



# Ten-year Trends in Family Medicine Residency Productivity and Staffing: Impact of Electronic Health Records, Resident Duty Hours, and the Medical Home

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**BACKGROUND AND OBJECTIVES:** Electronic health records (EHRs), resident duty hour restrictions, and Patient-centered Medical Home (PCMH) innovations have all impacted the clinical practices of residency programs over the past decade. The University of Washington Family Medicine Network (UWFMN) residencies have collaborated for 10 years in collecting and comparing data regarding the productivity and operations of their training programs to identify the program-level effects of such changes. Based on five survey results from 2000 to 2010, this study examines changes in faculty and resident productivity and staffing models of UWFMN residency training clinics using a standardized methodology, specifically describing the productivity impact of EHR changes and duty hour restrictions and the implementation of the PCMH by residencies.

**METHODS:** Data were systematically collected via standardized questionnaire, evaluated for quality, clarified, and then analyzed.

**RESULTS:** Resident productivity decreased over the 10-year interval, with resident total yearly patient visits down 17.2%. Core family medicine faculty productivity was highly variable among programs, and nonphysician provider visits increased. Faculty part-time status increased. Front office, medical assistant, and nursing staffing grew significantly, but other administrative staff decreased, resulting in minimal change in total non-provider staffing. A majority of programs engaged in PCMH initiatives in 2010 and had implemented an EHR.

**CONCLUSIONS:** Physician productivity in UWFMN residency programs decreased for all resident physicians from 2000 to 2010, likely due to a combination of decreased resident duty hours and other clinical practice changes. Productivity trends have implications for the structure and training requirements for family medicine residency programs.

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implementation of the Patient-centered Medical Home (PCMH),<sup>2</sup> and the incorporation of nonphysician providers, including nurse practitioners, physician assistants, and doctoral-level nurses into primary care.<sup>3,4</sup> Additionally, in 2003, the Accreditation Council for Graduate Medical Education (ACGME) implemented new resident duty hour rules, necessitating changes to resident clinic schedules and residency structure. More regulations are due for implementation in July 2011 that will again significantly impact residency schedules and structure.<sup>5</sup>

Family medicine residency programs have both led and responded to these many changes. Residency Review Committee (RRC) guidelines specify that residents should obtain experience with an EHR that documents and correlates comprehensive information and retrieves essential data for health maintenance and quality improvement purposes, and programs that do not currently operate an EHR must indicate future conversion plans.<sup>6</sup> With Preparing the Personal Physician for Practice (P4) leading the way,<sup>7</sup> residency clinics have begun to incorporate components of the PCMH, a model characterized by team-based delivery of comprehensive, coordinated

The practice and training of family physicians have been in flux for the past decade. Changes include the adoption of electronic health records (EHRs), with 2010 estimates showing that 50.7% of all physicians report complete or partial EHR usage,<sup>1</sup>

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care equipped to address preventive, acute, and chronic health needs in a patient-focused manner.<sup>8,9</sup>

Not enough is known about the effects of these changes on residency clinic productivity and staffing needs, as well as the impacts on resident training. The University of Washington Family Medicine Network (UWFMN) Benchmarking Project has regularly administered a survey to all family medicine residencies in the Washington, Wyoming, Alaska,

Montana, and Idaho (WWAMI) region since 2000 that evaluates the finances and operations of the programs. This report presents the 10-year trends in clinical productivity and staffing and examines these trends in light of program EHR implementation and resident duty hour changes. WWAMI residency PCMH implementation is also reported and compared to P4 program PCMH activities. Revenue and cost trends are reported in a companion paper.<sup>10</sup>

## Methods

The UWFMN is composed of 18 independently operated programs in the WWAMI states that share affiliation with the University of Washington (Table 1). The WWAMI network of residencies (described previously)<sup>11,12</sup> is comprised of two university-based programs, 14 community-based programs, and two uniformed services programs. The programs in 2010 housed an average of 23.0 residents (range 15–34, an increase of

**Table 1: UWFMN Program Structures**

	County Population Size, 2009*	Setting (University/Community)	Total Resident FTE (% Change From 2000 to 2010)	Total Faculty FTE (% Change From 2000 to 2010)	Satellite, Residents/Year	RTT, Fellowships	Main FPC is FQHC or Look-alike, *= Satellite in FQHC
AK	286,174	Community	34.0 (+42%)	10.1 (9%)	No	No	
ID	384,656	Community	32.0 (+14%)	19.7 (4%)	No	RTT, 2 fellowships	Yes (new 2010)
WA	240,862	Military	n/r	n/r	No	No	
WY	74,508	Community	21.0 (+5%)	2.0 (n/a)	No	No	Yes
WA	1,916,441	Community	29.0 (-6.5%)	8.3 (-12%)	6	No	*
WY	88,854	Community	19.0 (+5.6%)	15.0 (n/a)	No	No	Yes
WA	1,916,441	Community	32.0 (+7%)	15.3 (50%)	5	2 fellowships	*
WA	1,916,441	Community	15.0 (0%)	3.4 (-59%)	No	No	
ID	82,539	University	18.0 (+38%)	9.6 (+42.9%)	No	No	
WA	796,836	Military	n/r	n/r	No	No	
MT	144,797	Community	18.0 (0%)	6.0 (2%)	No	No	Yes
WA	250,979	Community	18.0 (0%)	9.8 (5%)	No	No	
WA	468,684	Community	21.0 (-22%)	11.2 (53%)	No	RTT, 1 fellowship	
WA	796,836	Community	24.0 (0%)	13.4 (46%)	No	1 fellowship	
WA	1,916,441	University	24.0 (0%)	9.2 (1%)	2	1 fellowship	
WA	1,916,441	Community	24.0 (0%)	11.4 (3%)	No	No	
WA	432,002	Community	20.0 (+6.4%)	16.0 (90.5%)	No	No	
WA	239,054	Community	19.0 (+11.8%)	11.1 (22%)	No	No	Yes
Average, exc. military (n=16)			23.0 (5.1%)	10.3 (21%)			

UWFMN—University of Washington Family Medicine Network, FTE—full-time equivalent, RTT—rural training track, FPC—family practice center, FQHC—Federally Qualified Health Center, n/r—not reported

\* US Census Bureau

5.1% from 2000, with eight residencies increasing their resident complement) and 10.3 faculty (range 6–19.7, a 21% increase from 2000). Six programs have satellite sites or rural training tracks in addition to the core program. The main family practice center (FPC) was a Federally Qualified Health Center (FQHC) in five programs in 2010, and an additional two programs had satellite residency clinics in FQHC settings. Two programs were excluded from any aggregate analysis because of their unique administrative structure (uniformed services residencies).

The comprehensive survey instrument querying finances, productivity, staffing, and other programmatic details was developed in collaboration with Network program directors and administrators, and the same instrument was used for all five data sets (see Appendix at <http://www.stfm.org/fmhub/fm2012/February/LeskoAppendix.pdf>). The current program administrators at each site filled out benchmarking surveys in 2000, 2003, 2006, 2008, and 2010. All but one site had at least one change in administrator over the 10 years of the survey; new administrators were oriented to the survey prior to first completion, emphasizing the understanding of data elements and

definitions to achieve as much input uniformity as possible. The central UWFMN office received the data, and a team of an administrative assistant and two physician project managers examined and analyzed the data for completeness and internal consistency. Data discrepancies and missing data were brought back to individual programs for clarification and correction when possible. Standardized spreadsheets of data for each of the five data sets for all programs were created; each data set was analyzed using the same approach, and summary tables displayed time trends both within programs and after aggregating programs. A follow-up program questionnaire was added in 2010 to define dates of implementation for EHR systems, PCMH changes, clinic moves, and other major changes that would impact the productivity of providers in clinics. The University of Washington Institutional Review Board exempted this project from review.

## Results

### Faculty Structure

Family medicine residency program faculty distribution and faculty/resident ratios are shown in Table 2. Four programs were excluded from

this result because of the unique administrative structure (one self-contained health maintenance organization residency) or because they joined the Network after 2000 and thus had incomplete staffing data for comparison (three programs). Tables 1 and 2 report slightly different overall faculty and resident averages because of these four program exclusions in the Table 2 analysis. Notably, family medicine core faculty full-time equivalent (FTE) positions increased (and actual core faculty bodies increased more) with only minor changes in other faculty types. Although the number of residents also increased, total faculty increases were greater such that the ratio of core faculty to FTE residents increased slightly. Use of non-core, contracted, or hourly faculty (not shown in table) showed few changes over the decade; use of volunteer faculty during the same time period was not queried.

### Productivity

Resident and faculty productivity over the past decade is of special interest due to resident work hour changes and perceived increases in hospital-based clinical responsibilities for faculty members. Table 3 details resident and faculty

**Table 2: Average Program Structure and Staffing, Core Faculty FTE (n=12 Programs)**

Year	Faculty or Clinic Role					Total Core Faculty FTE/ Resident FTE ratio
	Administrators/ Directors FTE	Other Family Physician Faculty FTE	Total Core Faculty FTE*	Total Core Faculty Persons	Residents FTEs	
2000	1.4	5.2	8.3	10.2	23.2	0.36
2003	1.6	5.6	9.8	11.0	22.7	0.43
2006	1.7	5.9	9.5	12.2	23.3	0.41
2008	1.3	6.4	9.0	11.9	24.5	0.37
2010	1.5	7.7	9.3	12.7	24.6	0.38
% Change 2000– 2010		+49%	+12%	+24%	+6%	+6%

FTE—full-time equivalent

Includes other specialties, pharmacy, and behavioral science

**Table 3: Annual FPC Productivity, Aggregate Mean (Range), n=12 Programs Except Where Specified**

Year	R1 Patient Visits/ FTE/Year	R2 Patient Visits/ FTE/Year	R3 Patient Visits/ FTE/Year	Core Family Medicine Faculty Patient Visits/ FTE/Year*	NP/PA Patient Visits/FTE/ Year**	Outpatient Visits/Year, Total, Main Residency Clinic	Inpatient Visits/Year, Residency Program
2000	281 (171–445)	671 (384–945)	1,205 (959–1,783)	846 (421–1,237)	nr	26,779	3,831
2003	276 (153–382)	676 (387–910)	1,062 (738–1,517)	749 (463–994)	nr	25,545	3,229
2006	243 (144–409)	571 (374–842)	934 (571–1,401)	883 (543–1,481)	2,186 (576–3,173)	27,088	4,295
2008	283 (160–480)	596 (459–717)	916 (580–1,393)	891 (317–1,769)	2,404 (795–5,500)	26,154	2,207
2010	258 (168–428)	581 (301–735)	946 (673–1,350)	783 (267–1,638)	2,464 (819–4,300)	29,975	2,974
% Change 2000– 2010	-8%	-13%	-21%	-7.4%	(2006–2010) +12.7%	+11.9%	-22.4%

FPC—family practice center, nr—not reported, NP/PA—nurse practitioner/physician assistant

\* n=10 programs

\*\* n= 9 programs

\*\*\* n=5 programs

productivity in the 12 programs with complete data over the 10 years. All training classes of residents experienced a decrease in yearly productivity, with the greatest decrease in the noted in the PGY-3 cohort. The greatest decrease in total calculated resident productivity was reported between 2003 and 2006; the major event that occurred between these two data sets was implementation of the ACGME duty hour regulations as of July 1, 2003. There had been a downward trend starting prior to that between 2000 and 2003, most striking for PGY-3s, but the overall levels stabilized from 2006 through 2010. Inter-program variation in productivity at all levels of training was marked; however, PGY-1, PGY-2, PGY-3, and faculty visits per hour remained relatively constant unchanged over this same time frame, implicating a decrease in clinic hours rather than decreased provider efficiency.

Faculty productivity was highly variable among programs, but faculty practicing in an FQHC model

revealed higher productivity. Non-physician providers (only recorded from 2006 on) demonstrated high and increasing productivity. The intensity of services administered by all provider types was calculated by the average relative value unit (RVU)/clinic visit over time; only five programs were able to provide RVU data and showed no consistent pattern of change. Notably, total inpatient visits attributed to the residency programs increased from 2003 to 2006 but then decreased over the decade by a mean of 22.4%, even as mean outpatient visits increased by 11.9%.

#### *EHR Implementation and Productivity*

Programs were queried in 2010 about EHR implementation. Fourteen of 16 programs (excluding military) had or were currently implementing an EHR, and the other two had planned implementation dates. Table 4 presents the timeline of EHR implementation for the 16 programs, the EHR product chosen,

and the R3 annual clinic visits for the data year most immediately preceding and following implementation, when available. The eight programs with complete before and after data showed an average 14.4% drop in R3 productivity after implementation, although three of those implementations were concurrent with resident work hour rule changes. Seven administrators wrote in a “comments” field that implementation of the EHR was associated with lower clinic productivity during the implementation months. Theoretically, EHR implementation would be more likely to affect efficiency (visits/hour), and visits per hour showed no EHR-attributable changes.

#### *Staffing Models*

Staffing models varied widely among family medicine residency clinics. Table 5 displays the aggregate staffing model changes over a decade for those personnel common to all clinics, including front office, nursing, and medical assistants, as well as total figures (highly variable

**Table 4: EHR Implementation Timeline (Note That R3 Visits Are Derived From the Yearly Benchmark Data Most Immediately Preceding or Following implementation)**

Program	Date of EHR	EHR Product	R3 Annual Visits Before	R3 Annual Visits After	% Change Before/After
1	February 2001	Epic	1,167	847	-27%
2	May 2004	Epic	nr	878	
3	December 2004	GE Centricity	1,005	1,116	+11%
4	August 2005	Note Worthy	1,317	1,143	-13%
5	Staged: November 2005, March 2006	Horizon Ambulatory Care (changing to Epic currently)	904	782	-13%
6	October 2006	Centricity	nr	656	
7	March 2007	Epic	571	580	+2%
8	March 2007	Epic	1,004	869	-13%
9	April 2009	McKesson Practice Partner	1,125	864	-23%
10	October 2009	Centricity	1,393	1,061	-24%
11	February 2010	Centricity	1,277	Future	
12	May 2010	GE Centricity	840	Future	
13	Summer 2010	McKesson Horizon Practice Plus	1,944	Future	
14	July 2010	Epic	1,232	Future	
15	January 2013	eClinicalWorks	Future	Future	
16	March 2013	GE Centricity	Future	Future	

EHR—electronic health record, nr—not reported

arrangements). Front office staffing increased 16%, medical assistants increased 62%, and total nursing increased 33%, but medical records personnel decreased 47% and billing staff decreased 7%, leading to a total staffing increase of only 4%.

#### *Medical Home Innovations*

PCMH activities were queried for the first time in 2010 and were common among the 16 residency programs that responded to the follow-up PCMH survey (Table 6). A majority of the programs indicated two or more PCMH activities, the most common of which were creating a patient satisfaction survey, electronic prescribing, and producing a population health database,

followed closely by disease registry. However, only seven programs were becoming PCMH certified, and only five received any revenue from their PCMH work.

#### **Discussion**

Changes in clinical practice such as implementation of EHR, ACGME resident duty hour regulations, and PCMH innovations have directly impacted family medicine residency training. However, specific clinic practice and productivity effects of these changes have been poorly quantified. This paper presents the productivity and staffing of the WWAMI family medicine residencies over the course of a decade in the context of their specific timeline

of EHR implementation and duty hour changes.

Residency clinic productivity definitely decreased from 2000 to 2010. The most significant total resident decrease occurred from 2003 to 2006; it was during this time that resident duty hour restrictions were implemented. Other contributing factors included EHR implementation and changing residency rotation or program requirements (cited by program directors and administrators).

The wide observed range of family medicine faculty outpatient productivity underscores the varied faculty job descriptions at each program, particularly the variation in percentage of faculty FTE dedicated to direct patient care activities in the



**Table 5: Non-provider Staffing of FPC Practices, Aggregate Mean (n= 12 Programs)**

Year	Personnel, FTE/10,000 Visits			
	Front Office	Medical Assistants	All Nursing (RN+LPN)	Total
2000	2.28	1.93	3.86	12.52
2003	2.55	2.99	4.14	13.40
2006	2.34	2.70	4.78	12.37
2008	2.60	3.12	5.13	13.53
2010	2.65	3.12	5.13	13.04
% Change 2000–2010	+16%	+62%	+33%	+4%

Total includes IT, medical records, billing, other administrative and human resources.

outpatient practice. Use of part-time faculty increased over the decade, as evidenced by twice the increase in faculty persons versus FTE. Total outpatient visits increased as expected with increased resident and faculty FTE, but inpatient volumes decreased dramatically between 2006 and 2010. This decline in residency-attributed inpatient volumes was striking and may be the result of increased use of hospitalist services not housed directly within the residency programs. This decline has implications for family medicine inpatient training, particularly if inpatient care is less frequently modeled by program faculty.

Core faculty to resident ratio increased over the decade, possibly indicating some combination of increased intensity of teaching requirements and increased clinical or research requirements by faculty. Additionally, there was an increase in nursing personnel over this 10-year period and a decrease in medical records and billing staff. The nursing increase may reflect both an increased need for nursing triage services as well as the growth of team-based care strategies in PCMH implementation, including use of chronic disease registries and care management. Decreased medical records and billing staff were related to EHR implementation, as well as outsourcing of these functions at the larger institutions.

**Table 6: WWAMI Family Medicine Residency Network Programs Involved in PCMH Initiatives in 2010; Total n=16 Programs**

PCMH Objective	# of Programs, (%)
Becoming PCMH certified	7 (44%)
Patient satisfaction survey	15 (94%)
Patient e-mail	8 (50%)
Patient Web portal	5 (31%)
E-prescribing	12 (75%)
Electronic medical list	10 (63%)
Point-of-care prompts	10 (63%)
Disease registry	11 (69%)
Population health data	12 (75%)
PCMH-related revenue	5 (31%)

WWAMI—Washington, Wyoming, Alaska, Montana, and Idaho region, PCMH—Patient-centered Medical Home

The WWAMI family medicine EHR implementation rate of 88% was higher than both the national rate, with half of all outpatient offices reporting some type of EHR system in 2010<sup>1</sup> and the Washington state family medicine EHR rate of 57.9%.<sup>13</sup> EHR implementation was not clearly linked to decreased productivity, although on average programs showed decreased productivity after implementation.

Implementation of PCMH components by WWAMI programs was high. Although some family medicine programs nationally have documented that PCMH implementation

enhanced productivity by decreasing no-show rates through open access, expanded hours, electronic communication, and other enhancements,<sup>14</sup> productivity effects of WWAMI PCMH uptake will have to be assessed through future surveys.

This benchmarking dataset has limits in its interpretation. Although the dataset was examined exhaustively, the turnover in program administrators created discrepancies in how some fields were reported. Missing data elements or clearly impossible numbers (such as an R3 average of 50 outpatient visits in a year) resulted in some programs

being excluded from analysis on a case-by-case basis. These data cannot be generalized for other reasons. The number of programs in the UWFMN is a small subset of the number of programs nationwide, and all are located in a specific region of the country. The concentration of programs in a metropolitan region (Seattle, Tacoma, and Olympia) provides more cross-pollination of ideas and innovations, as well as the support of large hospital systems and an academic medical center. Not coincidentally, EHR and PCMH implementation are high in these programs.

Nonetheless, these residency trends may help inform planning for residency training clinics in other locations. Decreasing overall resident productivity means that residents may contribute less to the overall clinic practice and points to a potential increase in the number of programs receiving RRC citations for inadequate outpatient visit volumes at the time of graduation. This problem may further worsen as the next iteration of ACGME duty hour regulations is implemented in July 2011.<sup>15</sup> Productivity may need to be measured by alternative methods in the future. Electronic and telephonic visits may become a substantial proportion of clinic visits and enhance continuity of care overall, even while simultaneously resulting in loss of direct patient contact. Family medicine program training requirements for outpatient visit volumes may need to be redefined in light of these changes.

Increasing productivity of nurse practitioners and physician assistants may somewhat mitigate the

productivity impact on residency clinics. Nursing staff management of complex patient populations in the clinics will also likely continue to grow as nurses assist with implementation of PCMH components.

Examination of the clinical effects of practice change will help illuminate best practices for residency clinics moving forward and assist with structural and educational planning. Residencies are by nature an important nidus of change for the specialty of family medicine.<sup>16,17</sup> Systems of care that include EHR, PCMH orientation, and full compliance with resident duty hours will increasingly demand creative solutions to preserve quality resident training.

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