The Effect of Patient Centered Medical Home on Well-Child HEDIS Compliance Within the Military Health System

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Abstract

Background. In 2011, the Military Health System began implementing the Patient Centered Medical Home (PCMH) model to improve patient outcomes, enhance quality of care, reduce costs, improve patient satisfaction and improve population health. The PCMH is a primary care model widely adopted by the private healthcare industry. Currently, there is no literature that studies the impact of the PCMH model on child wellness.

Objective. Our study aim was to investigate the effect of PCMH implementation on child wellness as measured by the well-child Health Effectiveness Data and Information Set (HEDIS) measure.

Methods. We conducted a quasi-experimental, retrospective, and cross-sectional study to compare non-PCMH clinics to PCMH clinics with respect to the well-child HEDIS compliance measure. Using a repeated measures design, we collected the frequency of well-child visit compliance of Tricare Prime dependent beneficiaries (n=2,145) born between observations period one (1 September 2008 – 31 August 2009) and period two (1 September 2012 – 31 August 2013) at one of the 11 selected primary care enrollment sites. We then conducted a univariate analysis of descriptive statistics followed by a logistical regression analysis to study the impact of PCMH on well-child visit compliance. The independent control variables for this study were observation date, enrollment site region, sponsor beneficiary status, sponsor rank group, and beneficiary risk level.

Results. By comparing well-child compliance rates of PCMH and non-PCMH groups in both the pre and post PCMH observation periods, the data shows similar improvements among both groups. PCMH was not significantly associated with well-child compliance at the .05 alpha significance level (p=.172). Among the control variables, North and West regions as well as Jr.

Enlisted were significant in the overall model and sensitivity analysis (p<.05). However, when the non-PCMH comparison group was removed PCMH was significantly associated with well-child compliance (AOR = 2.073; p=.001).

Conclusion. This study contributes to the healthcare management literature by being the first to investigate the impact of PCMH on well-child compliance within the military health system. The investigation showed that PCMH was not significantly associated with child wellness as measured by the well-child HEDIS compliance measure (p=.172) at the alpha significance level of .05. Additionally, the sensitivity analysis showed that when the non-PCMH comparison group is removed, PCMH implementation becomes significant (p=.001). This suggests that there are variables other than PCMH that better explain why well-child compliance improved from our pre-PCMH observation period to our postPCMH observation period. Further studies are suggested to identify critical variables impacting well-child compliance and to capture a greater sample size.

The Effect of PCMH on Well-Child HEDIS Compliance within the Military Health System

Introduction/Background

Measuring child wellness is an important quality of care component for the National Commission on Quality Assurance (NCQA); a private nonprofit organization that serves as an accrediting agency for qualified health plan issuers (Shi & Singh, 2015). In 1989, the NCQA developed a performance measuring tool named the Health Effectiveness Data and Information Set (HEDIS) to estimate quality of care (Shi & Singh, 2015) out of which the child-wellness HEDIS metric developed. Child wellness HEDIS measures center on access to primary care and utilization of health sustaining treatments (i.e. immunization status), but to date, no studies have been published that show the impact of the PCMH model on child wellness in the private sector as well as in the Military Health System. This study contributes new information about the relationship of PCMH implementation and child-well visit utilization within the Military Health System.

In 1967, the American Academy of Pediatrics introduced the concept of the PCMH in order to address an increasing demand of health care, scarce resources, rising costs, and decreasing patient satisfaction resulting from lower quality health outcomes (Kugler, 2012). As part of the "*Future of Family Medicine*" project, Family Medicine adopted the PCMH model in 2002 and since that time, the concept has been endorsed by many professional organizations including the American Academy of Family Physicians, the American College of Physicians, and the American Osteopathic Association (Kugler, 2012). Together with the American Academy of Pediatrics, the aforementioned organizations collaborated to develop seven joint principles describing the PCMH concept (Kugler, 2012). Those principles include personal physician, physician-directed medical practice, whole person orientation, coordinated and integrated care, quality and safety, payment reform, and enhanced access (Kugler, 2012). These joint principles establish the PCMH model as an interdisciplinary, team-based healthcare delivery approach focusing on primary and preventive care as well as a comprehensive approach to the health care process. Given the private sector adoption of this model within the United States (U.S.) health care industry, the Department of Defense followed suit and issued a memorandum for all primary care clinics to implement the PCMH model in 2011 (Schoomaker, 2011). Additionally, the U.S. Army Medical Command issued a command policy in 2008 to establish goals for HEDIS measures aimed to improve disease prevention as well as early identification of illness, and the aggressive management of chronic disease. Since 1991, the NCQA has developed 81 HEDIS measures across five domains of care used by over 90% of managed care health plans to measure performance. The US Army Medical Command has been using these performance measures since 2006 and continues to provide command emphasis on these measures to achieve its strategic goals.

One of the measures developed by the NCQA residing in the "*Utilization and Relative Resource Use*" domain is the "*Well Child Visits in the First 15 Months of Life*," which measures compliance of preventive care provided early in the lives of children. This measurement supports the preventative care dimension of the PCMH model and has been adopted by the Military Health System.

This study investigates the association of PCMH implementation with the compliance of well child visits within the first 15 months of life as defined by the HEDIS measure and attempts to answer the question, "What impact does PCMH have on Well-Child Compliance?" The overall aim in the study was to contribute new information about PCMH's impact on child wellness. Several studies have evaluated the impact of PCMH on HEDIS measures such as cancer screenings, asthma management, and diabetes management (Nielson et al., 2014). However, significant gaps in research exist evaluating the impact of the PCMH model on preventive pediatric care and moving preventive care forward in the delivery process. Currently, there are no studies within the private sector and the military health system that have specifically addressed this issue. This study will provide empirical analysis about the relationship of PCMH and well-child visit utilization.

Literature Review

The PCMH has captured the attention of large health system organizations in both federal and private sectors (Hudak et al., 2013). There is a growing need to change the fragmented and inefficient way medicine is delivered in the United States (Werner et al., 2013). The goals of implementing PCMH center on reducing cost, improving quality of care, and increasing access to health care services. The principles that underlie PCMH include coordinated care, physician-directed care, whole person orientation, quality, and safety (Kugler, 2012). This literature review has two dimensions. First, we review studies that investigate the effects of PCMH as an independent variable, and second, we look at factors associated with child wellness. After reviewing the literature, two limitations emerged. First, unclear operational definitions of PCMH make comparisons outside of a study difficult unless PCMH is standardized. For instance, many studies use non-NCQA rated clinics as PCMH models while few studies use NCQA certified medical homes. Second, few articles investigate the effects of PCMH on child wellness, but there are many articles about the factors associated with child wellness.

Patient Centered Medical Home (PCMH)

Although the academic literature and industry reports say very little about the effects of PCMH on child wellness, they do show us the effects of PCMH on cost, utilization patterns, quality, population health, inpatient admissions, and patient satisfaction. To date, there is only one randomized control trial that looks at the effects of pediatric PCMH on children with chronic illness. Mosquera et al. (2014) conducted a randomized control trial where chronically ill pediatric patients received care at a traditional pediatric clinic or from a pediatric PCMH. The study observation occurred between March 2011 and February 2013. Pediatric patients who were randomly assigned to pediatric PCMH clinics showed significant advantages over pediatric patients receiving care at traditional pediatric clinics including reduced emergency department utilization, decreased Pediatric Intensive Care Unit admissions, decreased number of days in a hospital, reduced per child-year costs by $10,000, reduced serious illness, and increased family satisfaction.

Other studies showing the effects of PCMH focus primarily on cost, quality, access, and patient satisfaction outcomes. Nielsen, Gibson, Buelt, Grundy, & Grumbach (2014) reviewed 13 peer reviewed articles and seven industry reports from the years 2012-2013 where PCMH was the intervention. In all of the studies they reviewed, they discovered that the PCMH model was associated with favorable outcomes with respect to cost of care and unnecessary services, population health indicators and preventative services, access to care, and patient satisfaction.

Rosenthal et al. (2013) conducted an interrupted time series design and looked at four years of multipayer claims data which contained outcomes information. Comparing five PCMH clinics to 34 Non-PCMH clinics, the authors (Rosenthal et al., 2013) found no appreciable differences between the two clinic types with respect to quality metrics set by the NCQA except that ambulatory care sensitive ED visits were significantly lower among the PCMH clinics than non-PCMH clinics. Reid et al. (2013) also used an interrupted times series research design and studied the effects of PCMH on ED utilization, primary care visit utilization, secure electronic messaging usage, and telephone encounters with a provider. Results for PCMH clinics indicated a 6.7% decline in primary care utilization, but a 123% increase in the use of secure electronic messaging, and a 20% increase in telephone encounters with a provider as well as 13.7% and 18.5% percent decreases in patient emergency department utilization over two consecutive years. Likewise, Driscoll et al. (2013) employed a time series analysis, but used a qualitative rather than quantitative design. They observed similar effects with respect to emergency department utilization declines when PCMH clinics offered same day appointments.

Transitioning primary care clinics to the PCMH model have captured the interests of researchers. For example, one study (Rosenberg et al., 2012) compared primary care clinics transitioning to a PCMH model from 2008-2010 to non-PCMH primary care clinics during the same time frame. The unit of analysis was University of Pittsburg Medical Center health plan beneficiaries (n=23,930). They discovered that PCMH clinics generated a 160% return on investment when compared to non-PCMH sites, as well as lowered pharmacy costs, lower hospital admissions/readmissions, and reduced emergency department utilization. Industry reports from Oregon Health Authority (2013), Highmark Blue Cross Blue Shield of Pennsylvania (2013), Blue Cross Blue Shield of Michigan (2013), and Blue Cross Blue Shield of Alabama (2013) also show cost savings and improved quality of care associated with PCMH implementation.

Researchers have also compared cost and quality of care measures from clinics with partial and full PCMH implementation (Paustian et al. 2014). Their findings showed that a fully implemented PCMH model yields greater cost savings and higher quality of care compared to partially implemented PCMH clinics (Paustian et al., 2014). Similarly, Ffield, Forrest, Burleson, Martin-Peele, & Gillespie, (2013) studied quality and patient satisfaction outcomes among clinics that transitioned to NCQA's nationally acclaimed Physician Practice Connections-PCMH recognition program within a two year time frame. Clinics transitioning to the NCQA Physician Practice Connections-PCMH revised payment incentives to include a $2.50 per member per month reimbursement for achieving quality targets and up to $2.50 for achieving Physician Practice Connections-PCMH recognition. Compared to traditional primary care clinics, those clinics that transitioned to the PCMH model performed significantly better on at least two of the 11 quality indicators which were hypertensive blood pressure control over two years and breast cancer screening over three years. Moreover, Horizon Blue Cross Blue Shield of New Jersey (2013) attributed an increase in preventative screenings (i.e., colorectal, and breast cancer) to their investment into PCMH implementation. In 2006, WellPoint, Inc invested in 10 pilot PCMH clinics in New Hampshire, Colorado, and New York and their researchers (Raskas et al., 2012) investigated the relationship of layered incentive payments to PCMH providers for coordinating care, reducing unnecessary costs, and providing quality care. Preliminary data suggests that the PCMH clinics in New Hampshire and Colorado are meeting some cost and quality objectives and this result has been replicated by Care First (2013), which reported a cost savings of 98 million dollars after two years of PCMH implementation. These studies confirm what other studies have found; PCMH demonstration projects have achieved limited but significant achievements in efficiency and quality outcomes with respect to PCMH implementation, especially as provider incentives are aligned with quality of care outcomes. Additionally, the Connecticut Enhancement Program (2013) underscores the importance of coordinated care in state driven health initiatives which make state workers accountable for their health and reward them when they engage in specified health practices.

Although there is a burgeoning body of literature that shows many benefits of the PCMH model, one robust study (n=35,059) conducted in New Jersey indicated no meaningful cost or quality differences between PCMH and non-PCMH clinics (Werner et al., 2013). Furthermore, some researchers (Jackson et al., 2013) cast doubt on the methodological rigor of current studies on PCMH to date, suggesting that policy makers should be cautious with large scale PCMH investments. Also problematic is that the current literature fails to provide consistent definitions and nomenclature for PCMH (Jackson, et al., 2013). One way to overcome this challenge is to define PCMH from benchmarks set by the NCQA. This method provides one legitimate way to standardize recognized PCMH clinics and may enable researchers to generalize their findings to larger populations because PCMH comparison groups would be more accurate.

Child Wellness & Associated Factors

The Whitehall study (Marmot et al., 1991) was a seminal research project that showed the impact of social context on individual health and wellness. The study indicated that social class as measured by grade of employment was tied to an individual's health. Those individuals from a lower socioeconomic status (SES) tended to have significantly poorer health outcomes compared to individuals with higher grades of employment. Likewise, child wellness has followed a similar associational pattern with respect to parental education, income, and family structure (Spurrier et al., 2003; Martin, 2006; Wilcox, Taylor & Donovan, 2010). In general, HEDIS measures are positively associated with SES (Zaslavsky et al.., 2000).

For instance, Flacking, Walling, and Ewald (2007) discovered that despite Sweden's strong social welfare support system and positive breastfeeding tradition, low maternal SES impacts infant breastfeeding duration. Mothers who received unemployment benefits, social welfare and equivalent disposable income, and had low education levels, were much more likely to achieve poorer breastfeeding outcomes. In another study, Flacking, Nyqvist, and Ewald (2007) concluded that socioeconomic factors had stronger predictive power over breastfeeding outcomes than size at birth or neonatal disorders. The authors (Flacking, Nyqvist, & Ewald, 2007) offered no suppositions to explain these outcomes, but Belsky et al. (2007) noted that poor parenting was positively correlated with low socioeconomic status. One critical factor of child wellness identified in the literature is marital status. For example, Martin (2006) found that children raised by single mothers fare worse on several child wellness metrics than children raised by their biological parents, and this remained true even when controlling for income factors.

Military researchers have also investigated SES effects on child wellness. Within the United States military population, unintended pregnancies were strongly associated with socioeconomic factors including unmarried status, lower enlisted rank, low educational achievement, and living in the barracks (Custer, Waller, Vernon, & O'Rourke, 2008). Despite the relative wealth of the U.S. compared to other countries of the world, the U.S. has higher infant mortality rates than in Europe. Chen & Williams (2014) sought to provide an answer to this seeming contradiction. They found that this inconsistency was primarily explained by greater inequalities among minorities in America, especially among the African American population. In contrast, well-off individuals in the US, Finland, and Austria had very similar infant mortality rates. Chen & Williams (2014) concluded that the post neonatal mortality in the U.S. was entirely due to high mortality among low SES groups.

Hypothesis

NCQA certified PCMH implementation will show a greater positive effect on Well-Child HEDIS Compliance than non NCQA certified pediatric clinics within the Military Health System.

Conceptual Model

This study adapted Aday and Anderson's (1973) conceptual model to form the basis for our empirical model and research design. The five factors that constitute our conceptual model include, Health Policy, Characteristic of Health Delivery System, Utilization of Health Services, Characteristics of Population at Risk, and Consumer Satisfaction (see Figure 1). Additionally, Figure 2 displays the Characteristics of Population at Risk including Demographics, Social Structure, Beliefs, Family, Community, Perceived and Evaluated. These characteristics are placed within broad categories: *Predisposing*, *Enabling*, and *Illness Level* variables. For example, Demographic, Social Structure, and Beliefs fall under *Predisposing*, Family and Community are subsumed under *Enabling*, and Perceived and Evaluated fall under *Illness Level*.

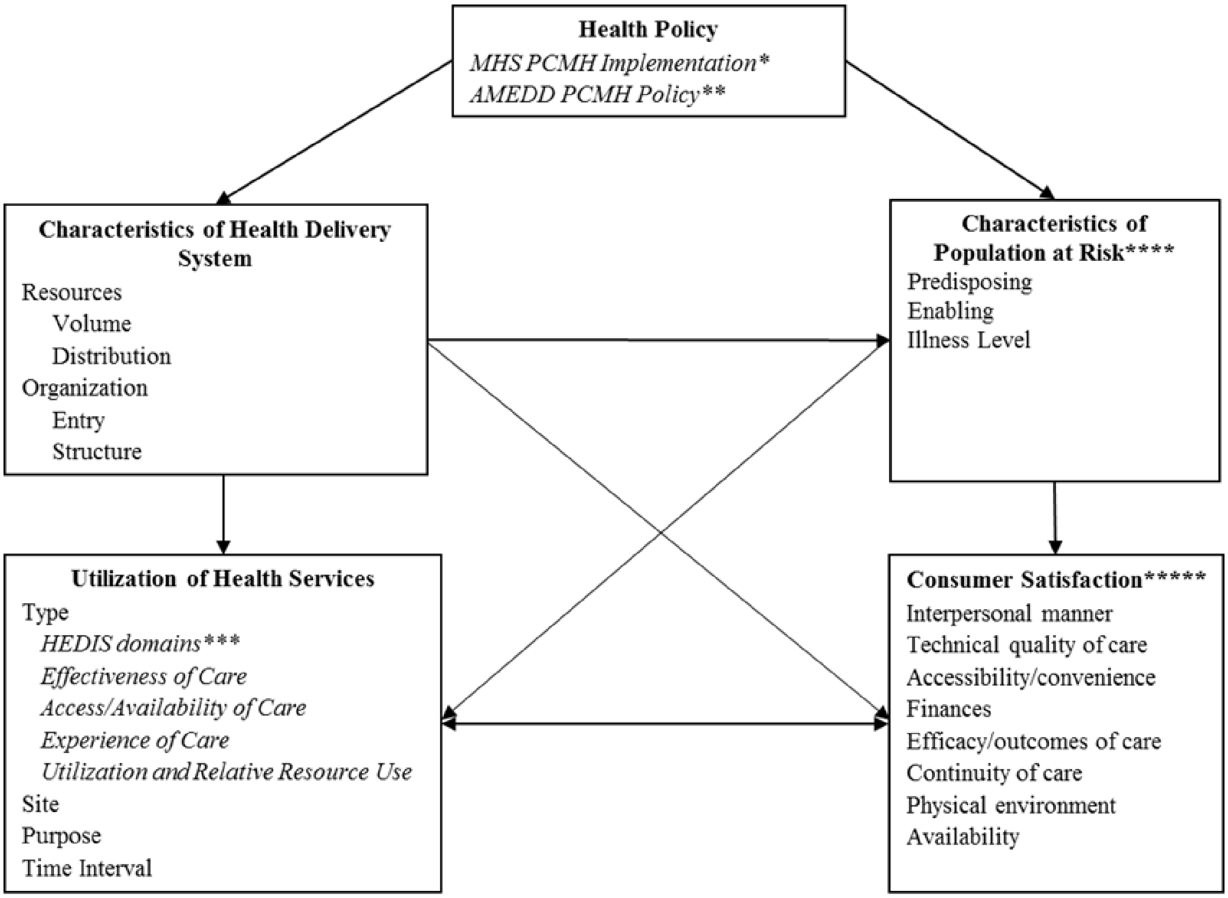

Figure 1. Conceptual Model. Framework for PCMH Impact on HEDIS Metrics (adapted from Aday & Andersen , 1974)
*Policy Memorandum Implementation of the "Patient-Centered Medical Home" Model of Primary Care in MTFs, Office of the Assistant Secretary of Defense for Health Affairs, dated September 18, 2009.
**Operation Order (OPORD) 11-20, Army Patient Centered Medical Home, dated January 2011.
*** Health Plan Employer Data and Information Set (HEDIS) Measure Goals, Headquarters, U.S. MEDCOM, dated December 09, 2008.
****Andersen & Newman individual determinants of health services utilization (1973)
***** Eight dimensions of satisfaction (Ware et al., 1983)

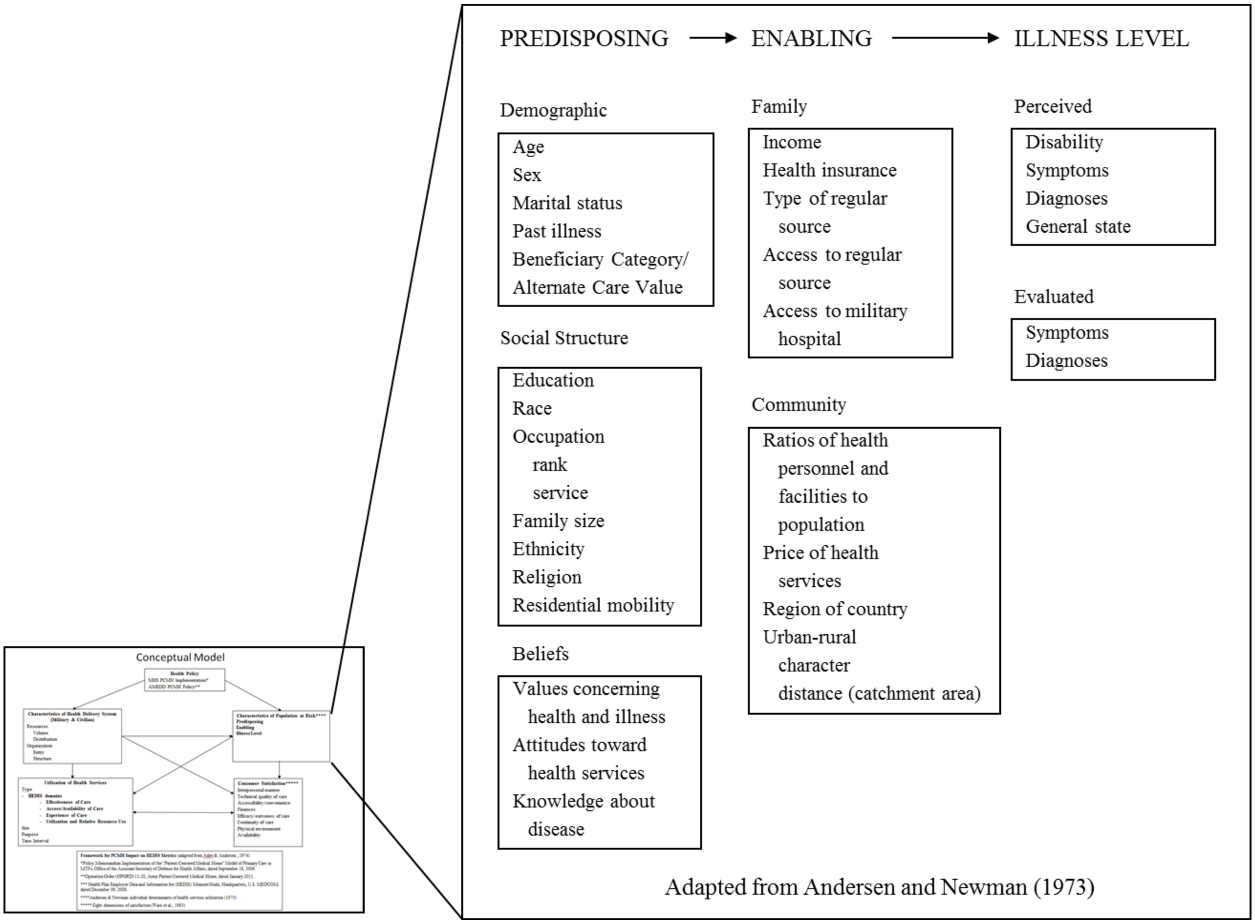

Figure 2. The Characteristics of the Population at Risk based upon an individual's Predisposing, Enabling, and Illness Level factors. Model adapted from Anderson and Newman (1973).

Empirical Model

The Empirical Model represented in Figure 3 displays the variables evaluated in this study. Three of the four factors of our Conceptual Model were included in our Empirical Model. First, the Characteristic of the Healthcare Delivery System is the implementation of PCMH within the military health system, and serves as our primary independent variable of interest. In this study, we look at nine PCMH clinics and two non-PCMH comparison groups. Second, the Utilization of Health Service's category is represented by our dependent variable – well-child visit compliance score. Third, Characteristics of the Population are the control variables in our study and are comprised of occupation (Sponsor Rank Group), Residential Mobility, Region of

Country, and Diagnosis (Health Risk Score) which are populated data fields available through our data source, Management and Analysis Reporting Tool (M2 Data MART).

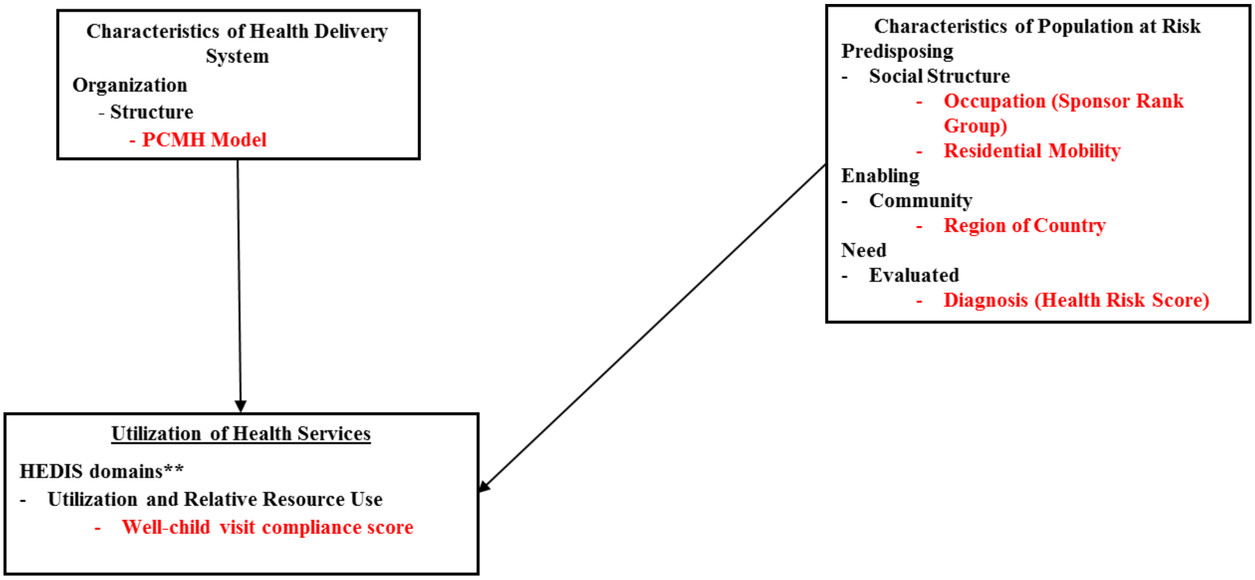

Figure 3. Empirical Model. Framework for PCMH Impact on HEDIS Metrics (adapted from Aday & Andersen, 1974)
*Operation Order (OPORD) 11-20, Army Patient Centered Medical Home, dated January 2011.
**Health Plan Employer Data and Information Set (HEDIS) Measure Goals, Headquarters, U.S. MEDCOM, dated December 09, 2008.

Methods

We conducted a quantitative, quasi-experimental, retrospective, cross-sectional study using the Military Health System (MHS) Management and Analysis Reporting Tool (M2 Data MART) as our means to gather secondary data down to the individual beneficiary level. The M2 Data MART captures and organizes data from the MHS Data Repository for various analytical purposes within the MHS. Using a repeated measures design, we collected the frequency of well-child visit compliance of Tricare Prime dependent beneficiaries born between observations period one (1 September 2008 – 31 August 2009) and period two (1 September 2012 – 31 August 2013) at one of the 11 identified primary care enrollment sites. The unit of analysis in the study was the individual child beneficiary. Well-child compliance rates for each child were collected based on the observed child completing six or more well-child visits within the first 15 months of life. Eligible children were tallied as compliant or non-compliant as each monthly birth sample reached 15 months of age (e.g., children born over the period of 1 – 30 September 2008 were tallied as compliant or non-compliant in December 2009).

The PCMH sites were selected in part due to the similarity in timing of PCMH implementation and NCQA validation and certification; 9 of the 11 applied for and received validation and certification by the NCQA not later than 30 June 2012. The remaining two non-PCMH sites, observed during the same time periods as comparison groups, did not undergo any known significant PCMH transformation during the observation period. Well-child compliance observation periods for the sample coincided 15 months after each of the beneficiaries' birthdays, resulting in a sample of 27,071 eligible beneficiaries observed over 24 monthly periods: December 2009 – November 2010 and December 2013 – November 2014. The first observation period pre-certification captured observed data between 20 to 32 months prior to NCQA certification in order to minimize variance associated with personnel, equipment, and organizational changes associated with the implementation of PCMH. The second observation period post-certification captured observed data 14 to 26 months post NCQA certification in order to observe beneficiaries born after NCQA certification and minimize variance due to personnel, equipment, and organizational changes associated with the implementation of PCMH (see Figure 4 for the observation timeline).

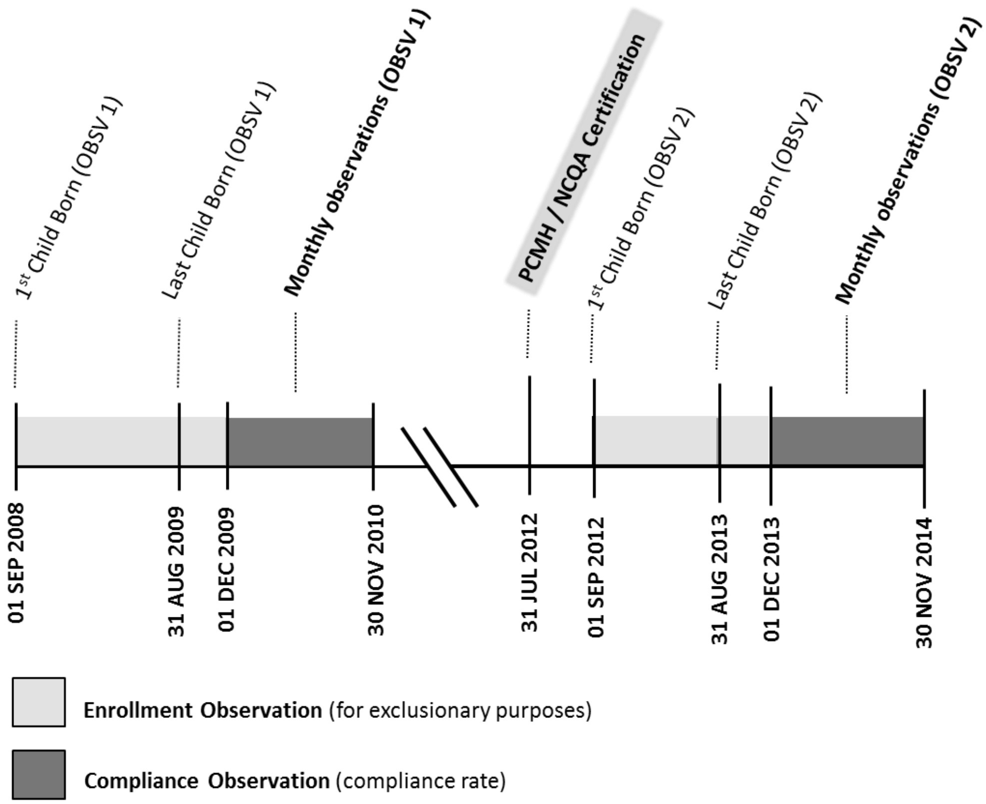

Figure 4. Observation timeline

In order to more accurately assess the impact of PCMH at the selected sites, we excluded beneficiaries who experienced a greater than 30 day lapse in TRICARE Prime enrollment (n =18,880) and excluded those who changed enrollment site during the observation period (n =6,046). Both eligibility criteria were chosen in order to minimize the impact of well-child visits due to changing enrollment sites or lapse in enrollment. Additionally, the eligibility criteria aligned with the methodology used by the Military Health System Population Health Portal to establish an eligible child population and assess well-child compliance (Military Health System Population Health Portal, 2014). After applying our exclusion and inclusion criteria, a total of 2,145 records remained. The complete exclusion and inclusion criteria are shown in Figure 5.

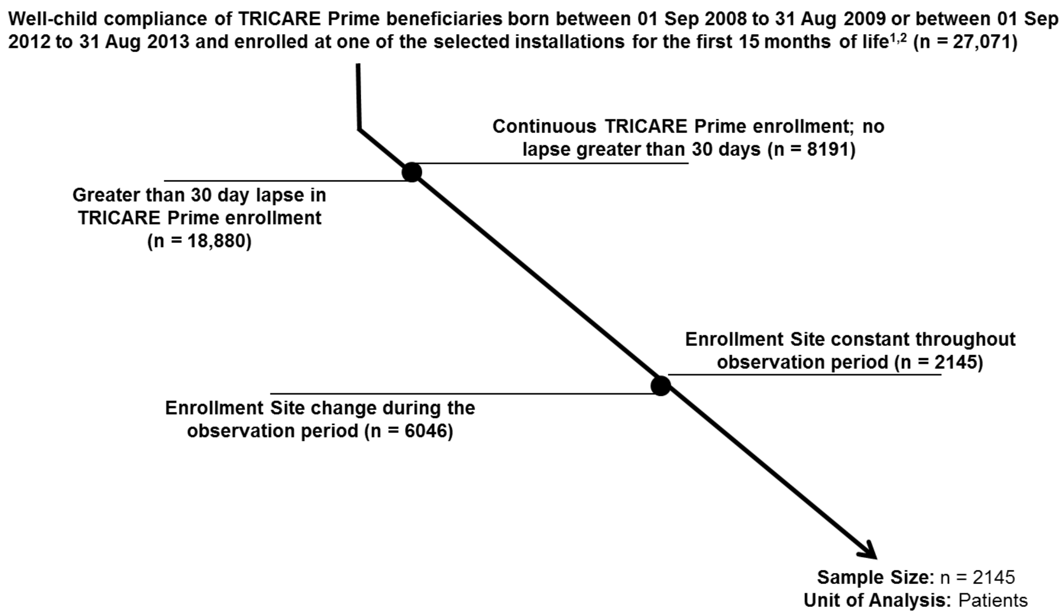

Figure 5. Exclusion and inclusion criteria from MHS Mart (M2)
[1] Observation sites with PCMH implementation and certification on/around 30 June 2012: Ft. Polk, LA; Ft. Carson, CO; Redstone Arsenal, AL; Fort Lee, VA; Schofield Barracks, HI; Ft. Irwin, CA; Ft. Benning, GA; Ft. Stewart, GA; and Ft. Sill, OK
[2] Observation sites without PCMH implementation: Tripler AMC, HI; and San Antonio MMC, TX

Qualified well-child visits observed must have had at least one of the procedure or diagnosis codes listed. Procedure Codes: 99381, 99382, 99391, 99392, or 99461. Diagnosis Codes: V20.2, V20.31, V20.32, V70.0, V70.3, V70.5, V70.6, V70.8, V70.9. In addition, the provider specialty code associated with the visit must be coded as a primary care provider: 000, 001, 002, 003, 007, 039, 040, 042, 052, 300, 301, 302, 303, 320, 322, 503, 603, 604, 605, 610, 901, 911, 923, 925, 937, 949, 967 (Military Health System Population Health Portal, 2014). Definitions for all CPT ICD-9-CM, and provider specialty codes are located in Appendices A and B respectively.

Table 1

Variable Table

Concept	Measure	Variable Name	Use in Analysis	Level of Measurement	Data Type	Measurement Unit	Data Source	Resource
Utilization	Well-Child Compliance	CHILD_ COMP	DV	Nominal	Binary	0 = Less than 6 well-child visits within first 15 months of life 1 = 6 or more well-child visits within first 15 months of life	M2	Aday & Andersen, 1974, p. 214
Delivery System	PCMH Identified	PCMH	IV	Nominal	Binary	0 = Not appointed 1 = Designated	MEDCOM	NCQA, 2011, PCMH, para. 1
Time	Observation Date	TIME	IV	Nominal	Categorical	1 = Dec 09 – Feb 10[a] 2 = Mar 10 – May 10 3 = Jun 10 – Aug 10 4 = Sep 10 – Nov 10 5 = Dec 13 – Feb 14 6 = Mar 14 – May 14 7 = Jun 14 – Aug 14 8 = Sep 14 – Nov 14	M2	Aday & Andersen, 1974, p. 214
Delivery System	Enrollment Site Region	REGION	IV	Nominal	Categorical	1 = Pacific 2 = Western 3 = Southern[a] 4 = Northern 5 = Europe	M2	Aday & Andersen, 1974, p. 214
Social Structure	Sponsor Beneficiary Status	SPONS_ STAT	IV	Nominal	Binary	0 = Non-active Duty 1 = Active Duty	M2	Liu, Einstadter, & Cebul, 2010, p. 415
Social Structure	Sponsor Rank Group	RANK	IV	Nominal	Categorical	1 = E1 – E4 (EJ) 2 = E5 – E9 (ES)[a] 3 = O1 – O3; WO (OJ) 4 = O4 – O9 (OS)	M2	Whitehall, 1999
Illness Level	Beneficiary Utilization of Services	RISK_ SCORE	IV	Interval	Continuous	Risk Level	M2	Newacheck & Kim, 2004

[a] Reference category for each categorical variable

Table 1 is the variable table used in this study. The dependent variable, well-child visit compliance, was coded as zero if less than six well-child visits occurred within the child's first 15 months of life or one if at least six well-child visits occurred within the child's first 15 months of life. The primary independent variable used was the presence (or lack of) an NCQA certified

PCMH. Additional independent variables were used as control variables: observation date, enrollment site region, sponsor beneficiary status, sponsor rank group, and beneficiary risk level.

The last variable mentioned, beneficiary risk level, captures accumulated health risk score based on prior diagnoses and drugs accumulated within the previous 12 months, and compares this score to the average Tricare Prime enrollee within the same period. Infants with comorbidities are more likely to consume healthcare services (M2). Research has defined a clear association between children with greater severity of diagnoses and the consumption of healthcare services in both the outpatient and inpatient settings than children with less severe diagnoses. Grupp-Phelan, Lozano, and Fishman (2001) show that the costs of healthcare are much greater in children with asthma than children without asthma in part because of many upper respiratory disorders that are associated with asthma. Additionally, Newacheck and Kim (2004), looked at utilization data from the Medical Expenditure Panel Survey and found that while children with special health care needs account for less than 16% of the child population, they accounted for 52.5% of children's hospital days. Additionally, their data showed that children with special health care needs had more than twice as many physician visits (4.35 vs 1.75; $p < .01$; Newacheck & Kim).

A binary logistic regression model was used determine if there was an association between the implementation of PCMH and well-child compliance across the 11 observed sites. Statistical Package for Social Sciences (SPSS), version 21.0 developed by the International Business Machines (IBM) Corporation.

Results

The univariate analysis provides the comparison of average compliance rates between comparison groups and sample distribution percentages across the independent variables pre and post intervention, or PCMH implementation. By comparing compliance rates of PCMH and non-PCMH groups pre and post intervention, the analysis shows parallel improvements in the average compliance between the two comparison groups. The univariate analysis of the data in the variable table (Table 1) indicates well-child compliance rates for the clinics that would eventually implement the PCMH model (n=9) and for non-PCMH comparison groups (n=2). PCMH serves as the intervention. The clinics that adopted PCMH increased from 36% pre-intervention to 42% well-child compliance (Table 2), and the non-PCMH comparison group increased from 49% to 61% for the same time periods as shown in Table 3. The descriptive statistics represented in Table 2 and Table 3 also gives the mean health risk scores for both the pre and post-intervention samples for the PCMH and Non-PCMH comparison groups as well as the percentages of the sample sizes in each comparison group stratified by the categories of each control variable.

Table 2

Univariate Analysis (PCMH Comparison Group)

Variable	Pre-PCMH (2008-2009)			Post-PCMH (2013-2014)		
	N	% (M)	SD	n	% (M)	SD
Well-Child Compliance	662	(36%[a])	0.48	1133	(42%[a])	0.49
Health Risk	662	(0.44)	0.82	1133	(0.61)	1.25
Region						
South	420	63%		668	59%	
West	160	24%		361	32%	
North	82	12%		104	9%	
Sponsor Rank						
Jr. Enlisted	203	31%		436	39%	
Sr. Enlisted	365	55%		560	49%	
Jr. Officer	67	10%		117	10%	
Sr. Officer	27	4%		20	2%	
Sponsor Status						
Active	603	91%		1085	96%	
Non-Active	59	9%		48	4%	
Time Period						
Dec 09-Feb 10	134	20%				
Mar 10-May 10	140	21%				
Jun 10-Aug 10	168	25%				
Sep 10-Nov 10	220	33%				
Dec 13-Feb 14				229	20%	
Mar 14-May 14				218	19%	
Jun 14-Aug 14				306	27%	
Sep 14-Nov 14				380	34%	

[a]Well-child compliance reported as a mean compliance percentage of the sample for the period.

Table 3

Univariate Analysis (Non-PCMH Comparison Group)

Variable	Non-PCMH (2008-2009)			Non-PCMH (2013-2014)		
	N	% (M)	SD	n	% (M)	SD
Well-Child Compliance	184	(49% [a])	0.50	166	(61% [a])	0.49
Health Risk	184	(0.42)	0.66	166	(0.48)	1.02
Region						
South	75	41%		43	26%	
West	109	59%		123	74%	
North						
Sponsor Rank						
Jr. Enlisted	32	17%		34	20%	
Sr. Enlisted	102	55%		77	46%	
Jr. Officer	28	15%		30	18%	
Sr. Officer	22	12%		25	15%	
Sponsor Status						
Active	169	92%		155	93%	
Non-Active	15	8%		11	7%	
Time Period						
Dec 09-Feb 10	40	22%				
Mar 10-May 10	47	26%				
Jun 10-Aug 10	54	29%				
Sep 10-Nov 10	43	23%				
Dec 13-Feb 14				35	21%	
Mar 14-May 14				35	21%	
Jun 14-Aug 14				47	28%	
Sep 14-Nov 14				49	30%	

[a]Well-child compliance reported as a mean compliance percentage of the sample for the period.

Following the univariate analysis, multivariate analysis using the Statistical Package for the Social Sciences (SPSS) was conducted by performing a binary logistic regression (see Table 4). The Hosmer and Lemeshow test indicates the Chi-Square test is not significant at the alpha level .05 ($p = 0.759$) and the Omnibus Test of Model Coefficients is significant at the alpha level.05 ($p < 0.001$). Both tests indicate a good model fit and the Cox & Snell R Square value

(R^2 = 0.163) indicates approximately 16.3% of the variance in the well-child compliance rates can be accounted for by the variance of the independent variables in the model.

A binary logistic regression of the data reveals that the PCMH implementation, the primary independent variable of interest in the model, at the alpha significance level of .05 is not significantly associated with well-child compliance rates (p=0.172). However, when performing a sensitivity analysis (see Table 4) on the model by removing the Non-PCMH comparison group from the binary logistic regression model, the PCMH intervention becomes significant indicating patients are more than twice as likely to meet the well-child compliance standards of 6 visits within the first 15 months of life (AOR = 2.073; p = .001). Both the Omnibus Test for Model Coefficients and the Hosmer and Lemeshow test indicate a good model fit for the model in the sensitivity analysis and the Cox & Snell R Square value (R^2 = 0.153) indicates 15.3% of the variance in well-child compliance can be accounted for by the variance of the independent variables in the sensitivity model.

Table 4

Binary Logistic Regression and Sensitivity Analysis

Variable	Model Regression			Sensitivity Analysis		
	Sig.	AOR	95% CI	Sig.	AOR	95% CI
PCMH	0.172	0.770	[0.530, 1.120]	0.001*	2.073	[1.328, 3.236]
Health Risk	0.108	1.075	[0.984, 1.174]	0.078	1.087	[0.991, 1.192]
Region						
South	†	†	†	†	†	†
West	0.000*	0.195	[0.159, 0.239]	0.000*	0.207	[0.164, 0.260]
North	0.000*	0.177	[0.126, 0.248]	0.000*	0.178	[0.126, 0.250]
Sponsor Rank						
Sr. Enlisted	†	†	†	†	†	†
Jr. Enlisted	0.001*	1.452	[1.172, 1.800]	0.000*	1.559	[1.238, 1.963]
Jr. Officer	0.111	0.779	[0.573 - 1.059]	0.187	0.791	[0.558, 1.121]
Sr. Officer	0.845	0.954	[0.594 - 1.531]	0.306	0.715	[0.377, 1.358]
Sponsor Status						
Active	†	†	†	†	†	†
Non-Active	0.471	0.864	[0.580, 1.286]	0.498	0.857	[0.548, 1.340]
Time Period						
Dec 09-Feb 10	†	†	†	†	†	†
Mar 10-May 10	0.760	0.931	[0.588, 1.286]	0.913	0.971	[0.568, 1.658]
Jun 10-Aug 10	0.414	0.832	[0.534, 1.294]	0.307	0.766	[0.459, 1.278]
Sep 10-Nov 10	0.876	1.035	[0.672, 1.593]	0.607	0.880	[0.540, 1.434]
Dec 13-Feb 14	0.634	0.879	[0.517, 1.495]	0.000*	2.237	[1.546, 3.238]
Mar 14-May 14	0.172	0.691	[0.406, 1.175]	0.004*	1.716	[1.186, 2.484]
Jun 14-Aug 14	0.124	0.668	[0.400, 1.116]	0.006*	1.593	[1.143, 2.220]
Sep 14-Nov 14	0.001*	0.431	[0.258, 0.717]	††	††	††

Note. AOR = adjusted odds ration; CI = confidence interval; Sig. = Significance.
†Reference category for each categorical variable.
††Due to redundancies, SPSS removed degrees of freedom for the Time Period variable in Sep 14 - Aug 14 in the sensitivity analysis.
*p < .05.

Discussion

Our main finding, that PCMH implementation is not significantly associated with well-child HEDIS compliance (p=.172) was surprising. Several studies have shown that PCMH has a positive impact on utilization, cost, satisfaction, and quality measures (Nielson et al., 2014), and one randomized control study (Mosquera et al., 2014) indicates that pediatric PCMH clinics, showed significant advantages over non-PCMH pediatric clinics with respect to costs, patient outcomes, quality, and satisfaction.

One of the ways the military health system estimates quality of care is compliance to HEDIS measures such as the well-child HEDIS compliance measure. Yet, no studies to date have explained how the PCMH model may impact child wellness both in the private sector and within the military health system. This is meaningful because children of military families face unique challenges that may place them at risk for health problems. For example, some military researchers have especially noted concerns over the psychosocial effects on children from military families who are often separated from their parents who are serving deployment assignment overseas (Flake, Davis, Johnson, & Middleton, 2009; Fitzsimons & Krause-Parello, 2009). Given the unique challenges of soldier deployment, regular well-child checkups are essential appointments to help pediatric providers screen for psychological morbidities and to address other health needs.

Understanding the factors associated with well-child compliance will assist management and policy makers to craft evidenced based policies and will provide researchers with good information to test predictive statistical models. Although our model showed that PCMH implementation was not significantly associated with well-child HEDIS compliance ($p=0.172$), we have identified several limitations of our study and research ideas germane to future researchers and policy makers in the military health system. Because PCMH has become the standard delivery model for providing primary care in the military health system, it is necessary to account for its progress in achieving strategic aims set forth by the policy makers within the Military Health System.

Limitations

Although this study contributes valuable information about the effects of PCMH implementation on well-child utilization within the Military Health System, several limitations exist in our study. First, the non-PCMH comparison group sample size (n=350) was considerably smaller than the PCMH group (n=1,795) because our inclusion criteria significantly limited the number of facilities and the overall sample size. Second, data for well-child eligible appointments provided out-of-network could not be evaluated to measure true compliance rates. Third, due to data constraints, demographic factors that may influence well-child compliance scores such as sponsor marital status, sponsor age, and sponsor race could not be evaluated. Fourth, there was a significant amount of dependent active duty beneficiaries excluded from our study (n=18,880) because of gaps in Tricare Prime continuous enrollment. Future researchers would do well to uncover the reasons for these enrollment lapses in order to recapture these patients into PCMH clinics and better serve their needs. Lastly, 6,046 dependent active duty beneficiaries were excluded from our sample because of site changes during observation periods.

Future Research

Future research efforts within the military health system should seek to account for Tricare beneficiaries who received well child visits in the private sector. Researchers who capture this information will be able to account for many beneficiaries missing from our sample. Further research may consider changing the statistical model from logistical binary regression to linear regression analysis in order to change the independent variable (PCMH) from binary to continuous in order to assess PCMH's predictive value on well-child compliance rates. This study is mainly associational in nature. Because the PCMH group and non-PCMH group's well-child compliance rates improved from period one to period two, future researchers may also design studies that investigate possible Hawthorne effects associated with incorporating the NCQA's well-child compliance HEDIS measure into the Military Health System.

Furthermore, a more robust study comparing the well-child compliance rates of private sector PCMH facilities with the well-child compliance rates of similarly sized PCMH facilities in the Military Health System may be a beneficial comparison group study.

Conclusion

This study contributes to the healthcare management literature by being the first to investigate the impact of PCMH on well-child compliance within the military health system. Child wellness was measured by the well-child HEDIS compliance measure as defined by the NCQA; six well child visits within the first 15 months of life. Our study showed that PCMH was not significantly associated with child wellness as measured by the well-child HEDIS compliance measure (p=.172) at the alpha significance level of .05. Additionally, the sensitivity analysis showed that when we remove our non-PCMH comparison group our model becomes significant (p=.001) at the .05 alpha significance level. This suggests that there are variables other than PCMH that better explain why well-child compliance improved from our pre-PCMH time period to our post PCMH time period.

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Appendix A

CPT Codes

99381 - Initial comprehensive preventive medicine evaluation and management of an individual including an age and gender appropriate history, examination, counseling/anticipatory guidance/risk factor reduction interventions, and the ordering of laboratory/diagnostic procedures, new patient; infant (age younger than 1 year)

99382 - Initial comprehensive preventive medicine evaluation and management of an individual including an age and gender appropriate history, examination, counseling/anticipatory guidance/risk factor reduction interventions, and the ordering of laboratory/diagnostic procedures, new patient; early childhood (age 1 through 4 years)

99391 - Periodic comprehensive preventive medicine reevaluation and management of an individual including an age and gender appropriate history, examination, counseling/anticipatory guidance/risk factor reduction interventions, and the ordering of laboratory/diagnostic procedures, established patient; infant (age younger than 1 year)

99392 - Periodic comprehensive preventive medicine reevaluation and management of an individual including an age and gender appropriate history, examination, counseling/anticipatory guidance/risk factor reduction interventions, and the ordering of laboratory/diagnostic procedures, established patient; early childhood (age 1 through 4 years)

99461 - Initial care, per day, for evaluation and management of normal newborn infant seen in other than hospital or birthing center

Appendix B

ICD-9-CM Codes

V20.2 - Routine infant or child health check

V20.31 – Health supervision for newborn under 8 days old

V20.32 – Health supervision for newborn 8 to 28 days old

V70.0 – Routine general medical examination at a health care facility

V70.3 - Other general medical examination for administrative purposes

V70.5 – Health examination of defined subpopulations

V70.6 – Health examination in population surveys

V70.8 – Other specified general medical examinations

V70.9 – Unspecified general medical examination

Provider Specialty Codes

000 – General Medical Officer

001 – Family Practice Physician

002 – Family Practice Physician

003 – Family Practice Physician Resident/Intern With License

007 - Family Practice Physician Resident/Intern Without License

039 - Pediatric Resident/Intern Without License

040 - Pediatrician

042 – Adolescent Medicine Physician

052 - Pediatric Resident/Intern With License

300 - Aerospace Medicine Physician

301 - Aerospace Medicine Resident/Intern With License

302 - Aerospace Med Flight Surgeon/Family Practice Physician

303 - Aerospace Medicine Resident/Intern Without License

320 - Preventive Medicine Physician

322 - Hyperbaric/Undersea Physician

503 - Pediatric Medicine Consultant

603 - Pediatric Nurse Practitioner

604 - Primary Care Nurse Practitioner - Qualified

605 - Primary Care Nurse Practitioner - Entry

610 - Clinical Nurse - Entry Level Nurse Practitioner

901 - Physician Assistant

911 - Aerospace Medicine

923 - Family Practice/Primary Care

925 - General Medicine

937 - Neonatal/Prenatal Medicine

949 - Pediatrics

967 - Pediatrics, Developmental