for same year as post EMR year- all other Ontario GP/FPs	Percentage change
2005	18	191,341.92	351,250.58	83.6	9,865	183,570.21	10,046	243,426.91	32.6
2006	38	200,836.27	256,882.30	27.9	10,129	214,025.09	10,149	248,381.12	16.1
2007	8	196,967.16	210,036.06	6.6	10,046	243,426.91	10,352	273,961.63	12.5
2008	12	257,109.93	347,937.54	35.3	10,149	248,381.12	10,666	285,366.01	14.9
2009	26	271,144.45	275,189.77	1.5	10,352	273,961.63	10,872	279,978.02	2.2
Overall mean (weighted)		223,399.46	285,240.30	27.6		233,100.21		266,678.94	14.4