

Does customized in-practice support improve EMR meaningful use in
Primary Care? Evidence from a retrospective mixed methods evaluation

by

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MSc Candidate HINF, University of Victoria, 2014

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1 STUDY PURPOSE

The purpose of this study was to evaluate the effect of the Physician Information Technology Office's (PITO) post implementation support program on Electronic Medical Record (EMR) meaningful use within a primary care (PC)¹ setting. British Columbia's provincial model of meaningful use is called the "Clinical Value Model" and the coaching support offering is called "Post Implementation Support" delivered as part of BC's Physician Information Technology Office (PITO)'s Post EMR Implementation Support program.

1.1 BACKGROUND

As the uptake of EMRs has increased, several provincial Electronic Medical Record funding bodies have begun the shift from promotion and support for deployment and adoption of EMR toward the emphasis of maturity of use, or meaningful use of EMR (COACH: Canada's Health Informatics Association, 2013). In February, 2013, the Canada Health Informatics Association published the Canadian EMR Adoption and Maturity Model. This publication describes a multi-jurisdictional collaborative effort towards defining EMR meaningful use in Canada (COACH: Canada's Health Informatics Association, 2013).

COACH notes that many provinces have now developed their own EMR maturity models, which are similar to the meaningful use model developed by the Healthcare Information and Management Society (HIMSS) in the United States.² COACH's Canadian Model seeks to bring together models from four provinces, Ontario, Manitoba, Alberta and British Columbia, under one standard to be used by all (COACH, 2013). While these models are similar and seek to develop a common understanding of the primary care physician's level of use of EMR, each province has approached this analysis differently. There is inherent value in understanding how physicians in BC use their EMRs. Canada Health Infoway's EMR Benefits Evaluation Study, notes that EMRs can fundamentally change the work in physician practice (Pricewaterhouse Coopers, 2013). However what is more desirable is to ensure that EMR use

¹ Primary care defined as 'family doctor' type services

² <http://www.himss.org/files/HIMSSorg/content/files/EMR053007.pdf>

reaches the level of uptake needed to result in clinical behaviour changes and improved clinical outcomes for patients (Canada Health Infoway, 2013). According to a survey of physicians in Ontario using EMRs, 65% responded that EMRs helped improve the quality of care they delivered to their patients (Ontario MD, 2012). Price, Singer and Kim (2013) used an EMR adoption framework to measure overall use of EMR in Manitoba. The authors found that two limitations to higher levels of adoption of EMR were poor data quality and lack of familiarity with or availability of EMR functionality. According to Lau et. al, who conducted a systematic review to examine the impact of EMR on physician practice, there are few demonstrable positive findings to date (Lau, Price, Boyd, Partridge, Bell, & Raworth, 2012). They put forward some key recommendations in order to improve the impact of EMR on physician practice. These included the use of templates and decision support tools to ensure efficient and accurate capture of information at point of care; clinical workflow change in order to benefit from the EMR's advanced characteristics such as recall methods, and electronic referral of information; ensuring the EMR assists in maximizing billing incentives available to offset costs of use; and improving patient safety by using alerts and other decision support tools. These benefits, if leveraged appropriately, may help adoption of EMR demonstrate a more positive impact on patient care (Lau, et al., 2012)

PITO's support program offers physician's assistance in addressing some of the key recommendations made by Lau et.al (2012). In theory, this support may help alleviate some of the barriers to EMR adoption and use, and provide some positive impact to patient care. When referencing Lau et. al's systematic review in 2012, they note if there is improvement of EMR use in areas such as use of drug alerts, clinical decision support tools, and use of templates to facilitate data entry at point of care, one could hypothesize that a positive impact on patient care may be realized longer term.

PITO has collected a substantial amount of data during its program operations, such as detailed meaningful use assessment data, details of the support provided to the physician, and a twenty-question program evaluation survey issued once the physician has completed the program. This data has not been analyzed to date. Given the hundreds of thousands of dollars being spent on this program, it is critical that PITO is able to assess whether the support model being delivered will result in the desired effect of improvement of EMR meaningful use by PC physicians. In addition to offering a valuable analysis of PITO data, this research will contribute to the current literature on EMR use, specifically in the BC environment and within the primary care setting. Over 85% of patient care is provided within primary care (Canadian Medical Association, 2012), the impact of EMR use on patient care is likely to be felt most directly in this setting.

1.2 DESCRIPTION OF THE SUPPORT MODEL

The number of PC Physicians using EMR in clinical practice in BC is nearing 73% (National Physician Survey , 2013). This figure has risen substantially since 2009, when only a third of physicians and surgeons in BC reported use of EMRs (Lai, Lau, & Shaw, 2009). Since its inception in 2007, PITO has offered support focused primarily on EMR procurement, EMR implementation, and the transition from paper medical records to EMR. However many physicians are increasingly interested in improving the use of the EMRs they have installed (Biro, Barber, & Kotecha, 2012). Additionally, Canada Health Infoway has as goal of incenting “more comprehensive use of EMRs so that 80% of participating clinicians meet clinical value targets that promote the effective use of EMRs” (2013)(Canada Health Infoway, 2013). To meet these needs, PITO has developed a “Post Implementation Support” program. This support program uses PITO’s EMR meaningful use model, called the “Clinical Value Model” (see Appendix A) as its framework. The Clinical Value Model (CVM) is made up of 5 levels of EMR use, very similar to coach’s EMR Maturity Model (COACH, 2013). There is an emphasis on both ‘Clinical Effectiveness’ and ‘Practice Efficiency’ use of EMR. Complexity increases via Levels, from simple billing and scheduling tasks at Level 1 to discreet data transfer between providers centering on the patient at Level 5. Figure 1 below describes the basic functions at each level (Smith, 2011).

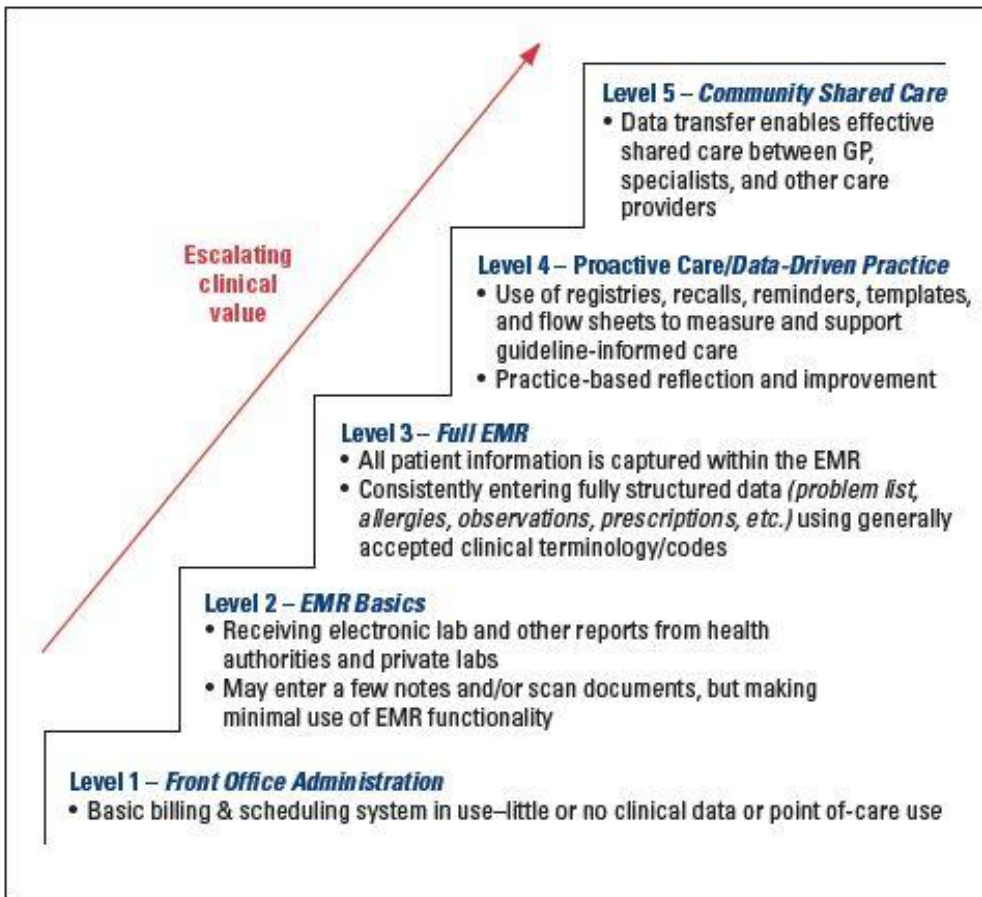


Figure. EMR "meaningful use" and clinical value model.

Figure 1- PITO's Clinical Value Model (CVM) diagram (Smith, 2011)

PITO's main objective is to help PC physicians to achieve Clinical Value (CV) Level 3 (e.g. CV3), at which point they are consistently entering fully structured patient data into the EMR. At CV3 they have established a foundational level of use for clinical effectiveness, which will allow them to develop a data driven practice and ultimately engage in patient centric and community shared care practice.

To help physicians achieve a baseline level of CV3, PITO has developed a new personnel role. A Practice Automation Coach (referred to as "Coach" in this research study) offers customized support to Physicians. The coach uses knowledge of change management, clinical workflow and EMR technology to guide a PC practice through improved office workflow as it relates to EMR usage. Generally, coaches have a background as either a Medical Office Assistant (MOAs) with EMR use experience, or EMR software experience with an understanding of PC workflow. Additional resources to assist the PC practice are available in the form of peer mentors, either physician or MOA colleagues. Peer mentors, often from the same locality, using the same EMR software provide additional assistance and support on

EMR procurement, implementation and use to their colleagues. EMR vendors may also have available advanced training as part of their service offering.

A high level view of the support program offered by PITO is shown in Figure 2 below.

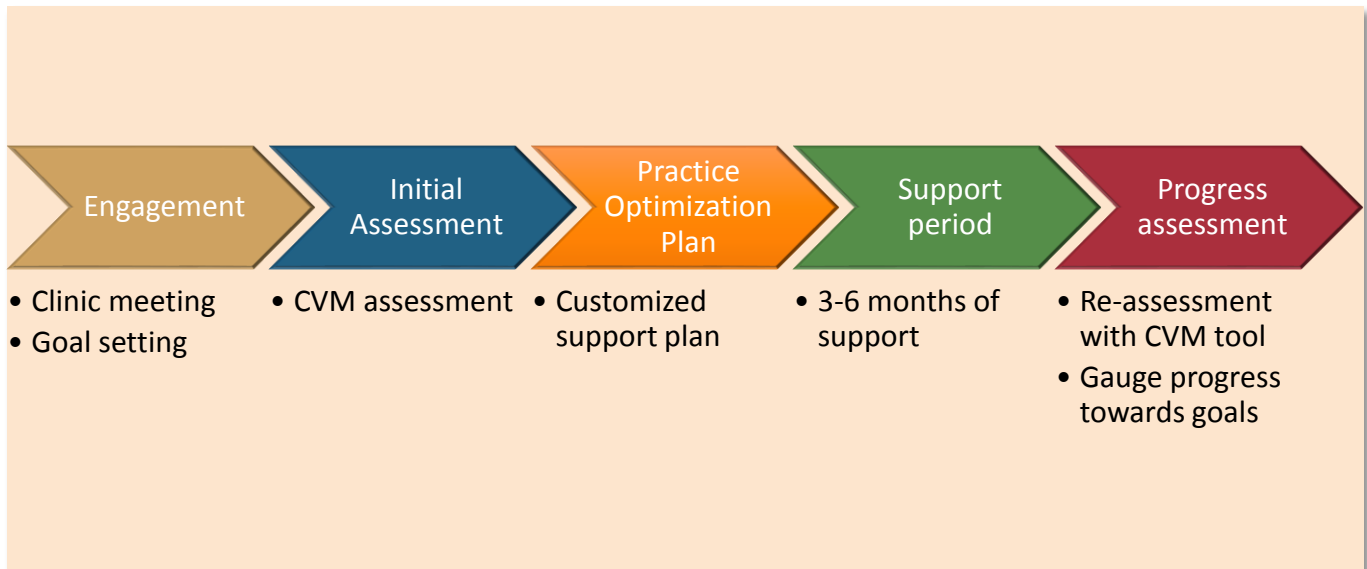


Figure 2- PITO's high level post implementation support program³

The support period may last anywhere from 1-6 months, but it begins with an expression of interest by the collective PC practice or individual physician. The coach will then meet with the clinic staff as a group to explore the PC practice's drivers and motivating goals for engaging in post implementation support and EMR optimization. Once the goals for EMR optimization are established and documented, the coach will then conduct a detailed clinical value assessment with each physician and key MOAs within the practice. This assessment is performed in practice, one on one with the physician, and usually lasts one hour to 90 minutes. The assessment follows the format of a questionnaire of 86 EMR focused workflow descriptions, administered by the coach. Responses to the workflow statements are based on use (e.g., Yes or No) of a particular EMR function or workflow process within the practice. Results thus provide a gap analysis of specific workflow functions related to EMR usage. The response is further qualified by a statement, which will gauge the physician and MOA's level

³ www.pito.bc.ca/post-implementation support program

of interest in learning more about a particular function, or working on improving the efficiency of a given workflow.

During the assessment, there may be opportunities for the coach to focus on “quick wins” for certain functions to ensure the assessment is seen as a value-added process. However, once the initial assessment is completed, the coach will use the assessment data, and, keeping in mind the established goals/drivers for optimization stated during the initial engagement, draft a customized practice optimization plan or “support plan.” The support plan is essentially a mini-project plan that outlines the clinic’s goals for improving meaningful use, and the action steps required to achieve those goals. The initial draft support plan uses targeted areas of interest, and a proposed CV level to create action steps. The support plan is then finalized with the Physician and MOA at a third in-person session.

The support plan contains all the components of a basic project plan, including stated objectives, action steps and timelines. For each action step, a resource person is assigned, as is an owner of the action who is responsible for ensuring it is completed. The coach reviews the draft plan with the physician and MOAs at the practice site, and adjusts the plan based on feedback. Implementation and the coaching strategies that accompany the plan can vary considerably, depending on the clinics goals, the level of support needed, and the resources available in the area. Each plan is unique, based on the multiple ways different actions can be assigned to any resource via different methods. Figure 3 below provides an illustration of this matrix. For example, a peer mentor may provide 1:1 coaching to a physician on how to build an encounter template to facilitate data entry, while the MOAs at the clinic may attend a user group on efficient document management workflow for electronic faxing.

Although dependent on availability of resources, each action can be assigned to a “resource” such as support from the coach, the EMR vendor via training services, or a peer mentor – MOA or physician peer. Actions common to a practice or a community may be assigned to practice site group learning, or community wide user group if that seems most appropriate. The PC practice and physician themselves may also take on an action, through group learning, or knowledge transfer between colleagues.

Once the action plan is in place, the coach will check in with the practice approximately every two weeks, in addition to the support the coach would provide themselves. Throughout the support period, the coach refers to the support plan and updates the status of each action during the check-ins, and helps coach and mitigate risks or issues which come up.

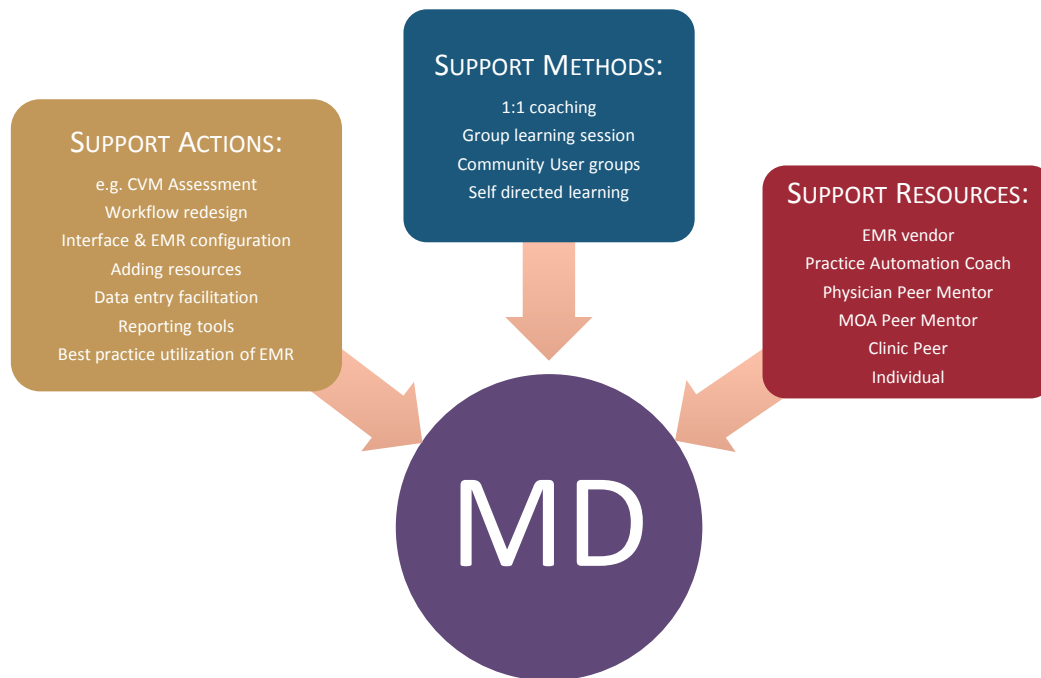


Figure 3- Description of support matrix for support period

Once the support plan actions are mostly completed, the coach will schedule a progress assessment – essentially a shorter version of the initial CVM assessment that indicates if there has been any change in EMR use. The coach will discuss with the practice if they require or desire additional support, or if they feel they have met their goals. If it's the latter, the coach will send the practice the link to a short online survey in order to provide feedback on the program. This concludes the support period, and the physician is then eligible to receive \$1,000 for their protected time while engaged in the support, and 6 hours of Mainpro-C Continuing Medical Education (CME) credits⁴.

1.3 ENABLERS OF IMPROVED MEANINGFUL USE

In a review of the literature, there were no specific articles studying the effect of direct support for physicians to improve EMR meaningful use in British Columbia, or in Canada. There are many articles on the subject of practice facilitation to enable quality improvement in primary care, but these are not exclusively aimed at meaningful use. However, numerous articles were found about EMR adoption, many of which offer recommendations regarding improving EMR usage in the hopes of realizing the

⁴ MainPro-C CME credits are education credits a physician can apply for via the College of Family Physicians of BC, in order to recognize the effort and learning for having taken part in a CME eligible activity.

benefits of health information technology. The following are six enablers of improving meaningful use of EMR as suggested by the literature below that this support program used:

- Change management and coaching support
- Goal setting
- Tailored interventions
- Protected time and funding
- Focus on advanced functionality and use
- Support to integrate EMR into clinical workflow

Brookstone and Brazillier recommended change management to mitigate the “disruptiveness of the technology cascade”. They also recommend peer support to assist with workflow integration, ongoing education sessions and user groups (Brookstone & Brazillier, 2003). Lau, Lai and Shaw (2009) add that post-implementation support is needed for advanced use of EMR. In 2012, Lau et. al made additional recommendations regarding improving EMR success in the absence of being able to change the EMR interface. They suggested an emphasis on redesigning clinical workflow, maximizing financial billing incentives, and patient safety features such as drug alerts (Lau, et al., 2012). Additionally they note some barriers to EMR use as lack of time or funding to incent this work. Baskerville, Liddy and Hogg (2012) conducted a systematic review of the literature regarding practice facilitation on primary care and recommended the use of a detailed assessment, customized plan and tailored intervention as keys to improving performance. Even as far back as 1997, Markus and Benjamin listed key success factors of IT enabled transformation and recommended an “IT change facilitator role” to enable the people within a practice to create the change, a concept that rings true in this model.

1.4 STUDY AIM AND OBJECTIVES

This study's aim was to determine if physician's participating PITO's post implementation support program improve their meaningful use of EMR. The program has been in place for almost two years now, providing an opportunity to assess how the program is fairing. As the project manager tasked with the implementation of this program, this researcher was interested in evaluating the effectiveness of the program. Given the substantial amount of data collected as part of program operations, the scope of this study was limited to the following objectives:

- Evaluate the effect of PITO's post implementation support program on EMR meaningful use within one Division of family practice⁵ in BC:
 - Include a sample of 29 Physicians from one division of family practice in a semi-urban area of the lower mainland
 - Evaluate the pre-test and post-test scores for meaningful use
 - Evaluate the detailed responses to the meaningful use questions on the assessment
 - Explore the themes and CV levels of support physicians requested, including the resources assigned to support the physicians
 - Evaluate the physician's feedback regarding the value of the program and its expected impact on their EMR meaningful use
- Make recommendations to PITO regarding the effectiveness of the support program and clinical value model of meaningful use, and provide future research direction regarding support for improving EMR meaningful use

⁵ <https://www.divisionsbc.ca/provincial/home>

2 METHODS

This study used a retrospective mixed methods approach to analyze previously collected data in a convergent parallel design (Creswell & Plano Clark, 2011, p. 77). Qualitative and quantitative data, which were collected in parallel, were analyzed separately, and then compared and contrasted (Creswell & Plano Clark, 2011).

The rationale for this method was in part based on the availability of quantitative and qualitative data, which is collected on an on-going basis as part of PITO's Post implementation support program. Analyzing both quantitative and qualitative data offers the opportunity to converge two forms of data to bring greater understanding of the research question than would otherwise be obtained by either type of data on its own (Creswell & Plano Clark, 2011). In addition, triangulation of data helps to minimize bias and provide a richer description of the phenomenon (Johnstone, 2004). Creswell et. al. recommend the use of mixed methods research as a methodologically sound practice for PC research, and describe a "Convergent Design Model" as one of three possible models for mixed methods research in primary care (Creswell et al., 2004). The use of triangulation of multiple sources of data enhances the integrity of the research outcome, while providing greater validity (Creswell & Plano Clark, 2011). In 2008, Green et. al used a retrospective mixed methods evaluation to describe the impact of managed clinical networks on diabetes care in primary care. Because PITO has provided both qualitative and quantitative data, this research methodology approach seemed to be the most suitable.

2.1 METHODOLOGY DESIGN

In this study, there were four main data sources available, described in further detail below. These data sources were analyzed separately, with an appropriate method for the source. As recommended by Creswell Fetters and Invakova (2004), the results of each analysis were interpreted in the discussion phase, and provided evidence to answer the research question (Creswell, et al.,2004).

Figure 4 provides an overview for the convergence model of data analysis as suggested by Creswell et. al.

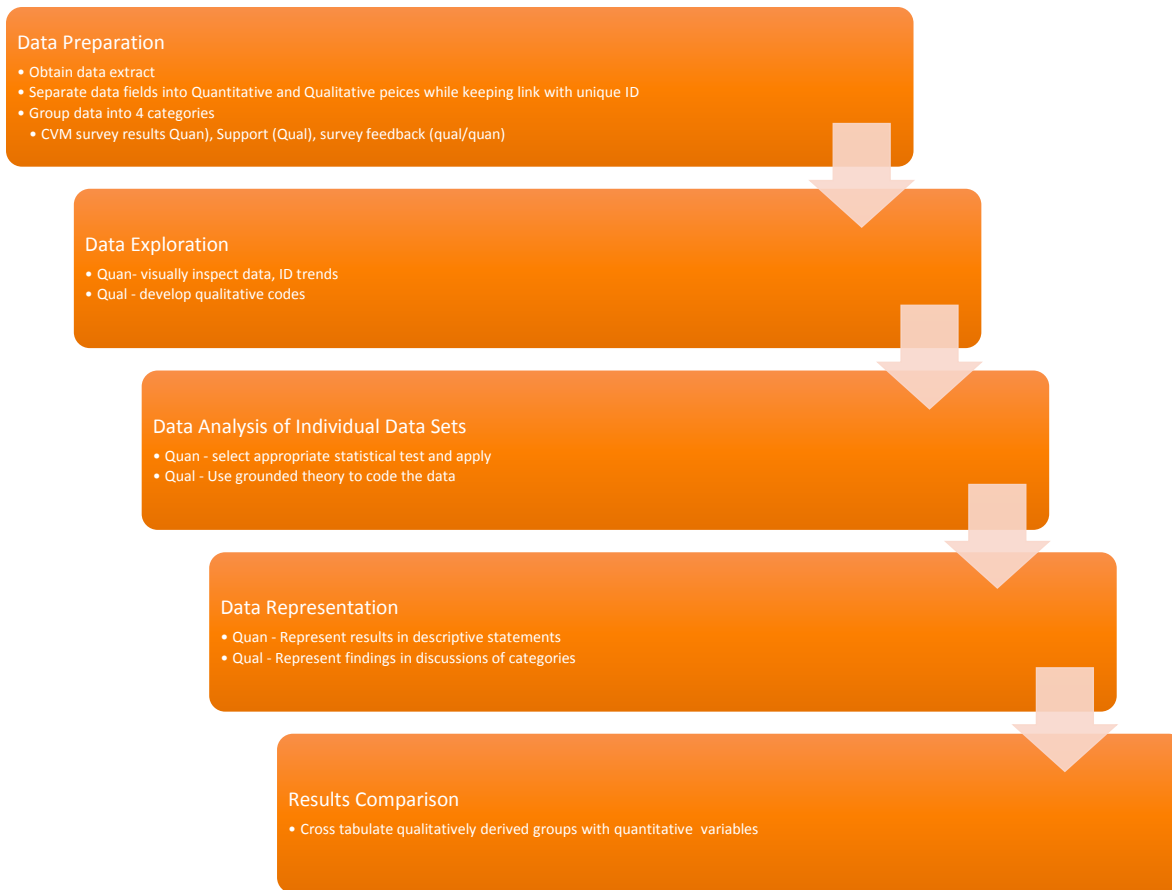


Figure 4 - Approach for triangulation design: convergence model of data analysis

2.2 STUDY POPULATION

The sample size used in this research study was restricted in order to keep the scope and timeline within manageable limits, and to reduce the number of variables. From the over 800 participating physicians to date, this study focused on a sample of approximately 30 PC physicians supported by one Practice Coach within one division of family practice in BC. The constraint to one division of family practice and one coach reduced variability by providing a more homogeneous sample of PC physicians, in a semi-urban environment, drawing on similar resources and services for support. The limit to one coach also reduced the subjective variability of the assessments. Furthermore, all twenty nine physicians used the same EMR software, which further reduced the variability of vendor support and EMR functionality.

Figure 5- Sample size from total PITO eligible physicians in BC' illustrates how this sample of physicians fit within the larger sample available of participating physicians in PITO's post

implementation support program, and the overall “eligible⁶” physicians in BC. PITO defines “eligible” physicians as⁷:

- Any full-service family practice (FSFP) clinic in BC, with or without an ancillary walk-in clinic, regardless of the particular EMR in use.

A full-service family practice physician is defined as:

- A general practitioner who has a valid BC MSP practitioner number (registered specialty 00).
- Currently in general practice in BC as a full service family physician
- Responsible for providing the patient’s longitudinal general practice care:
- Co-ordination of patient care across the spectrum of primary, secondary, and tertiary care, including making referrals and acting upon consultative advice.
- Longitudinal care of patients across the spectrum of their medical needs.

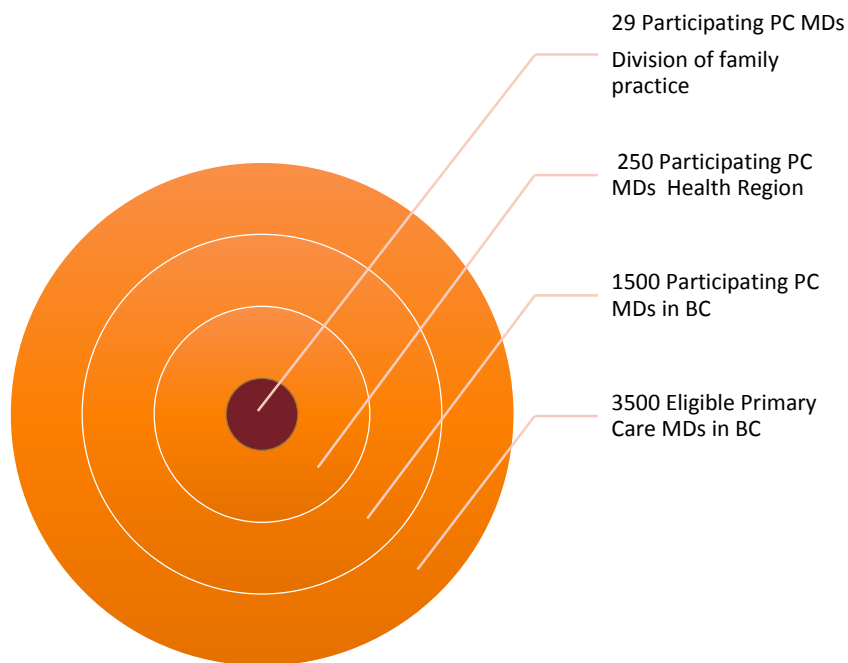


Figure 5- Sample size from total PITO eligible physicians in BC

⁶ “Eligible” is defined as PC physicians live on EMR who could potentially be eligible to receive post implementation support.

⁷ <http://www.pito.bc.ca/support/post-implementation/eligibility/>

2.3 DATA SOURCES

All data used in this retrospective research study used the de-identified data, collected as part of the the usual operations of PITO's Post Implementation Support Program, for secondary analysis.

Table 1 presents a summary of the three sources of secondary data, which provided eight types of data sets that were used. These included quantitative data from the pre-test and post-test CVM assessment; support actions, methods and resources used; and qualitative data from the support plan actions and responses to a feedback survey conducted after the support cycle was completed. The pre and post-test CVM assessment responses of “no” to “yes” provide an estimation of improvement in EMR meaningful use prior to support (e.g. baseline) and after support. The support plan data provides insight into what type of support occurred as well as who provided it. The web-based feedback survey provides Likert-scale scores and unstructured responses, both of which gauged the “perceived effect” of the support received.

The following paragraph describes the surveys and assessment tools used throughout the coaching process, and from which the data was collected. A CVM assessment tool, an 86 question subjective assessment tool based on the Clinical Value Model and administered by the Coach was used to collect the assessment data and scores for the pre and post-test. A sample image of the tool is available in Appendix B.

The CVM feedback survey is a web-based survey tool created with Survey Monkey (Appendix C). Physicians are required to complete the feedback survey as part of their participation in the program. The survey contains two types of questions, 10 questions with structured responses in form of Likert scales or structured choices, and two open-response questions. Responses to all questions were required in order to complete the survey.

Table 1 - Data sources

Data Sources	Type	Description	Data storage	Sample Size	Unit
CVM assessment for each physician ⁸	Quantitative	CVM assessment “Pre” scores	Access database	86 questions x 29 MDs = 2494 per type = 9976 pieces of data	Numerical value
	Quantitative	CVM assessment “Post” scores			
	Quantitative	CVM assessment “Pre” response qualifiers			Structured data (yes/no and qualifiers)
	Quantitative	CVM assessment “post” response qualifiers			
	Quantitative	Months of support provided	Access database	58 dates	Numerical value
CVM feedback survey	Quantitative	Online feedback survey responses	CSV files	10 questions- 5 point likert-scale x 29 = 290 data points	Numerical value
	Qualitative	Online feedback survey responses	CSV files	10 questions x 29 respondents = 290 “files”	Free text data
Practice Optimization plan – a.k.a. Support plan	Qualitative	Support “methods”, “activities” and “resources” ⁹	Access database	5 types of support “resources”, “methods” and variable types of “activities” in multiple combination for 29 participants	Structured text data & free text data

2.4 DATA ANALYSIS

Table 2 provides an overview of the method of analysis used for each data source. The approach to data analysis in this mixed methods research study was to first obtain the sources of data as described in

⁸ PITO captures demographic and CVM subjective assessment data (Clinical Effectiveness & Practice Efficiency Scores, pre and post support), time data from initiation of support to completion and other practice characteristics which will be available as data source for this research.

⁹ As described in Figure 3

Table 1 above. Then each data source was analyzed separately as described in further detail below, the results compared and the data triangulated in order to draw conclusions.

Table 2- Analysis for each source of data

Analysis type	Data Sources	Data description	Separate analysis for each data source
Quantitative	CVM assessment for each physician ¹⁰	CVM assessment "Pre" scores	Quantitative data analysis of numerical pre and post test scores & responses: Visual inspection Checked for trends Applied descriptive statistics and Paired 's T-Test Use of excel pivot table for structured response data
		CVM assessment "Post" scores	
		CVM assessment "Pre" response qualifiers	
		CVM assessment "post" response qualifiers	
		Months of support provided	
Quantitative	CVM feedback survey	Online feedback survey responses	Quantitative data analysis of likert scores: Visual inspection Checked for trends Use of pivot table
		Online feedback survey responses	Qualitative analysis of free text comments with thematic coding methods: Coded the data Assigned labels to codes Grouped codes into categories Categories compared and related
Qualitative	Practice Optimization plan – a.k.a. Support plan	Support "activities" and "resources" ¹¹	

Pre-test and post-test CVM assessment scores were tabulated, and the difference between the scores analyzed using a paired T-test (Jackson & Verberg, 2007), which is used to compare pre-test and post-test data. The paired T-test was calculated using Microsoft Excel© 2013 version data analysis service pack, using the pre and post-test scores for all 29 physicians (Keselman & Algina, 2010). Additional analysis includes the number of questions for which the responses were "no" on post-test, and the qualifying response statement. Table 3 is a summary of the possible responses to each question. The first column is a 'yes' or 'no' statement preceded by a qualifying statement. For analysis purposes, the writer has added an interpretation of the meaning of the response and qualifier.

Table 3- List of response options and qualifiers with interpretation

Yes/No	Qualifier	Interpretation
Yes	Process is fine	Yes I am using this function in my EMR and its working well

¹⁰ PITO captures demographic and CVM subjective assessment data (Clinical Effectiveness & Practice Efficiency Scores, pre and post support), time data from initiation of support to completion and other practice characteristics which will be available as data source for this research.

¹¹ As described in Figure 3

Yes	Process needs improvement	Yes I am using this function in my EMR but workflow could use some improvement
Yes	But EMR functionality is poor	Yes I am using this function in my EMR but the functionality is poor (EMR functionality is somewhat of a barrier)
No	Started but inconsistent	No I am inconsistently using this function in my EMR
No	Not started but interested soon	No I am not using this function in my EMR but I am interested
No	EMR Functionality is poor	No I am not using this function in my EMR because the EMR functionality is poor (EMR functionality is a barrier)
No	EMR Functionality not available	No I am not using this function in my EMR because the functionality is not available (EMR functionality is a barrier)
No	No not yet (too far out)	No I am not using this function in my EMR because I am not ready or not interested (e.g. 'readiness barrier')

This additional analysis offered some understanding of the remaining barriers to increased EMR meaningful use once the support process was completed.

The responses to the CVM feedback survey questions for which the answers were structured and based on a Likert scale are presented in bar chart format. Displayed by percentage of response types for individual questions in order to show the discreet quantitative variable. The qualitative responses are presented in tabular format.

The subjective responses from the feedback survey were qualitatively analyzed, identifying common words and key phrases relating to satisfaction with the support received. A code book was developed based on themes which emerged through the qualitative data analysis process.

The support "actions" for each plan were reviewed and categorized into themes using qualitative analysis. Key words taken from the Clinical Value Model such as 'medications', 'reports' were used to determine the categories and themes. Again using the CVM levels, the categories were ranked into corresponding levels. For example, 'Medication formulary usage' at CV2, and 'Clinical decision support tools' are part of Clinical value level 4. Once these categories and levels were determined, using Microsoft Excel© 2013 version's 'find' tool, the number of actions, which contained a certain category or theme, were counted. Once the categories were counted they were sorted into their corresponding CV levels.

The action plan support "resources" are finite and made up of structured text data. These are quantified into 5 types of resources and were analyzed using Microsoft Excel© 2013 pivot tables. The support "actions" were described with unstructured free text data. They were analyzed thematically by identifying common words and key phrases relating to the types of workflow descriptions for each level in the clinical value model (CVM).

Results of each data set were then reviewed and compared in order to substantiate or reject the conclusions drawn from the independent analysis of each data set. For example, reviewing the CVM scoring data allows a conclusion to be made on the change in meaningful use on post-tests. Then the CVM feedback survey data themes were reviewed to support or reject the conclusions that were made. Interpretations presented in the discussion include findings from all of the data analyzed.

3 RESULTS

The following section presents the results of the mixed methods data analysis in five parts. First, a brief overview is presented for the sample of physicians whose data was included in this study. Second, a presentation of the quantitative scoring analysis of the pre and post-test meaningful use scores are provided in table form. Third, the additional analysis of two sub groups of physicians, including their responses to questions and pre and post-test scores is described. The presentation of the qualitative analysis results of the type of support provided to each physician makes up the fourth part. Finally presented are the quantitative and qualitative results from the CVM feedback survey.

3.1 SAMPLE

The sample of physicians included in this study was limited to physicians who used common EMR software and worked in the same division of family practice, and thus practiced in the same semi-urban area of BC. Figure 6 illustrates number of years of experience using EMR in practice. Almost three quarters of the physicians sampled had over 3 years of experience using an EMR in their medical practice. No physician had been using EMR for less than one year. The majority of physicians in this study had not recently adopted EMR.

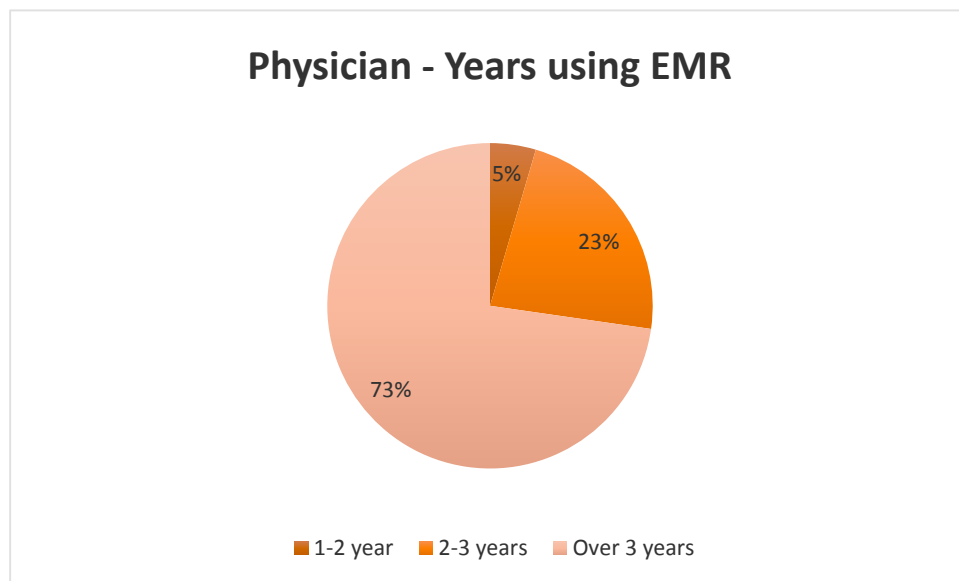


Figure 6- Physician years of experience using an EMR

Physicians participated in the PITO post-implementation support program between the months of January 2013 and December 2013. The support cycle varied between 3 months to 9, with an average of 5 months of support between the initial assessment (pre-test) and progress assessment (post-test).

3.2 QUANTITATIVE CVM ASSESSMENT SCORES

The following section describes the results of the quantitative scoring analysis from the CVM assessment tool, for the clinical effectiveness (CE) scores and practice efficiency (PE) scores.

Table 4 summarizes descriptive statistics of the clinical effectiveness (CE) and practice efficiency (PE) scores for the pre-test (Initial assessment, pre-test scores) and post-test (Progress assessment, post-test scores). The pre-test scores for clinical effectiveness show that most of the physicians in the sample were functioning at a mid-level range of 2.98. Post-test, the mean rose to a CV level of 3.94.

Table 4- Clinical effectiveness and Practice efficiency scores pre and post test

Statistic	CVM assessment scores			
	Pre-test CE	Post-test CE	Pre-test PE	Post-test PE
Mean	2.98	3.94	2.68	3.86
Median	2.9	4.0	2.9	4.0
Mode	2.9	4.0	2.9	4.0
SD	0.51	0.10	0.41	0.39
Variance	0.26	0.01	0.16	0.15
Score range (min-max)	1.4-3.9	2.9-4.3	1.9-2.9	3.6-4.0
P-value	<0.001		<0.001	
Mean change in score	0.96		1.18	

Note the CE scores were higher in pre-test than the PE scores, and both scores were similar on post-test. Figure 7 provides a graphical view of the frequency of distribution of the 'change' in score, from pre-test to post-test, for clinical effectiveness. The mean change in CE score was calculated to be 0.96, but you can see that a change in score of 0.5 and 1.1 was the most common change followed by 1.0. Only one physician had a score change of 2 points and one with no change at all. The significance of this clustered distribution of score change is explored further in this paper.

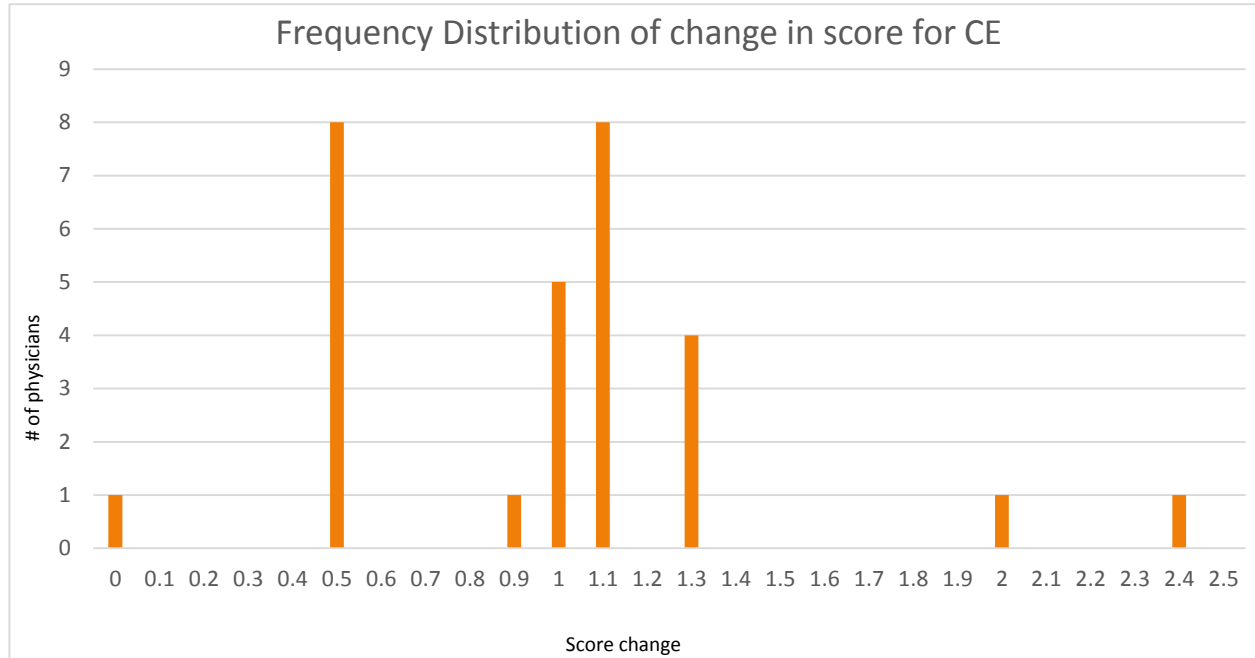


Figure 7 - Frequency distribution of change in score for clinical effectiveness

In order to determine if the change in scores from pre-test to post-test were statistically significant, a paired t-Test was conducted for both the clinical effectiveness scores and the practice efficiency scores. Based on the p value of $p < 0.001$ the null hypothesis was rejected, that there was no mean difference between the variables, and accepted the alternate hypothesis that there was a significant difference between the pre and post test scores for clinical effectiveness. The same test was conducted for the practice efficiency scores, and the results also indicated a statistical difference between pre-test and post-test PE scores.

3.2.1 Sub-group analysis

Two groupings of physicians were identified: those who's Clinical Effectiveness scores changed by ≤ 0.5 and those whose scores changed ≥ 0.9 . The group whose CE scores changed by ≤ 0.5 are part of group A, and those whose scores changed more than 0.9 are part of group B. There is a natural split, with 9 physicians as part of Group A and 20 as part of group B, out of the total sample size of 29 as illustrated in Figure 8.

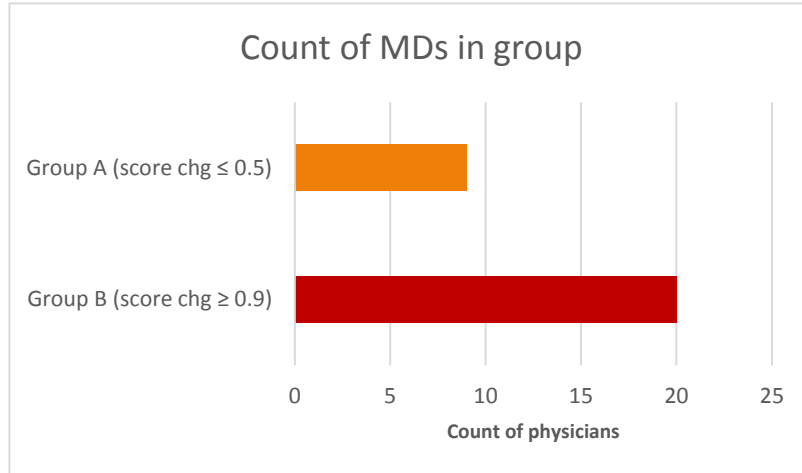


Figure 8- Count of physicians in groups A and B

Of note in

Figure 9, Group A users had higher mean scores for both Clinical Effectiveness and Practice Efficiency on pre-test (Initial Assessment- pre-test), than Group B users. Both groups experienced the similar average change in score of 1.17 and 1.20 increases in PE scores, from pre-test to post-test. Group A users were all assessed at fairly high levels of EMR use with a mean score of 3.54 on initial assessment. Group B has a lower mean score on pre-test of 2.72, and both groups had similar mean post-test scores, of 3.98 for group A, and 3.92 for group B. The outcome of interest is that they started off at different levels and ended up at similar points.

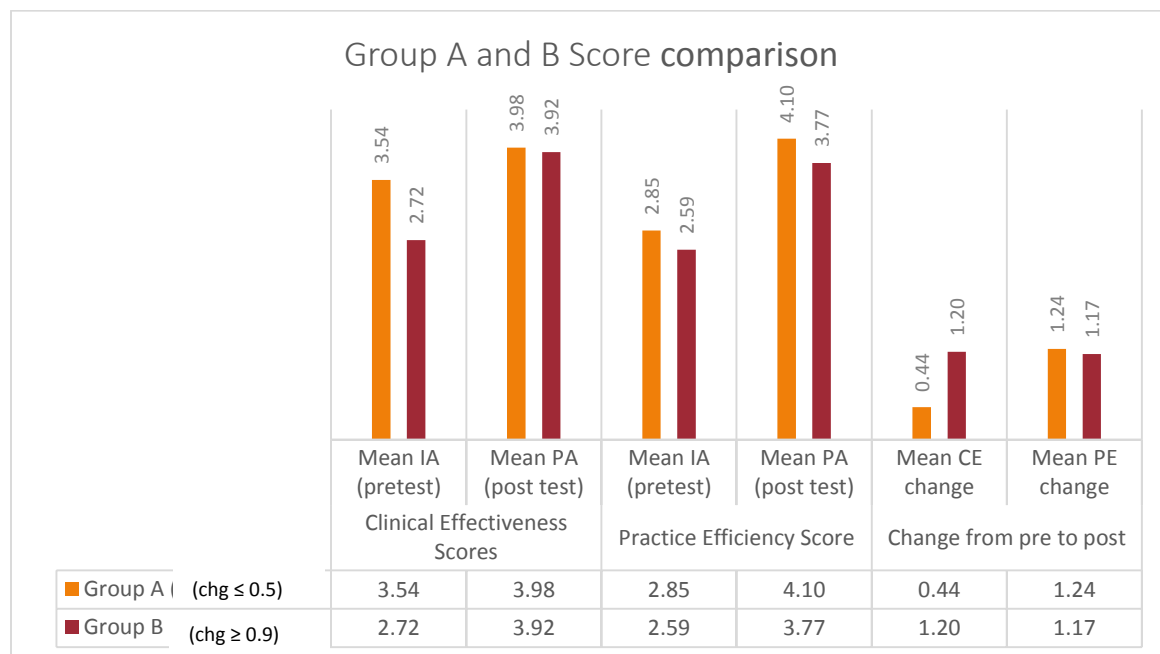


Figure 9- Mean score changes and comparison for groups A and B

3.3 QUANTITATIVE CVM ASSESSMENT RESPONSE ANALYSIS

As discussed in the background in section 1.1, responses are captured based on a physician's use of a particular workflow, as either 'yes' or 'no'. The response is then further qualified with a statement regarding; the degree of use, interest in use, or any barriers to use, either related to workflow using the EMR, or related to EMR functionality.

3.3.1 Responses describing EMR functionality or readiness barrier by clinical value level

Table 5 lists the number of 'No' responses qualified by an EMR functionality barrier or interest/readiness barrier for the whole sample (groups A and B combined). According to these results, the only items limited by EMR functionality are at CV level 5.

Table 5 – All participants' post-test responses of 'No' for questions indicating EMR functionality barrier or no interest

Responses by CV level	Count of response
6. No - Functionality Not Available	23
CV5 Levels	23
7. No - Not Yet (too far out)	72
CV4 levels	2
CV5 Levels	70

Note that no physician in either group indicated that 'EMR functionality was poor' at levels CV4 and 5. CV level 4 questions with 'No' responses were not qualified with 'EMR functionality was poor' or 'not available', indicating that EMR functionality is not a perceived barrier at CV level 4. Responses of 'No not yet- too far out' means the physician is not ready or not interested to adopt a particular EMR function. These responses are considered to be readiness barriers. According to these responses, the EMR functionality and readiness barriers lay at CV5 levels for this physician sample. Furthermore, there was three times the number of readiness barriers to EMR functionality barriers.

3.3.2 Response analysis group comparison by all clinical value levels

Noting that EMR functionality and readiness barriers existed primarily for CV5 levels, the sample was then broken down into the two groups. They were compared to identify if there was a difference in response to questions (workflow descriptions) between the two groups.

Figure 10 presents this comparison between the two group's responses as a percentage. It looks at which workflow descriptions were answered 'No' on post-test, qualified by 'EMR functionality barrier', or 'not yet/no interest' for all CV levels. There were a small percentage of responses in group B at CV levels 3 and 4, which indicated some perceived functionality or readiness limitations at lower levels. In particular, 'adding clinical data to requisitions and forms' at level 3, and 'analysis of scheduling reports' and use of 'decision support for requisitions' at level 4. In particular, 'adding clinical data to requisitions and forms' at level 3, and 'analysis of scheduling reports' and use of 'decision support for requisitions' at level 4.

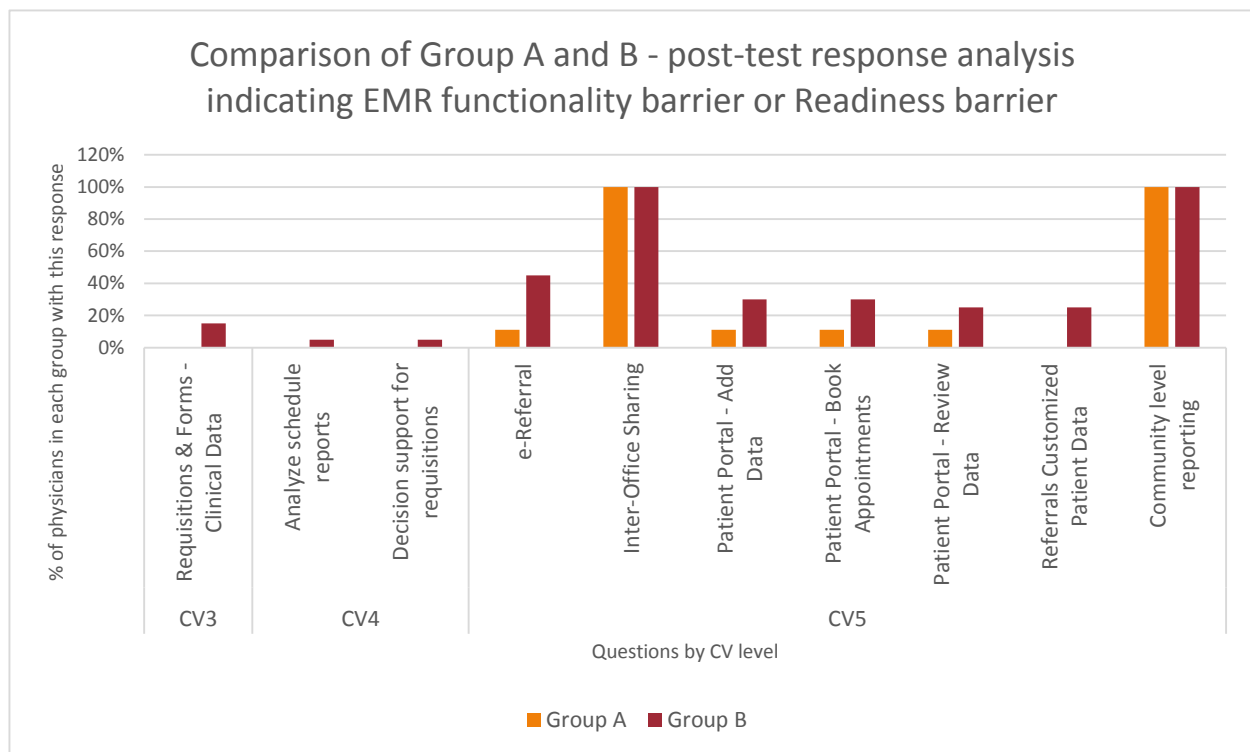


Figure 10 - Comparison of group A and B, responses indicating an EMR functionality barrier or limitation by all CV levels

Group B had the similar responses for CV5 workflow items as group A, with one addition 'referrals with customized patient data'. Group B has a slightly higher percentage of no responses than group A with 'e-referral' and 'patient portal'; patients reviewing data in their charts, booking appointments and contributing to their charts by adding data. Unanimously, 'inter-office sharing of patient charts' (meaning, other healthcare providers charting in the primary care chart from a remote access point), and 'community sharing of aggregate reports' (meaning community level population reporting) were common barriers to both groups.

3.3.3 Response analysis group comparison for clinical value level 4 by qualifier

In order to further understand differences between the two groups, all the possible qualifiers to any 'No' response were reviewed. Figure 11 includes all the 'No' responses for CV4 workflows only, by group B since as noted above group A did not respond 'No' to any questions at CV4.

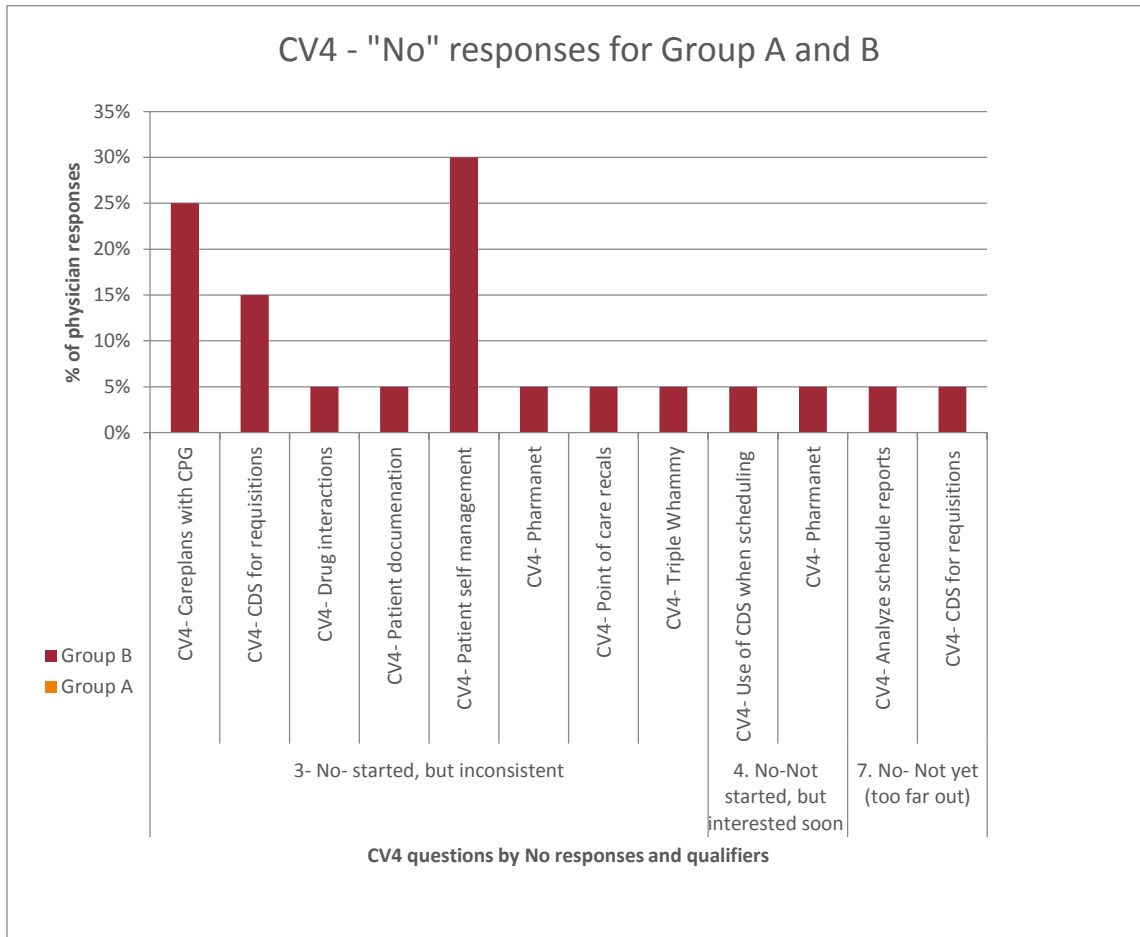


Figure 11 - CV4 'No' responses for groups A and B

This included all the 'no' response qualifiers listed in Table 3 but there were only three qualifying statements chosen by physicians. Group B physicians responded, mostly with a future interest in use, or using but just starting to use certain functions. Group B who did have the highest score change, were still not using some CV4 functions on post-test. Also of note, are the responses above in Figure 10, barriers to CV4 'analysis of scheduling reports' and 'decision support for requisitions' elucidated in Figure 11 simply being 'not yet, too far out'.

Figure 12 illustrates both groups' responses to CV5 level questions. Group A had the majority of their responses in the 'Not yet too far out' category, for community sharing of aggregate reports. However both groups unanimously agree that this function is too far out. For the response option of 'functionality not available', 70% of group A responded that only inter-office sharing of charts was not available, whereas group B perceive that 'e-referral' and use of 'referrals with customized patient data' was an EMR functionality barrier.

Patient portal appeared to be of interest for over half of both groups based on the 'not started but interested soon' qualifier. Responses to 'patient portal - reviewing data' indicate that they had started using a patient portal in practice but not consistently, 5% and 50% for groups A and B respectively. For this same question about patient portals, 30% of group B users and 10% of group A users feel this function is still 'not yet, too far out' indicating limited readiness or interest at the time of post-test.

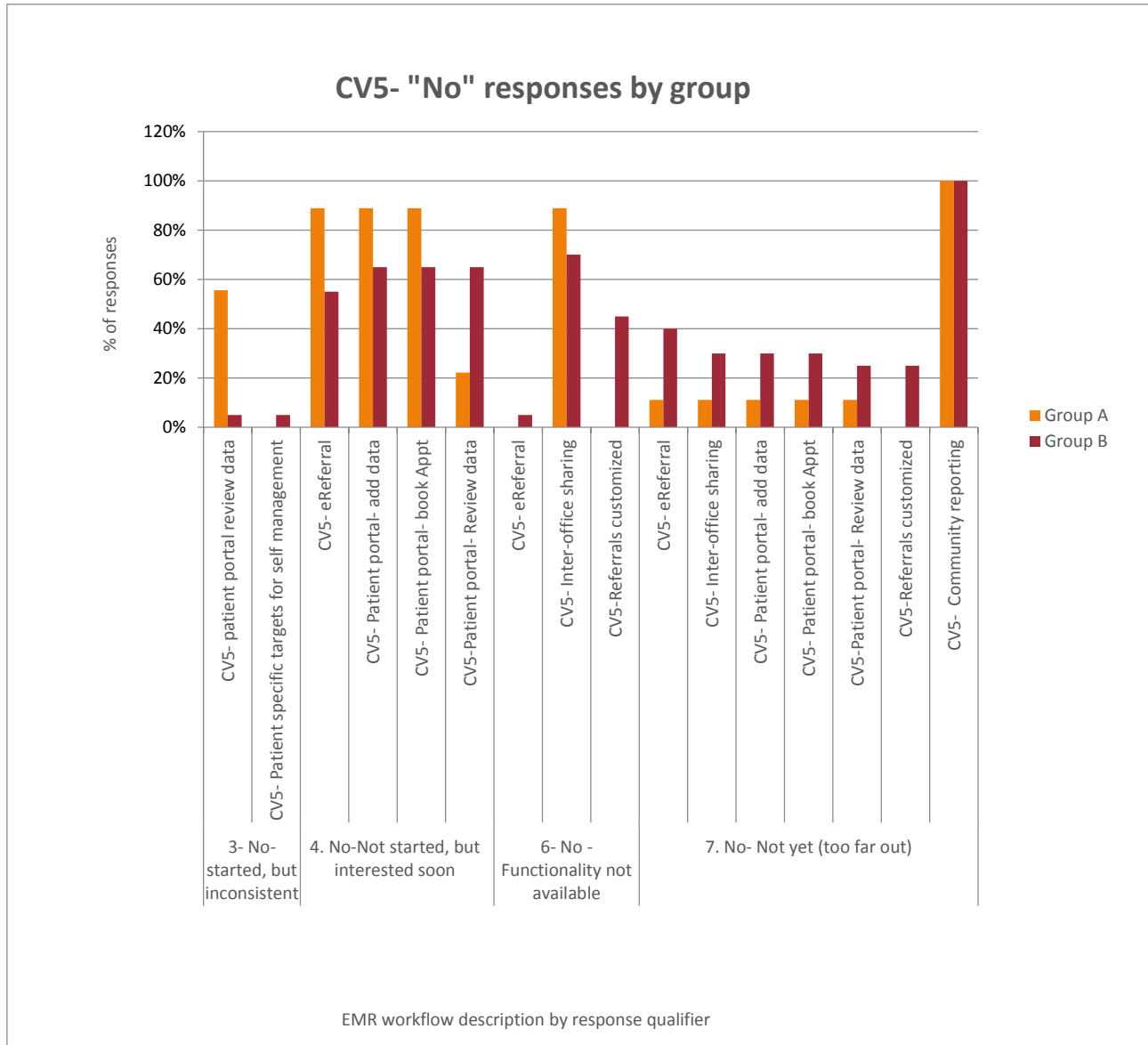


Figure 12- Group comparison for 'No' responses by CV5 level questions

3.4 QUALITATIVE DATA FROM THE CVM ASSESSMENT SURVEY SUPPORT PLAN

The following section describes the results of the qualitative analysis of the support plan created as an outcome of the initial CVM assessment (pre-test). The support plan included types of supportive ‘actions’ a physician was provided, by a certain ‘resource’. The ‘method’ of support as described in the background of this paper, for example, 1:1 sessions, or group sessions was not identifiable in the support plan data as it was supposed to be. The practice coach did not describe in each action step what

method of support was provided. One could presume that user groups are provided in group sessions, however practice coaching, peer mentoring could be provided in either 1:1, groups, remote sessions or face to face. Therefore it was not possible to include the ‘method’ of support in the data analysis.

3.4.1 Support plan overview

Each of the 29 participating physicians had a support plan created by the practice coach, with supportive actions assigned to a resource person who would provide the support. In this sample, the number of supportive actions varied from 2 to 8, with an average of 6.5 actions per plan and a total of 190 actions for the whole sample.

Most of the action steps contained more than 2 different supportive action themes, for example, ‘annotating medications’ and ‘medication reporting’ are two different themes but part of the same action step assigned to a common resource.

3.4.2 Comparison of support plan between groups A and B

The analysis below explores the differences in the support themes each group received as part of their action plan. Figure 13 illustrates these differences in graphical format. For group B, those who experienced a greater score change and had a lower mean initial clinical effectiveness score, had a

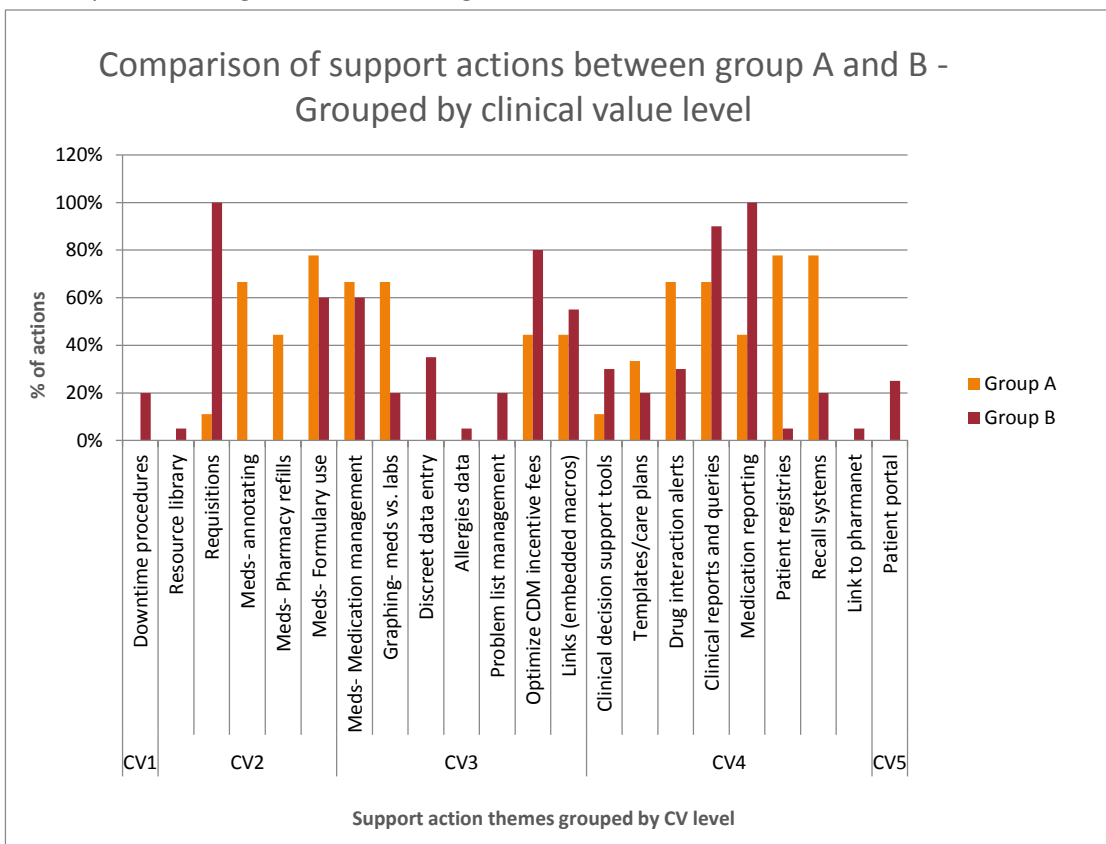


Figure 13- Comparison of support action themes between groups by clinical value level

greater variety of categories of support actions as part of their plans. There were 7 more categories of actions assigned to group B compared to group A. Of particular note, 'problem list management', 'discreet data entry', and 'Allergies data' are actions taken by group B, but not group A. Group A had two themes of actions which were not part of group B's plans, 'annotating medications' and 'pharmacy refills'. All of these areas for both groups are CV level 2 and 3 functions and related to lower level EMR use (Smith, 2011).

At CV2 levels, 'requisition management' are more noticeably part of Group B's action plans. Reporting functions such as 'medication reporting', and 'clinical reports and queries', which are CV4, items were also notable for Group B. Group A had fewer physicians requesting support in these areas.

However, group A users did have CV2 level items on their action plans, in particular, the two mentioned above and 'prescription formulary usage'. CV level 3 items on group A's action plan included 'medication management', and 'graphing labs and meds'. Both groups at CV3 were interested in 'links with embedded macros' however group B had twice as much interest in 'optimizing CDM incentive fees' than group A.

There were no CV level 5 items on the group A's action plans, despite the fact that in Figure 12 indicated an interest in 'e-Referral' and 'patient portal' on post-test for this group. Whereas a quarter of group B physicians indicated interest in patient portal on their support plans. Additional response analysis for pre-test questions may be of benefit, however to limit the scale of this study, this analysis was not done. The approach was to assume that actions on the support plan indicated area of interest in improving meaningful use.

3.4.3 Analysis of 'resources' assigned to support plans

Each action in the plan is assigned to a different resource. Resources available to support physicians via this support model, are the practice coach (PAC), peer mentors, user groups, the clinic or physician themselves, or EMR vendor training. Figure 14 shows the resource to which the actions were assigned. It appears that Group A more strongly favoured user groups as a support resource, versus group B who favoured peer mentor support. It's possible that lower level users of EMR preferred the 1:1 support with peer mentors versus the group learning's that were offered in user groups. The statistical differences between groups were not compared. However in group B, there were a greater variety of support resources used, including physician action and unassigned support. The unassigned support could be a data error, or omission on the part of the practice coach when creating the plan or an

indication of lack of resource able to support that particular action. No actions were assigned to EMR vendor training for any physician in either group.

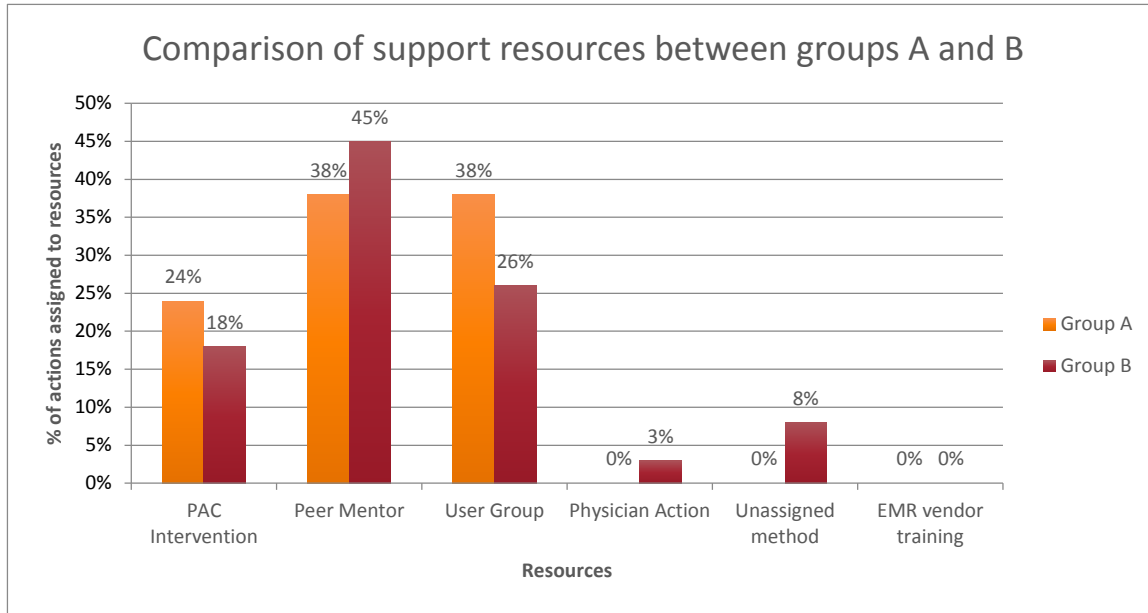


Figure 14- Comparison of percentage of support resources assigned to actions between groups A and B

3.5 QUANTITATIVE DATA FROM CVM FEEDBACK SURVEY

The following section presents the results of the analysis of the structured responses to the feedback survey. Each physician completed this survey following the support phase and post-test (progress assessment), in order to rate the quality and value of the service. Only a selection of questions were analyzed based on their relevance to the study aim. For the following questions, responses were structured using nominal or ordinal scales, but with a limit of 3-5 choice scales depending on the question. Each physician who participated in the support program completed this survey in order to be eligible for reimbursement funding, and therefore the response rate was 100%, and the ‘N’ for this data set is 29, the same physicians who participated in the support phase.

3.5.1 Rating of the CVM assessment and impact of EMR meaningful use

The following questions relate to the CVM assessment (pre and post-test) itself as a measure of EMR meaningful use, and the effect of EMR meaningful use on clinical practice. These responses offer some insight from the participant’s perspective regarding the value of the tools, process and the program. Specifically how accurately the pre and post-test measured clinical value of EMR, how clinically

valuable advancing EMR meaningful use is in general and finally, to what degree did the support program assist EMR to effect both practice efficiency and clinical effectiveness.

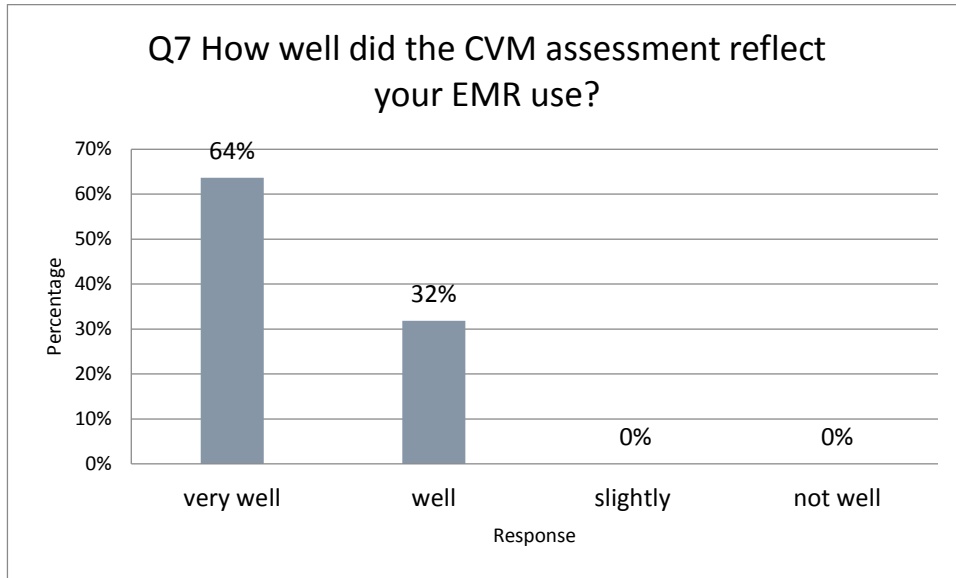


Figure 15- Physician’s responses to “how well did CVM assessment reflect EMR use” by percentage

All physicians responded that the CVM assessment reflected their EMR use well or very well (Figure 15).

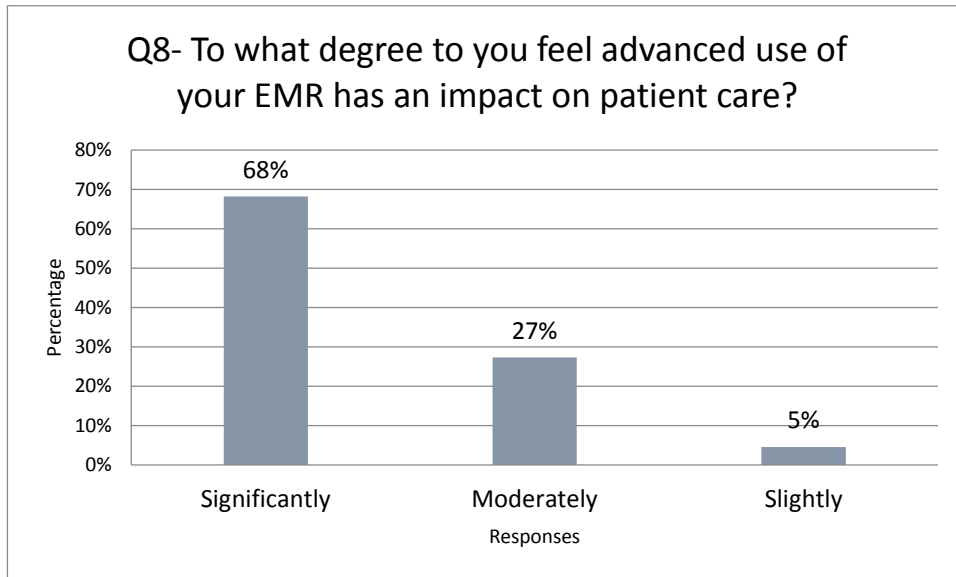


Figure 16-Physician's responses to “what degree advanced use of EMR impacts patient care” by percentage

95% of physicians responded that advanced EMR use impacted patient care significantly or moderately (Figure 16).

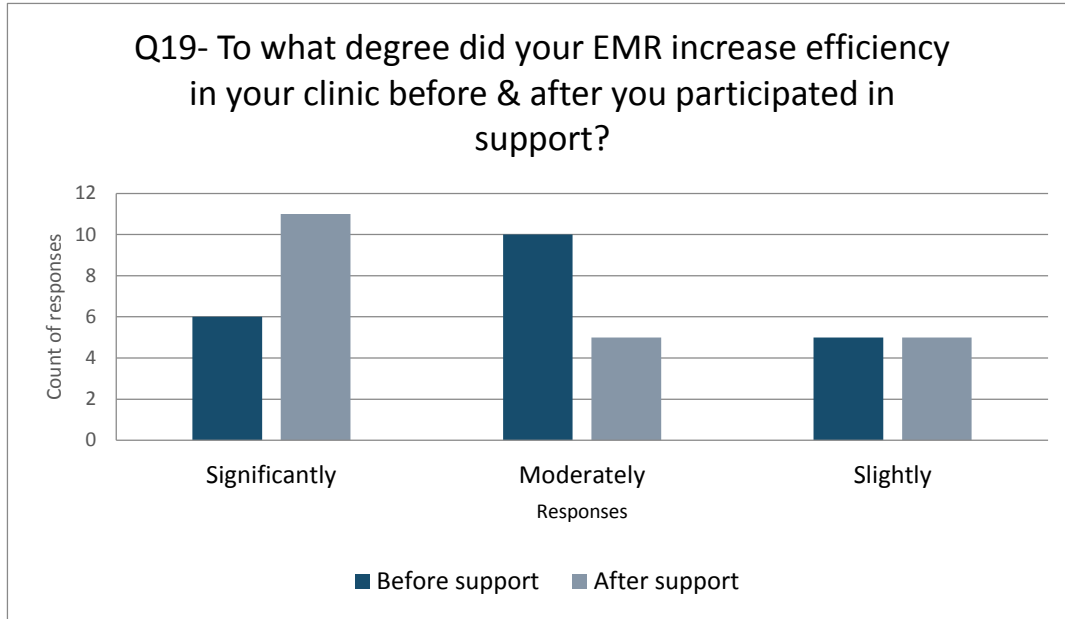


Figure 17- The change in perceived impact of EMR on efficiency before and after support

Figure 17 describes a rather complex response to the question 'To what degree did your EMR increase efficiency in your clinic before and after you participated in support?' Its noted that the response choice of 'significantly' increased by almost double from before to after support, while the response of 'moderately' went down by half for before to after support, with the choice of 'slightly' remaining the same for before and after. This indicates that subjectively and retrospectively the support program seemed to increase the EMR's effect on efficiency in the office. This perception is not seen to the same degree in Figure 18 below, which answers a similar question but for clinical effectiveness. In this case, the 'significantly' responses went up by 3, and 'moderately' responses went down by 2.

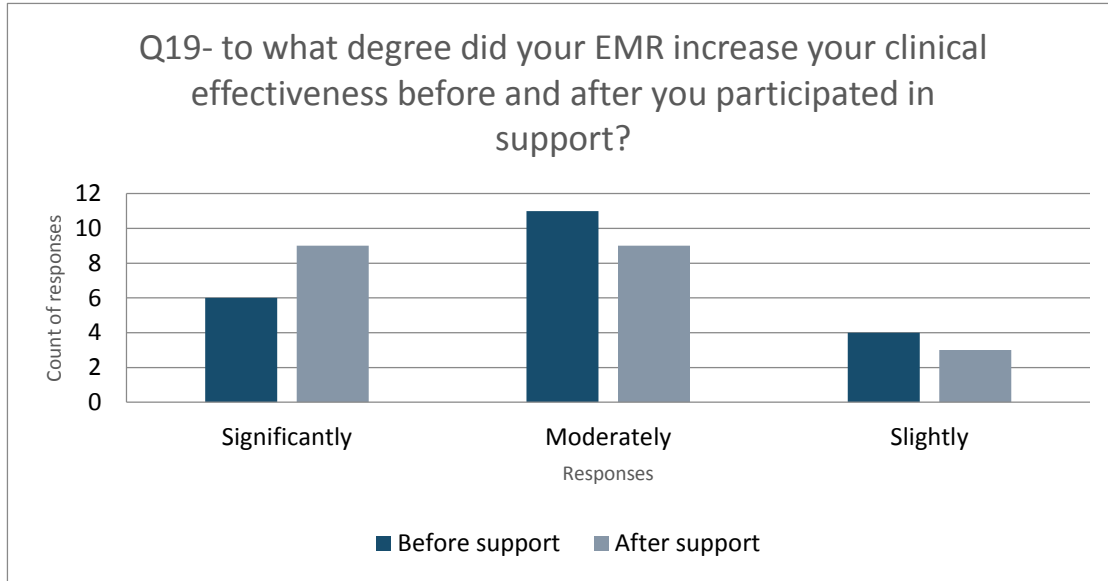


Figure 18- The change in perceived impact of EMR on clinical effectiveness before and after support



Figure 19- Physician rating of the overall experience of the support program

100% of physicians rated their experience with the in-practice support program as good or excellent (Figure 19).

3.6 QUALITATIVE DATA FROM CVM FEEDBACK SURVEY

The following section presents the qualitative analysis results of the free text responses to the same feedback survey in section 3.5. Most of the questions in the survey contain an area to record free text comments. Three questions that contained comments were analyzed out of a possible 21 questions. The volume of free text comments was fairly low, with 34 comments from 10 physicians for the three questions. The analysis of these free text comments, included grouping of comments into themes and categories using thematic analysis. For one question (Table 6) the responses could not be categorized into various themes simply due to limited number.

3.6.1 Feedback on support program overall

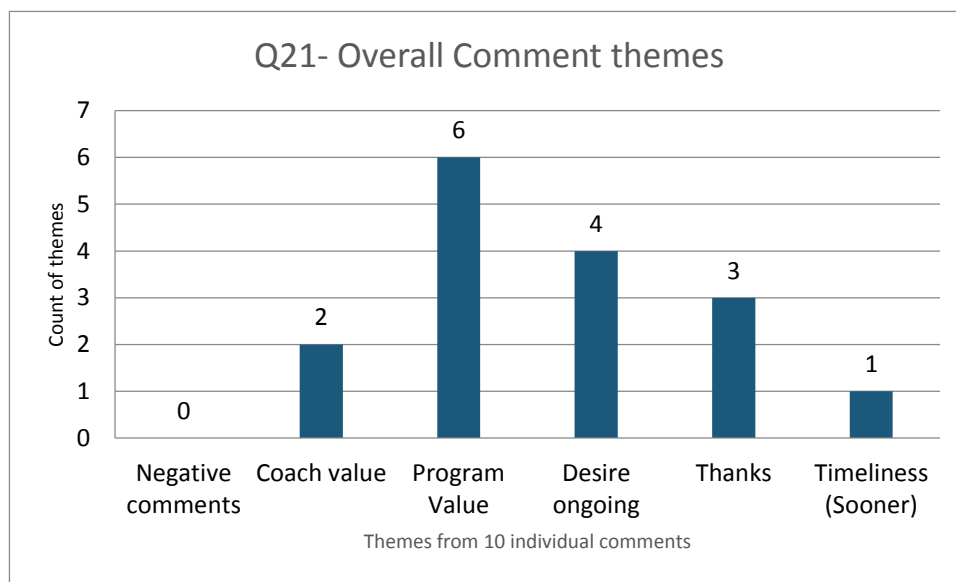


Figure 20- Count of comment themes for the question regarding overall feedback on the support program

Figure 20 is a summary of the free text comments for the question 'rate your overall experience with the in-practice support program' grouped into the most common themes. The lack of negative comments aligns with the positive feedback in the structured response area in Figure 19. The themes of the comments related to the program's value, the coach's value, a desire to have ongoing or continued support, with a few comments simply thanking the organization for the experience.

3.6.2 Feedback on effectiveness of methods of support

Table 6 is a tabulation of the comments verbatim, relating to the question ‘How effective was each support resource’. They are grouped by resource and then broken down into positively themed and negatively themed comments. Of particular note, there were only positive comments for the peer mentors, and more negative comments for the effectiveness of user groups and vendor training. The one negative comment regarding the coach, was related to the absence of support during EMR implementation, for which there was no practice coach involvement¹².

Table 6- Tabulation of the positive and negative comments regarding each support resource

Support resource	Positive comments	Negative comments
Coach	Helpful, achieve goals, identify gaps in EMR use	Need strong support at implementation and extended period after
Peer mentor	Very helpful	
	Very worthwhile	
	Useful, 1:1, specific areas/questions, approach problems	
	More training from peers, know EMR use from MD perspective	
User groups	Helpful review of how to do	Value more 1:1 support
		Circulate tips and tricks learned in UG
Vendor training		Expensive, superficial, complex program (EMR)
		Poor, disorganized, not able to demonstrate EMR
		Could have been better
		Extremely poor

13

In section 3.4.3, Figure 14 which describes the resources assigned to the practice plans, user groups and peer mentors were each used about 1/3 of the time as a resource. Vendor training was not used at all as a resource in the practice plans, yet there were four comments in this feedback question relating to vendor training, notably all of which were negative.

¹² This is based on the researcher’s inside knowledge of the PITO’s programs

¹³ N = 10 physician’s comments

3.6.3 Feedback about expected impact of Support on practice efficiency and patient care

Figure 21 describes the free text responses categorized into themes based on expected impact of support to both practice efficiency and patient care, with several comments referring to generalized positive impact.

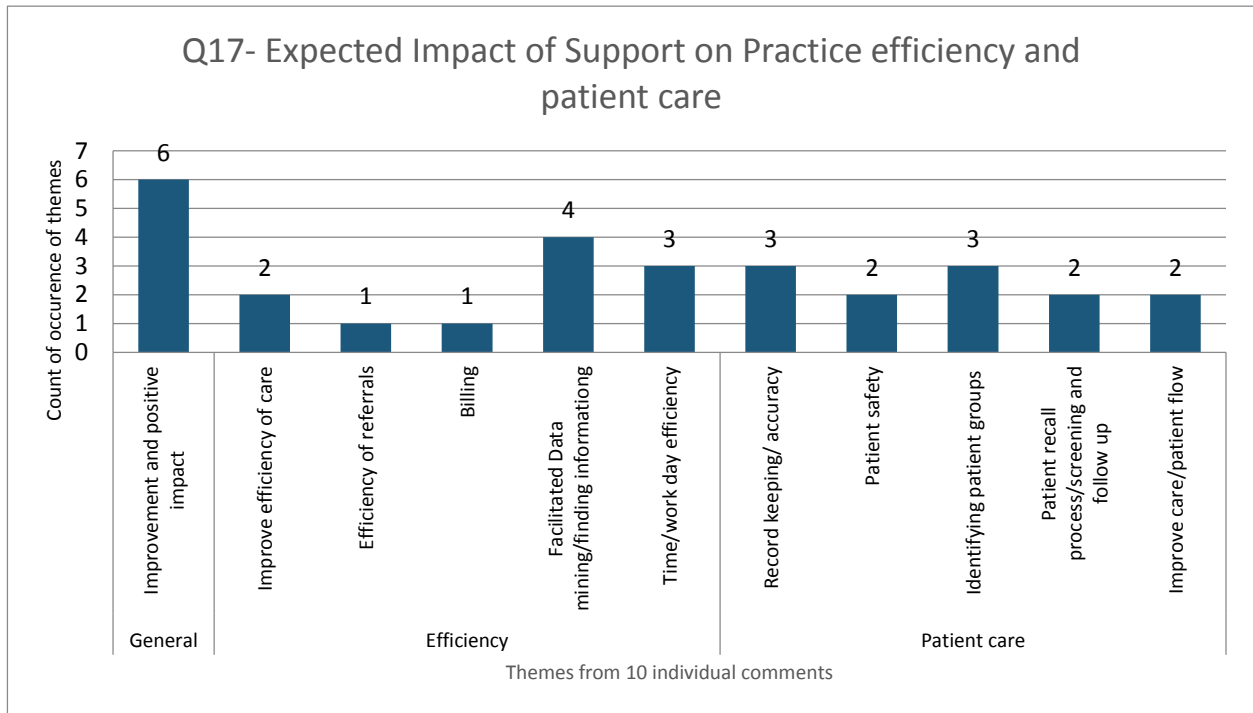


Figure 21- Count of themes for responses to question regarding the expected impact of support on practice efficiency and patient care

For practice efficiency the most common themes related to finding information or data mining, and for patient care regarding accurate patient records, and identifying patient groups. These themes indicate that the majority of the expected impact of support on improved use of EMR relates primarily to data quality; ability to find information (data), patient records, and finding patient groups all relate to coded data within an EMR. All of these are part of EMR use, or clinical value level 3, which focuses on the presence of coded data in an EMR. Comments for this question all indicate that physician’s surveyed expect a positive impact on patient care and practice efficiency after receiving support.

These results were not further analyzed by groups A and B. The rationale for this, was that the results in section 3.5 were all positive and therefore there did not seem to be any additional value from a further analysis by physician group. Additionally, the sample of free text responses for this section was

fairly limited and therefore breaking it down into smaller samples for each group did not seem reasonable.

4 DISCUSSION

To our knowledge, this is one of the first studies in Canada that has reviewed the effect of an in-practice support program on physician's meaningful use of EMR. The sample of 29 physicians included in this study were all from the same division of family practice, within a semi-urban area, had used the same EMR software for over one year, and were supported by the same practice coach during the program. This helped to reduce some of the variability of the larger data sample available for physicians across BC. The availability of four different types of data provided a rich overview of the effect of the support program on EMR meaningful use.

Four key findings resulted from this research. First, meaningful EMR use increased for all participants in the program. Second, there are several barriers to EMR meaningful use. Third, the level of actual EMR use does not seem to correlate to level of EMR support desired by these same physicians. Finally, EMR vendor training, although available, was not used as a method of support.

There is one recommendation made as a result of this study, and three suggested future research directions.

4.1 KEY FINDINGS

4.1.1 Improved meaningful use

All physicians in this study improved their meaningful use scores. Based on the physician's subjective responses in the CVM feedback survey, the physicians felt the clinical value model assessment tool provided an accurate reflection of their EMR use.

During the quantitative scoring analysis, there emerged two natural groupings of physicians. Group A had a higher level of EMR use on pre-test and their clinical effectiveness scores changed the least. Group B had a lower level of use on pre-test but showed a greater change in EMR use score on post-test.

Both groups A and B's final combined mean scores for both clinical effectiveness and practice efficiency were close to CV level 4. Since the final mean scores on post-test for both physician groups were similar, this could indicate the possible "EMR ceiling" effect as suggested in the research on EMR

adoption by Price, Singer and Kim in 2013 (Price, Singer, & Kim, 2013). Similar to their findings, in this study, many of the highest level functions such as e-Referral, aggregate reporting and patient portal are not being used by physicians and both groups of physicians had similar 'No' responses to these functions. Therefore an analysis of the post-test response 'qualifiers' to questions at levels CV 4 and 5 was done in order to better understand any possible barriers to increased EMR use.

4.1.2 Barriers to increased EMR use

There were four barriers to EMR use identified through the additional response analysis that were consistent with findings from others who examined EMR use: EMR functionality barrier (e.g. an EMR ceiling effect (Price, Singer, & Kim, 2013)), lack of awareness of EMR functionality (Price, Singer, & Kim, 2013), physician readiness barrier (Wise, Alexander, Green, Cohen, & Koster, 2011) (Weiner, Amick, & Lee, 2008), and lack of support resources (Lau, Price, Boyd, Partridge, Bell & Raworth, 2012).

Physicians were able to respond to the EMR workflow questions with 'Functionality not available' to indicate that they perceived that there was an EMR functionality barrier for those items. The entire sample of physicians responded this way to at least one CV5 level item, but did not choose this response for any CV4 level item. This substantiates one reason why the mean scores for both groups of physicians remain at CV4 and no higher on post-test. The more detailed look into which questions physicians responded this way, indicates differences in perception of availability of certain EMR functions, such as e-Referral. This could mean that the EMR was configured differently for some users, or they had not subscribed to certain functionality. Lau et. al's recent clinical adoption evaluation in two BC primary care practices, identified over thirty EMR usability issues, including configuration issues, and default settings, all of which can affect how a physician perceives the usability of the EMR (Lau, Partridge, Randhawa, & Bowen, 2013).

The findings above may also be explained by a lack of EMR functionality awareness on the physician's behalf rather than a true functionality barrier. Some of the physicians indicated that they were using the e-referral function. It was therefore available (either as part of the usual product, add on or configurable feature) to some physicians. Those physicians who responded that it was not available were simply not aware of its availability to them. This is based on their colleague's responses, which indicated they were using this function, or there was no barrier for this function. This meant some physicians expressed no concern with that feature, indicating those who thought it was unavailable, were either not aware or their EMR's were configured differently. These findings are similar to those of

Price, Singer and Kim when they concluded that a lack of EMR functionality awareness may be a barrier to increased meaningful use (Price, Singer, & Kim, 2013).

The barrier of 'lack of readiness' on the physicians part to use a particular function is indicated by the response to assessment questions with 'not yet – too far out'. For the higher levels of use, there were a greater number of responses with 'no, not yet - too far out' than there were for 'no-functionality not available'. This indicates that lack of physician readiness to adopt higher level EMR functions was the largest barrier to EMR use in this study. Group B physicians had a greater number of readiness barriers than group A physicians, with the latter group indicating readiness barriers only at the highest level of EMR use (CV5). One possible explanation for why the groups had different readiness barriers, could be comfort level with EMR to begin with. Those with higher initial scores (e.g. Group A) may have had more comfort with their EMRs at the beginning of the study. Group A had no negative responses to any CV4 level items, indicating a comfort with this level of EMR use. Group B indicated by their responses to CV4 items, that they had just begun to use certain functions and for others, had a future interest. This substantiates that they had a lower comfort level with EMR overall than Group A users.

However both groups responded with the similar readiness barrier to a CV5 level function of 'community sharing of aggregate reports'. Weiner et. al describe in their 2008 review of the literature regarding organizational readiness for change, that readiness must be defined as being "willing and able" to change. In other words, is the physician willing adopt this higher level EMR function such as 'community sharing of aggregate reports' and is the EMR able support this function (Weiner, Amick, & Lee, 2008). Physicians had the option of responding that the EMR functionality was not available, therefore the lack of adoption indicated that it was an issue of readiness rather than availability. These physicians were all from the same division of family practice and 'EMR community of practice'¹⁴ using the same EMR software. Therefore, they were in a good position to share aggregate population reports as some divisions in BC have begun doing.¹⁵ According to Weiner's definition of readiness, this indicates they were not 'willing' to consider this function, since they could have been 'able', therefore there is a readiness barrier for this high level function. Whether their lack of willingness was due to factors such as lack of time, resources, culture of community practice or simple lack of interest is unknown.

¹⁴ <http://pito.bc.ca/support/communities-of-practice/>

¹⁵ <https://www.divisionsbc.ca/datacollaborative/partnerships>

Finally it is also possible that there were no support resources available for CV5 items, or that the time limit on support prevented work on these areas. This in itself could be a barrier to higher levels of EMR use. This finding was reflected when the only CV level 5 items actioned to the support plans were not assigned to a support resource. Whether or not this indicated a pervasive lack of support resources for CV5 items, there was no additional data available to provide any further insight.

4.1.3 EMR use and desired support

The thematic analysis of support plan actions for both groups of physicians indicated that physicians were interested in working on lower level CV2 and 3 items. This is despite the fact that most physicians scored above 3.0 on the pre-test. In particular, group A physicians whose mean pre-test score was 3.54, had many actions in their support plans relating to CV2 and 3 levels.

The results above indicate that desired support was not limited to 'use' of EMR but perhaps 'optimal' use of EMR. These results occurred because physicians may have responded in pre-test to CV questions with 'yes' I am using this function, which created a positive score for that function. However the response could have been qualified with statements that indicated an additional desire to work on this area to further improve its use. One would have expected to see a physician who scored above 3 on pre-test exclusively request assistance with areas they were not using at levels 4 or 5, but this was clearly not the case.

Additionally both groups of physicians, indicated that the support they received was of value based on the positive rating of the overall support program. Furthermore, the thematic analysis of feedback responses indicated high value of the program and desired ongoing support, despite high levels of EMR use by these physicians. In the written feedback regarding each resource, the physician's comments suggested they greatly valued access to peer mentoring and coaching support. These findings are in line with recommendations made in the literature regarding peer support and IT change facilitation (Brookstone & Brazillier, 2003) (Markus & Benjamin, 1997).

4.1.4 Methods of support

Support resources available to physicians in this study included peer mentors, the practice coach, user groups and EMR vendor training. In this sample of physicians, the support resources used were peer mentors and user groups as most common resources followed by the practice coach.

The key finding of the support analysis was the complete absence in the use of EMR vendor training as a support resource. There were no actions in the support plans assigned to EMR vendor training for any physician in either group. This type of support was available to the physicians, and the

costs were reimbursable out of their CV3 achievement outcome payment. The availability of EMR vendor training is part of the advertising and engagement strategy for the program, so the physicians should have been aware that vendor support was available to them. The EMR vendors would not have been made aware of their client's participation in the program unless the physician expressed interest in EMR vendor training. Therefore it must be assumed that the physician's declined to use EMR vendor training as a resource for support.

Within the action plan qualitative analysis, there did not appear to be an indication as to why this support was not utilized. However, in the qualitative analysis of the CVM feedback survey, there were several negative comments made regarding the quality of EMR vendor support and training. However none of the physicians received support from their EMR vendor in this program, so it is probable that the feedback in the survey is directed towards the physician's experience in EMR implementation. If they felt their experience with vendor support was negative as the comments suggest, then that may provide an explanation as to why the physicians did not choose EMR vendor support as a resource during this program. In Protti's comparison of the support models in Denmark and New Zealand, they note that primary health care organizations work closely with EMR vendors to develop the EMR functionality (Protti, Bowden, & Johansen, 2008). Further research of the role of EMR vendor support in improving EMR meaningful use may be of benefit.

4.2 RECOMMENDATIONS

One objective of this study was to provide PITO with recommendations regarding its program and clinical value model of EMR meaningful use assessment. Additionally, this study was to provide direction regarding future research, which may be of interest in the field of EMR meaningful use and the provision of support to primary care physicians.

This study revealed a lack of correlation between the CVM scores and the level of desired support. This speaks to the benefit of measuring the degree to which a physician is using the EMR, rather than a simplified 'yes' or 'no' answer. Therefore looking exclusively at the scores and support plan it is inconclusive if the support increased meaningful use of EMR or simply focuses on improving the optimization of EMR use. If it's the latter, it may be better measured by the degree of competency with their EMR use rather than the more black and white CV assessment usage score method.

Although not part of the EMR use scoring mechanism, PITO did ask physicians who participated in the support program to provide feedback via a survey. The analysis of this survey feedback indicated

that participation in the program was of value to them, and they expected it to have positive impact on EMR use and patient care.

The two points above may indicate that regardless of the meaningful use score, the support to help optimize workflow and use for all levels of EMR, is of value to physicians. In fact, Lau, Price and Keshavjee have established a conceptual model for Clinical Adoption (CA) of health information systems based on Canada Health Infoway's Benefits Evaluation framework (Lau, Price, & Keshavjee, 2011). In this model, EMR use and user satisfaction are both critical components of EMR usage quality. Lau, Partridge, Randhawa, and Bowen (2013) recently applied this CA model in two primary care practices who had newly implemented EMR. They found that user satisfaction was good, despite some areas of low usage such as clinical decision support. They did however recommend ongoing support and training over time in order to realize the clinical value of EMR beyond implementation. Meaningful use models in the United States (US) are based on reaching a threshold of objectively measured use of EMR which may better determine the degree of EMR use. In an article describing the Health Information Technology adoption meaningful use model in the US, they define a meaningful use level and quality (Behkami, Door, & Morrice, 2010). Grevier et al. argue the point further. They state that EMR use which does not take into account the effect on patient outcomes, and if not supported by a presentation of objective data to the physician regarding actual use of EMR for clinical outcomes, will not have the desired effect of meaningful use of EMR (Grevier, et al., 2012). Crosson et. al agree with Grevier in their look at typical use of EMR in primary care on quality of diabetes care. They note that the provision of support to primary care users, which focuses on population management improvement, is the only way to state that EMR use is meaningful (Crosson, Ohman-Strickland, Cohen, Clark, & Crabtree, 2012). Therefore it's recommended that PITO adjust their CVM scoring model to include the depth of use of a function rather than a simple use of a function. They could include the response qualifier they currently use to the scoring mechanism to further weight the score according to degree of use. For example, 'yes-process is fine' would get a full point, and 'yes- but process needs improvement' would get a half point, indicating more accurately that if a workflow area requires improvement, the physician is not using it to the same degree as the latter response. This may better elucidate definite EMR use and better correlate to the need for support desired by physicians participating in their support program. Furthermore, as suggested by Crosson et. al, adding measures which may predict positive impact on patient care would be of benefit. For example, workflow functions, which have direct impact on patient care, such as, use of medication interaction alerts to reduce incidence of adverse events would receive more weight in the scoring mechanism. Alternatively, they could remove the subjective scoring mechanism altogether,

opting to use the assessment tool as a gap analysis to guide areas of desired support. Then subjective meaningful use score could be replaced by the objective assessment mechanism in development as discussed in the research by Grevier et. al., (2012).

4.3 FUTURE RESEARCH DIRECTION

This research contributes to the literature by offering a fairly in-depth and targeted look into the types of support and assistance physicians are requesting regarding EMR meaningful use. It provides a glimpse into the opportunities of evaluating the effect of a support program on primary care EMR meaningful use. There are three potential areas for future research based on the outcomes of this study.

First, the CVM assessment tool itself could be changed as per the recommendations above in section 4.2. Better defining meaningful use by exploring additional measures that can better reflect the depth and quality of use of EMR. For example including specific measures to assess the impact to patient care could be considered. The tool could be tested for reliability and validity prior to usage with a larger sample of physicians. Alternatively, pursuing objective validation of EMR meaningful use as in the United States would also be of benefit. Adding some objective measures of data quality would contribute to the concept of measuring depth of use, in combination with the subjective breadth of use for areas that cannot be measured objectively.

It would be worthwhile pursuing a more robust evaluation using all the data available provincially for the approximate 1200 physicians who have engaged in this program to date. Controlling for the variables of the practice coach, differing EMR software, regional differences (urban vs. rural) may offer additional insight into the overall EMR use of primary care physicians in BC. In addition to their desired areas of interest and support and possibly a prediction of their areas of future interest in EMR use. Including the objective data available would also provide further understanding of their EMR use and data quality.

Finally, an exploration of the effect on an 'EMR ceiling' could be better understood based on a detailed response qualifier analysis with a larger sample of physicians. A case study analysis of the socio-cultural effects of communities or divisions of family practice on EMR meaningful use may also be helpful to better understand EMR usage barriers such as readiness to adopt higher functionality.

4.4 STUDY LIMITATIONS

There are three main limitations to this study; the sample size of physicians, the type of data used and potential bias from 'researcher affect'.

The sample of physicians was chosen purposefully to limit additional variables such as; different EMR vendor software, different practice coach providing support, demographics variability (rural versus urban) and availability of resources in the area. However, while those variables were limited, the reliability of the findings were limited due to the small sample size (Jackson & Verberg, 2007) compared to the sample of over 800 physicians who have completed the program to date.

The data itself is limited by the inability to validate the data collection tools prior to research, which is related to the limitation of the gated scoring mechanism of the CVM assessment tool. The data itself was not collected purely for research purposes, and therefore was used opportunistically for this study and only uses retrospective analysis. The data is subjective, based on physicians' personal answers to question in the pre-test clinical value assessment tool, and the feedback survey. Additionally, the data was limited to responses to questions, without interpretation, or the ability to gain further insight to the reasons why a physician responded a certain way. Therefore the data could only tell one part of a likely complicated story of EMR use.

Another area of bias in the data collection includes the practice coach's interpretation of the physician responses to the CVM meaningful use questions, as they complete the assessment. Finally, there was no available objective data for meaningful use for these physicians.

Other possible sources of bias include 'researcher affect' (Jackson & Verberg, 2007, p. 283) based on the researcher's relationship to the program being evaluated. This is somewhat mitigated by including two academic advisors who provide feedback on the interpretation of results.

5 CONCLUSION

In this study of 29 participating physicians in post implementation EMR support program, the data collected to assess their EMR meaningful use was analyzed. This study found that the reported meaningful use of EMRs increased through the program. Subjective feedback from physicians indicates the program was of value to them, and they felt the program positively impacted their EMR meaningful use, which in turn could positively impact their patients. In this study, there appears to be little correlation between the score the assessment calculates and the level of support the physician desires.

Barriers to EMR meaningful use were identified, including the existence of an 'EMR ceiling effect', physician readiness to pursue higher levels of EMR use, and resource limitations to support the highest levels of use.

It is recommended that PITO consider changing their CV meaningful use assessment scoring mechanism to take into account the degree of use or the desired degree of support physician are requesting in the support phase.

Additionally there may be some benefit in adopting Canada Health Infoway's system and use survey, as a validated tool to measure EMR use satisfaction (Lau, Price, & Keshavjee, 2011), rather than or in addition to the current CVM feedback survey.

It is recommended that PITO use their additional data set of over 1200 primary care physicians who have to date engaged in this support program, to investigate the effect of this support on a larger scale.

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7 APPENDIX A

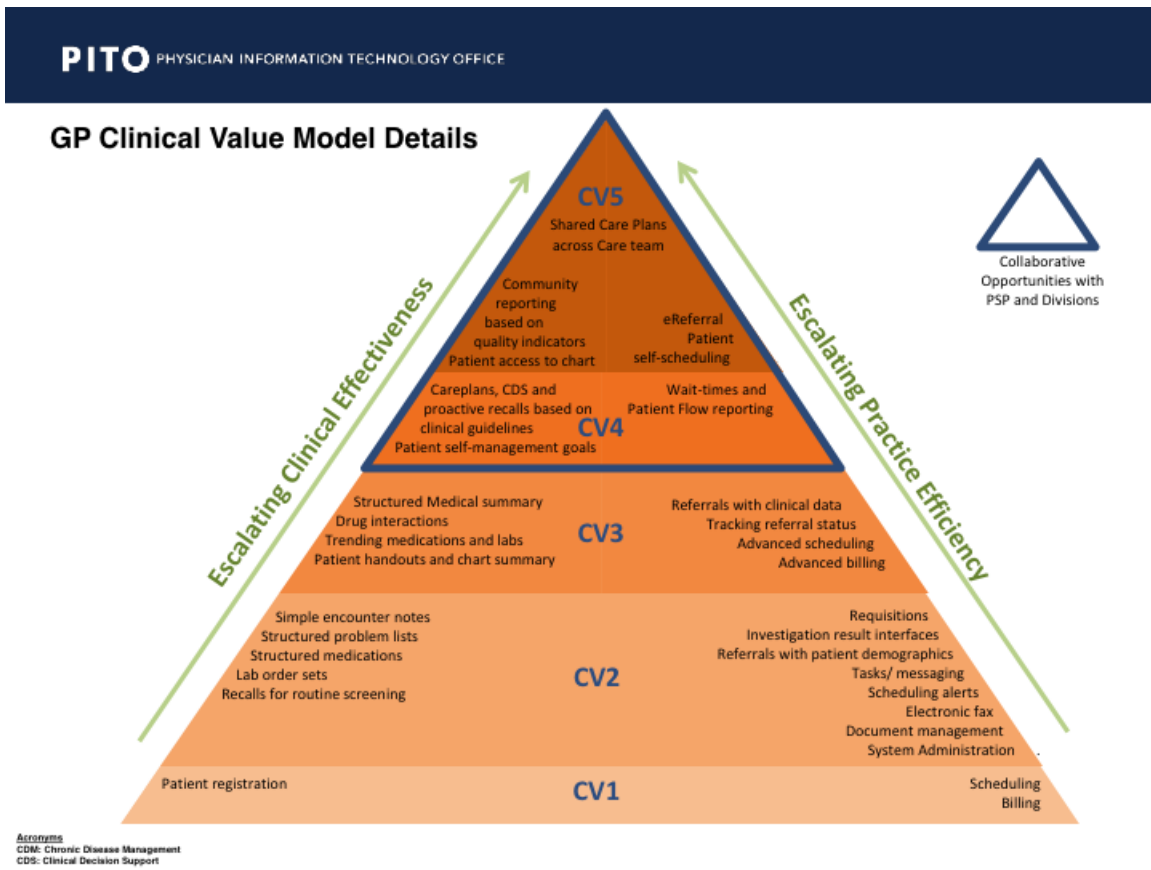


Figure 22- PITO's Clinical Value Model Pyramid Diagram

PITO's Clinical Value Model Assessment Tool

8 APPENDIX B

PITO EMR 'Clinical Value Model' Assessment for GPs

v4.01c

Physician Name: Clinic Assessment & POP
Clinic: Get Well Soon
Admin Staff Present:
Assessment Date:
Date Updated:
Completed By: Shelley Ray
Vendor and Go-Live Date: 0 - 2011 11 20

	Clinical Effectiveness	Practice Efficiency
Clinical Value Level:	0	0
CV1	0%	0%
CV2	0%	0%
CV3	0%	0%
CV4	0%	0%
CV5	0%	0%
Average Score:	0%	0%

Workflow Description	CV Level	Response	Assessment Notes	Action for POP?	Answered By	Primary Benefit
Patient Registration						
Reg-1 Our practice records all patient demographics in the EMR, using discrete (searchable) data where possible	0	No - Question Not Asked			MOA	Clinical Effectiveness
Reg-2 Our practice ensures patients are indicated as having a primary provider and are assigned a status	0	No - Question Not Asked			MOA	Clinical Effectiveness
Reg-3 Our practice has measures in place to ensure the accuracy of a physician's patient panel	0	No - Question Not Asked			MOA	Clinical Effectiveness
Scheduling						
Sch-1 Our practice schedules all in-office patient appointments in the EMR, including walk-ins	0	No - Question Not Asked			MOA	Practice Efficiency
Sch-2 I work from the day sheet in the EMR	0	No - Question Not Asked			Physician	Practice Efficiency
Sch-3 Our practice is able to search for the next available appointment	0	No - Question Not Asked			MOA	Practice Efficiency
Sch-4 Our practice records the wait type and/or reason for the wait	0	No - Question Not Asked			MOA	Practice Efficiency
Sch-5 Our practice has configured scheduling alerts	0	No - Question Not Asked			MOA	Practice Efficiency
Sch-6 Our practice has configured the schedule for appointment types and physician timing preferences	0	No - Question Not Asked			MOA	Practice Efficiency
Sch-7 Our practice uses functionality to search for the next available appointment by appointment type	0	No - Question Not Asked			MOA	Practice Efficiency
Sch-8 Our practice is able to navigate easily to the schedule from different modules in our EMR	0	No - Question Not Asked			Other MOA or Physician	Practice Efficiency
Sch-9 Our practice is able to use the features of the EMR to maximize the wait prior to the appointment	0	No - Question Not Asked			Physician	Practice Efficiency
Sch-10 Our practice actively tracks the appointment start, end, and wait times as well as location, and analyzes related reports to identify opportunities for improvement	0	No - Question Not Asked			Other MOA or Physician	Practice Efficiency
Document Management						
DM-1 Our practice has a process to manage the transition of paper charts (including those transferred from another physician)	0	No - Question Not Asked			MOA	Practice Efficiency
DM-2 Our practice has a process to archive and delete incoming documentation	0	No - Question Not Asked			MOA	Practice Efficiency
DM-3 Our practice has set up electronic fax for sending documents from the EMR	0	No - Question Not Asked			MOA	Practice Efficiency
DM-4 Our practice has set up electronic fax to receive incoming documents, and has a process to import them into the EMR without printing and re-scanning	0	No - Question Not Asked			MOA	Practice Efficiency
DM-5 Our practice has a standard process in place to review incoming documents to ensure that they are signed off and annotated by the physician if required	0	No - Question Not Asked			Physician	Practice Efficiency
DM-6 Our practice categorizes and assigns a standardized name for each document as part of the import process	0	No - Question Not Asked			Other MOA or Physician	Practice Efficiency
DM-7 Our practice transfers clinical data values from imported documents into discrete (searchable) data	0	No - Question Not Asked			Other MOA or Physician	Clinical Effectiveness
Billing						
B-1 Our practice completes all MSP submissions and reconciliations through our EMR	0	No - Question Not Asked			MOA	Practice Efficiency
B-2 Our practice completes all WCB submissions, including related forms and reconciliations through our EMR	0	No - Question Not Asked			MOA	Practice Efficiency
B-3 Our practice creates all private billings and third party billings through our EMR	0	No - Question Not Asked			MOA	Practice Efficiency
B-4 Our practice is able to generate accurate financial reports through our EMR, which meet our business needs	0	No - Question Not Asked			MOA	Practice Efficiency

Figure 23- Screen shot of page 1 CVM assessment tool

9 APPENDIX C

***5. Who guided your assessment and practice optimization plan?**

6. Please rate your overall experience working with him/her?

Exceeded expectations

Met expectations

Did not meet expectations

Not an effective use of my time

Comment:

***7. How well do you think the clinical value assessment accurately reflected your level of EMR use?**

Very well

Well

Slightly

Not well

Comment:

***8. To what degree do you feel that more advanced use of your EMR has/would have an impact on patient care?**

Significantly

Moderately

Slightly

Not at all

Comment:

Practice Optimization Plan

***9. Did you receive a copy of your practice optimization plan?**

Yes

No

Overall Experience				
*19. Please answer the following				
	Significantly	Moderately	Slightly	Not at all
To what degree did your EMR increase EFFICIENCY in your clinic BEFORE you participated in post implementation support?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what degree does your EMR increase EFFICIENCY in your clinic AFTER participating in post implementation support?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what degree did your EMR increase EFFECTIVENESS of patient care BEFORE you participated in support?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what degree does your EMR increase EFFECTIVENESS of patient care AFTER participating in post implementation support?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*20. Please rate your overall experience of PITO's post implementation support:				
<input type="radio"/> Excellent	<input type="radio"/> Good	<input type="radio"/> Ok	<input type="radio"/> Poor	
Comment:				
<input type="text"/>				
21. Other comments:				
<input type="text"/>				

*** 15. How well did you understand the actions required of you/your clinic as identified in the practice optimization plan?**

Very well	Well	Slightly	Not well
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comment:

*** 16. Would you say that the time and effort you spent working with PITO on post implementation support and the practice optimization plan was:**

Very worthwhile	Moderately worthwhile	Slightly worthwhile	Not worthwhile
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. When you complete any outstanding work identified through post implementation support, what impact do you expect it will have on your practice efficiency and patient care?

Motivation

*** 18. Please rate the degree to which each of the following motivated you to participate in the assessment process.**

	Significant factor	Moderate	Indifferent	Not a factor	N/A
Doing a better job/improved patient care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consistency of workflow and operational processes across the clinic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expected improvement on efficiencies/increased billings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the most from my investment in EMR	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3000 for objective validation of Clinical Value Level 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to support systems (user groups, peer mentors etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opportunity for advanced vendor training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encouragement from colleagues/peers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Benchmarking myself against my peers (score)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comment:

Figure 24 - CVM feedback survey - sample questions

10 APPENDIX D

Additional data analysis

10.1 RESOURCES ASSIGNED TO THE ACTION PLAN

This section of analysis looked at which resources were assigned to which supportive action themes. Figure 25- Support actions themes assigned to resources, illustrates this analysis for the entire sample. Again the support themes are grouped by CV level and presented similarly (and in the same order).

Generally it appears that higher level functions at CV4 and 5 are supported by the practice coach and user groups, whereas CV2 and 3 level items are supported by peer mentors. This appears to relate to the actions grouped by physician groups A and B, with group B who use more peer mentoring, and group A who use more user group support.

On detailed review, starting at the beginning of the graph with CV5 and 4 level items, 'patient portal' and 'link to PharmaNet' were both 'unassigned'. These actions were reviewed in the meta-data, and the sentence describes that patient portal and PharmaNet were to be assigned to the division of family practice group, which is not an available category of resources within the assessment but the free text indicates this was the plan.

'Recall systems' were part of both groups plans and it's noted that they were assigned exclusively to the practice coach for support. 'Patient registries' were more often part of group A's plan, and here primarily assigned to practice coach support. 'Medication reporting' support is split by practice coach and user groups, but more often part of group B's plans.

'Clinical reports and queries' were mostly assigned to user groups and more often part of group B's plans. 'Managing drug interaction alerts' were part of both groups plans, but assigned exclusively to peer mentor support. Note this is the only CV4 level item supported by peer mentors within this sample. 'Templates and care plans' and 'clinical decision support tools' are assigned to user group support exclusively, but part of both groups plans.

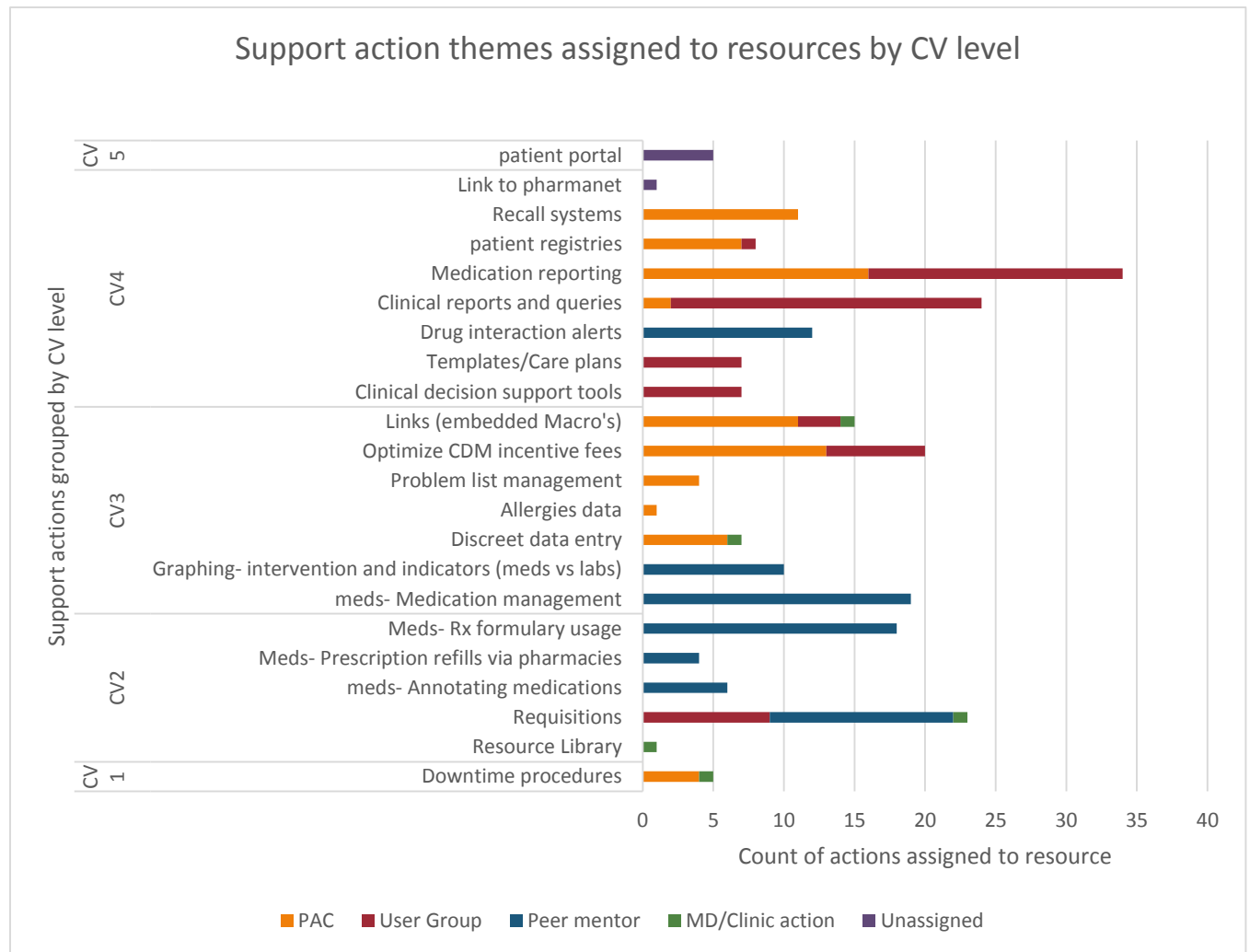
At CV level 3, 'Links (embedded macros)' and 'Optimizing CDM incentive fees' are assigned primarily to practice coach and some user group support, with one clinic/MD action, which means the clinic would be taking ownership of one aspect of this workflow implementation.

Of interest, data quality supports such as ‘problem list management’, ‘allergies data’ and ‘discreet data entry’ are all assigned to practice coach support, with one clinic level support for discreet data entry, of note these items are exclusive to group B’s plans.

‘Medication management’ and ‘graphing labs vs. meds’, both CV level 3 items are exclusively supported by peer mentoring. CV level 2 medication items such as ‘prescription writer formulary usage’, ‘prescription refills via pharmacies’ and ‘annotating medications’ are also exclusively supported by peer mentors. The two latter support themes, are also exclusively part of group A’s plans.

‘Requisitions’ which are primarily tasked to group B’s plans, are resourced by peer mentors and then user groups, with one clinic/physician support. ‘Resource library’ part of group B plan, tasked to the clinic themselves, and the only CV1 level item ‘Downtime procedures’

Figure 25- Support actions themes assigned to resources



10.2 RATING OF THE PRACTICE COACH

The following graph in Figure 26 illustrates the response to a question that asks the physician to rate their overall experience of working with the practice coach. The possible responses were 'exceeded expectations', 'met expectations', 'did not meet expectations' and 'not an effective use of my time'. For this question, an overwhelming majority of responses were 'exceeded expectations', with the remainder at 18% responded as 'met expectations'. No one responded with the two more negative responses, which indicates a good rating of working with the practice coach.

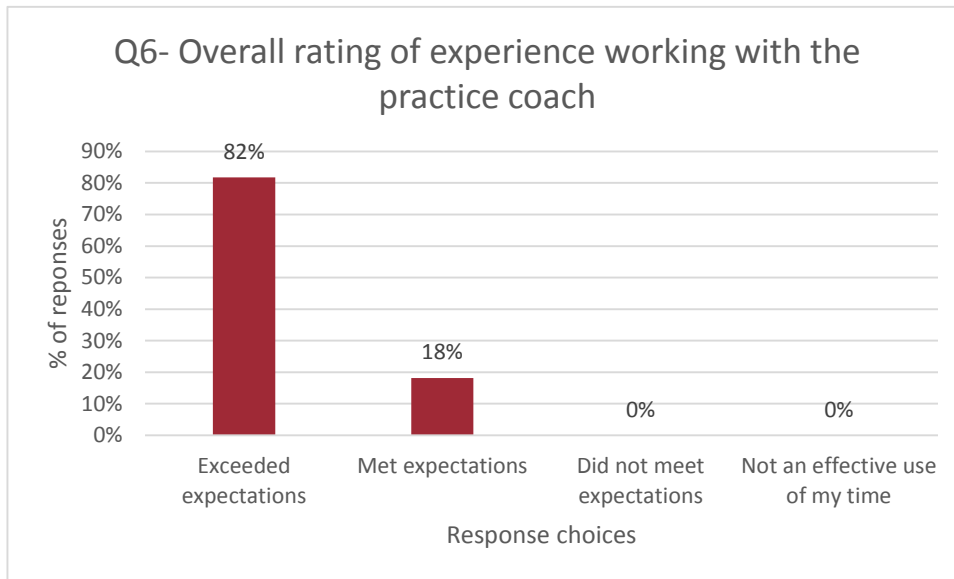


Figure 26- Overall rating of the experience working with the practice coach

The following Figure 27 illustrates the responses to the question of rating the effectiveness of the practice coach support. The possible responses were 'excellent', 'good', 'ok', 'poor', and 'not used'. The majority of responses fell into the 'excellent' and 'good' categories, with a few rated 'ok', and a few indicated they did not use practice coach support, but no one responded as 'poor' indicating an overall positive rating of the effectiveness of the practice coach support.

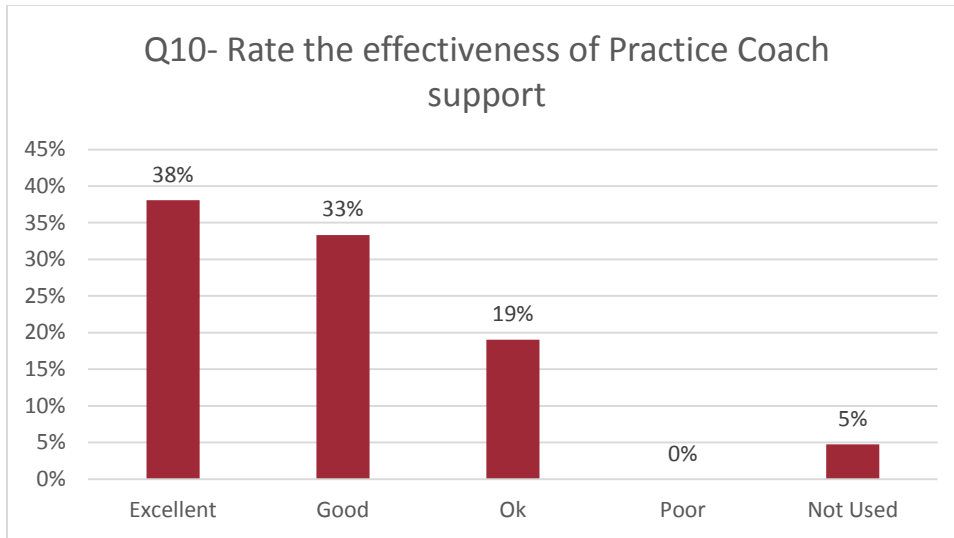


Figure 27- Rate the effectiveness of the practice coach support

10.3 FEEDBACK ON OVERALL RATING OF THE COACH

The following table describes the feedback in the free text comments associated with the structured responses in Figure 26, rating the overall experience of working the practice coach.

Table 7- Tabulation of the comments rating the overall experience of working with the coach

Q6- please rate your overall experience working with the coach
Coach is knowledgeable and enthusiastic
Very helpful and easy to talk to
Totally exceptional, patient, solid teacher with excellent computer/people skills
Made me feel at ease asking questions - "never a dumb question"

Table 7- Tabulation of the comments rating the overall experience of working with the coach, above is a tabulation of the 4 comments for the question. All comments were positive, however out of 29 participants, only 4 comments were noted, a small sample and thus could not be categorized further. However the positive comments relate to the overall positive feedback in the structured responses to this question in Figure 26.