A Simple Framework for Weighting Panels Across Primary Care Disciplines: Findings From a Large US Multidisciplinary Group Practice

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Background: Health system redesign necessitates understanding patient population characteristics, yet many primary care physicians are unable to identify patients on their panel. Moreover, accounting for differential workload due to patient variation is challenging. We describe development and application of a utilization-based weighting system accounting for patient complexity using sociodemographic factors within primary care at a large multidisciplinary group practice. **Methods:** A retrospective observational study was conducted of 27 clinics across primary care serving more than 150 000 patients. Before and after implementation, we measured empanelment by comparing weighted to unweighted panel size and the number of physicians who could accept patients. Perceived access was measured by the number of patients strongly agreed that an appointment was available when needed. **Results:** After instituting weighting, the percentage of physicians with open panels decreased for family physicians and pediatricians, but increased for general internists; the number of active patients increased by 2%. One year after implementation, perceived access improved significantly in family and general internal medicine clinics ($P < .05$). There were no significant changes for general pediatric and adolescent medicine patients. **Conclusions:** The creation of a weighing system accounting for complexity resulted in changes in practice closure, increased total patients, and improved access.

Key words: health services accessibility, practice management, primary health care

Understanding the population receiving care is crucial as pay-for-performance, patient-centered medical homes, and accountable care organizations further permeate the health care setting.[1] Viewing practices in terms of panels rather than individual patients

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The authors declare no conflicts of interest.

helps identify health needs across a population and improves resource allocation efforts. Empanelment, the ability to link a patient to a primary care clinician,[2,3] also allows for effective measurement of access to care. Access, in turn, has been linked to improved outcomes in numerous studies.[4-9] However, a recent survey showed only one-third of family physicians were able to accurately estimate the size of their own panel.[10,11]

Furthermore, how to identify the work involved in caring for a panel of patients is unclear. The number of patients cared for by a primary care physician (PCP) can vary substantially. Across primary care disciplines, it is well recognized that the number of patients in a panel is not an accurate marker of work. For example, the amount of work required to manage the care of a young healthy person will differ greatly from that needed for an older patient with multiple chronic conditions. The resources and effort required to care for patients vary based on several characteristics including demographics, health behaviors, access to care, and psychosocial issues.[12]

Although a few examples of how to create weighted panels based on patient characteristics have been published,[13-15] comprehensive descriptions of the process of panel restructuring based on weighting are limited in number, particularly across primary care disciplines. In addition, examination of the impact of this restructuring is limited. A single recent study found increased panel sizes to be associated with decreased appointment access but not patient satisfaction.[16]

The purpose of this article is to describe how a utilization-based weighting system that accounts for patient complexity was developed and applied to

primary care patient panels at a large academic health system. We then measure the impact on access and describe the ways health care delivery at our institution has transformed after implementing these changes.

METHODS

Setting
Health system is a public academic health system composed of the UW School of Medicine and Public Health, the UW Hospital and Clinics, and the UW Medical Foundation (the physician practice plan). PCPs constitute 22% of the 1280 members of the practice plan. Primary care at this health system is defined as the Department of Family Medicine and Community Health, and the divisions of General Internal Medicine, and General Pediatrics and Adolescent Medicine. Health system has 374 PCPs who admit patients to multiple hospitals and care for approximately 279 000 medically homed patients. Patients are considered as medically homed if they have an identified organizational PCP and a telephone contact or clinic visit within the organization in the last 3 years.

Impetus for change
In 2006, multiple factors led to access shortages for the health system. The organization lost physicians to competitors. At the same time, nationally, there were current and projected PCP shortages.[17-21] Practices had limited access for patients due to physicians' perceptions of being at capacity and unable to accept new patients. However, there were no clear metrics used to define when practices were full and hiring of new physicians needed to occur. Therefore, the organization placed a priority on data-driven decision-making to define a full panel, expand access, systematize workforce planning, and strategically and fairly allocate resources.

Process: Developing a primary care physician/patient assignment policy
In 2007, a diverse workgroup of family medicine physicians, general internists, pediatricians, obstetricians, gynecologists, and other non-primary care medical specialties convened to develop a decision flowchart for the assignment of patients to a PCP. Goals for this assignment were that it had to be sustainable, readily reproducible from existing data sources, and transparent. Using the electronic health record (EHR), patient assignment could be standardized using discrete and identifiable electronic fields.

One of the first issues identified was lack of a standard definition for what constituted being a PCP. The workgroup decided to define PCPs as physicians from general internal medicine, family medicine, or pediatrics due to these groups' willingness and abilities to provide comprehensive primary care. Therefore, it was decided that only physician names from these specialties would be allowed to populate the EHR PCP field.

Attributing patients to a PCP
The existing PCP fields in the EHR were neither robust nor reliable for consistent use in operationalizing quality, panel size, compensation, or resource allocation.

Therefore, the PCP field was cleaned by deploying a standardized script asked at check-in for any visit across the organization. Patients routinely were asked, "Who is your PCP?" and the information was entered into the EHR.

Refining panel metrics across primary care disciplines
In 2009, a combined workgroup across primary care disciplines was created. The charge to this workgroup was to review, standardize, and improve the panel definitions to allow for their use in population health management, defining capacity, and planning for workforce needs and resources. The workgroup examined 3 years of data containing demographic characteristics and utilization patterns, including telephone and medication refill encounters for patients with a primary care medical home at the health system. They also verified that all billable provider services within the system were captured across all age groups.

Age- and gender-based cut points
Based on these data (Figure 1), the group determined that there were different office visit patterns for those of different ages and genders. Age was related to workload in a complex manner, such that patients at lower and upper age ranges had more office visits (Figure 1). There were also differences by gender noted between ages 15 and 59 years, when male utilization was notably lower (Figure 1).

Establishing a proxy for patient complexity
The number of office visits and telephone encounters at a primary care clinic was used as a proxy for the primary care work involved in caring for a given population of patients and to develop a weighting scheme. The workgroup agreed that overall weighting of a panel must equal 100%.

In 2011, the group recognized that age and gender of a patient alone did not sufficiently predict workload variability, and specifically the socioeconomic and medical/psychiatric complexities of individual patients. As a proxy for these factors, the group chose patient insurance type, as there was no other way to capture
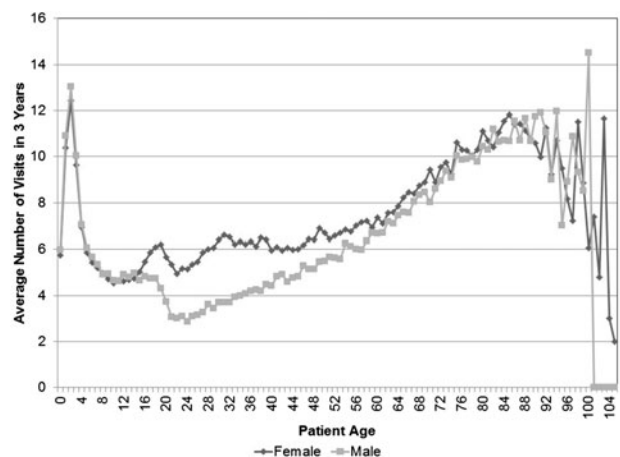

Figure 1. Average number of face-to-face encounters at primary care provider clinic site in 3 years by age (n = 242 245).

these data in any other discrete fields within the EHR. Insurance was consolidated into 3 categories: (1) Medicare for all age groups (since those on Medicare younger than 65 years tended to have complex medical and psychosocial issues, and those older than 65 years had increasing medical care needs due to aging and increased co-morbidity); (2) Medicaid for all age groups (due to the higher risk of having psychosocial and economic issues adversely influencing health); and (3) all other payers (health maintenance organizations, commercial insurance companies, and other insurers). Dual-eligible beneficiaries were assigned to their primary insurance. "Groupers" or "discrete fields" were established within the EHR to map to a patient's insurance.

Weight development

Finally, to develop weights, the average number of visits was determined for the entire primary care population. Patient phone calls were also factored by considering 4 calls as the equivalent of 1 visit. For each of the 36 groupings that reflected different age, gender, and insurance categories, a weight was calculated as a ratio of the average number of visits/telephone calls for patients in the grouping as compared with the entire population average (Table 1).

Definitions and calculations

To determine the impact of panel weighting on PCP panel composition and size, we retrospectively examined data on active patients that the organization

routinely collected on established PCPs (Table 2). The organization prepares regular panel size reports using a 3-year rolling horizon. Each department and PCP receives a monthly report containing a trended panel history and a list of patients who have been added or dropped. Criteria for dropping patients from an active panel included death, transfer within or out of the organization, or no office visits within the organization during the 3-year period.

We compared weighted and unweighted panels before and after November 2012. November 2012 was chosen because changes to panel weighting occurred in July 2012, and we allowed for a 4-month ramp-up period until full implementation. To account for variation in an individual's clinical full-time equivalent (FTE), all values were normalized by aggregating at the clinic level. This calculation was done by dividing the total number of active patients seen at a clinic by the total physician FTE at that clinic. We only considered established physicians who were present before and after the panel weighting was implemented.[22] We also compared the number of physicians with open panels. An "open panel" is defined as the ability to accept new patients. Providers were able to electively close panels at 1800 patients, or could reopen panels to accommodate access for additional patients.

To determine the impact of these changes on patient-perceived access, we examined responses to a standardized patient experience survey sent on behalf of the organization by Avatar International to a randomly selected group of patients seen in primary care clinics in 2011 (prior to panel weighting) and 2012-2015. We examined responses to the statement, "An appointment was available when I needed one." The percentage of responses indicating "strongly agree" for each question was then compared using a t test. Responses were considered significant at $P < .05$.

Table 1. Calculated Panel Weighting for Age, Gender, and Insurance Categories

Age, y	Insurance	Males Weight	Females Weight
0-3	Medicare	1.00	1.00
	Medicaid	1.51	1.44
	Other	1.64	1.55
4-14	Medicare	1.00	2.62
	Medicaid	0.85	0.78
	Other	0.84	0.82
15-39	Medicare	1.15	1.82
	Medicaid	0.69	1.20
	Other	0.53	0.81
40-59	Medicare	1.65	2.22
	Medicaid	1.13	1.45
	Other	0.80	1.00
60-74	Medicare	1.52	1.71
	Medicaid	1.42	1.57
	Other	1.12	1.21
≥75	Medicare	1.89	1.98
	Medicaid	1.04	1.71
	Other	1.33	1.09

Table 2. Definitions Use in Panel Reporting and Calculations

Term	Definition
Active patients	Patients who had an office visit with any provider within the health system in the past 3 y
Established physician	Those employed between 2009 and 2015 who had been employed by the health system for at least 2 y (no longer on salary guarantee)
Unweighted panel size	The number of active patients attributed to a physician
Weighted panel size	The number of active patients weighted according to age, sex, and payer characteristics
Open panel	Reflective of a primary care physician's ability to accept new patients. Primary care physicians were able to electively close panels at 1800 patients (per 1 full-time equivalent); panels could be reopened to accommodate additional patients if desired
Closed panel	Reflective of a primary care physician's ability to not accept new patients (eg, panel size at 1800 per 1.0 full-time equivalent as above)

RESULTS

During the 6-year study period, there were a total of 112 established PCPs working in 27 clinics: 55 family physicians, 24 general internists, and 33 pediatricians. Before panel weighting was instituted, 31% (17/55) of family physicians, 38% (9/24) of general internists, and 48% (16/33) of pediatricians had open panels. After instituting weighting, the percentage of physicians with open panels decreased for family physicians (25%; 14/55) and pediatricians (42%; 14/33), but increased for general internists (42%; 10/24).

Table 3 shows changes that occurred at the clinic level in the number of active patient panels and total visit numbers before and after panel weighting was instituted.

Overall, the number of active patients increased by 2% as compared with before panel weighting (from 150 243 active patients to 153 453 patients). At the clinic-specialty level, adjusting for FTE, 62% of family medicine clinics (8/13), 50% of general internal medicine clinics (3/6), and 63% of general pediatrics clinics (5/8) had increases in the number of active patients after weighting was implemented.

As shown in Figure 2, in the year after panel weighting, the proportion of patients who strongly agreed that an appointment was available when needed increased ($P < .05$) in family medicine and general internal medicine. There were no significant changes for general pediatric and adolescent medicine patients.

Table 3. Number of Active Panel Patients and Total Visits at Each Primary Care Clinic (n = 27) Before and After the Application of Panel Weighting[a]

Clinic Specialty	Active Panel Patients		Total Visits	
	Preweighting	Postweighting	Preweighting	Postweighting
Family medicine	1 948	1 687	6 558	13 143
	3 092	4 119	15 798	22 940
	1 605	2 012	11 313	13 386
	2 064	2 394	6 838	14 539
	1 834	4 297	10 347	13 243
	1 630	2 482	11 407	18 162
	2 474	1 926	21 202	16 726
	1 583	2 235	9 722	12 233
	1 851	2 211	11 479	12 674
	1 696	1 592	6 285	6 244
	2 478	2 519	15 579	14 228
	2 831	1 998	17 439	12 400
	2 941	2 210	8 030	14 693
Internal medicine	1 650	1 405	8 559	6 185
	1 244	2 705	4 177	7 360
	2 169	1 799	9 724	7 965
	2 041	2 520	8 552	9 217
	1 808	2 281	8 731	9 725
	2 315	949	11 928	11 092
Pediatrics	1 926	1 864	11 695	10 784
	1 280	1 687	8 253	10 018
	2 629	2 516	15 536	13 859
	1 461	1 540	9 622	9 753
	1 508	1 685	9 924	11 455
	1 963	1 908	6 266	6 558
	1 279	1 547	7 232	8 378
	1 950	1 994	11 334	11 683

Abbreviation: PCP, primary care physician.
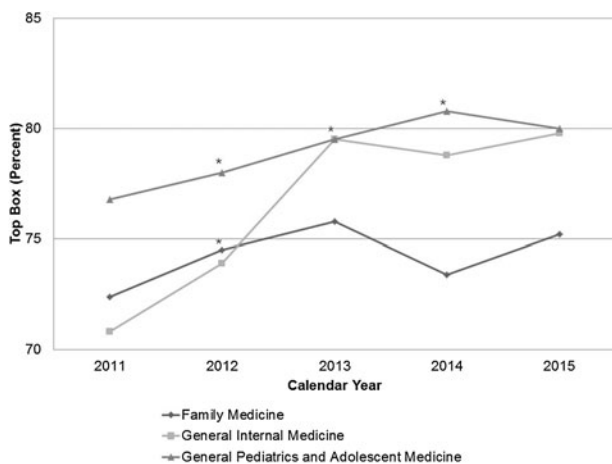[a]Normalized to 1.0 full-time equivalent.

Figure 2. Top box responses (2011-2015) for an appointment being available when needed. *Change from previous year significant at $P < .05$. The top box is the percent of "strongly agree" survey responses and the change is the difference between yearly top box percentages.

DISCUSSION

We describe the creation of weighted panels for PCPs within our organization using available EHR data to improve the precision of panel size by adjusting for workload based on differing patient characteristics. After this weighting was implemented, patients' perceived access improved in family medicine and general internal medicine clinics, despite an increase in the total number of active patients. We hypothesize that this is due to panels becoming "right-sized," and thus better able to reflect the amount of actual work required to meet the access needs of a population. Organizationally, this panel adjustment plan was clear enough to use in determining compensation, opening and closing panels, and making physician hiring decisions. Weighted panel sizes are also organizationally used for making staffing decisions, setting compensation,[22,23] building registries for chronic disease (eg, diabetes), and outreach to patients, all critical components of a high-performing primary care system.

Given the compelling need for empanelment to provide high-quality comprehensive primary care and to fairly attribute work,[22-24] PCPs need achievable strategies to determine panel attribution. Our comprehensive description of the panel weighting development process and the use of simple sociodemographic variables is transparent, easy to understand, and replicable. This work augments the few existing studies of panel weighting based on patient characteristics.[14,15] As the health care system evolves with EHR usage, use of similar variables could become a standard way to compare panels and populations across various organizations and geographical settings.

Panel weighting using an accurate metric for work is important for both providers and the organization currently, and in the future. Older physicians with aging practices appreciated the fact that weighting rec-

ognized the increased workload required to care for complex older patients. By right-sizing panels, access improved for existing patients through new patients being added to the physician's panels who had availability. If existing patients were unable to get visit in a timely manner, they were able to change to a PCP with more availability.

As the nature of primary care changes, additional non-face-to-face and asynchronous work measures will need to be incorporated in the panel definition. For example, e-visits, electronic messaging, telehealth visits, and huddling with care coordinators and behavioral health coordinators will need to be part of work measurement going forward. In addition, looking at patient care through the lens of defined patient panels could enable identification of current nonutilizers of the system to help develop outreach strategies for preventative health and other health care needs including chronic disease care. Finally, our system and others are interested in assessing cost of care and quality outcomes per panel member for the populations we are managing. This understanding could help create more value for payers and patients and better revenue management.

There are several limitations to this study. First, the period chosen for analysis (3 years) may not accurately reflect actively engaged patients, particularly in a rapidly fluctuating health care market where patients rapidly change health systems. If this were the case, panel size calculations would be inflated. The study period was chosen to coincide with how the organization defines active patients, which was based on the recommended 3-year frequency of Pap smears as a major driver of health care utilization in healthy women; however, the recommended frequency of Pap smears has since changed and may necessitate revisions in our model.[25,26] A second limitation to our weighting system is that it fails to take into account the added work of caring for patients with comorbidities,[27] language and health literacy barriers, and significant psychosocial or psychiatric illness. Similarly, categorizing those uninsured along with those who have other insurance may not accurately reflect the psychosocial and economic issues that occur for this subgroup. This weighting also did not incorporate primary care work activities outside of our own health system, which may have led to underweighting. These outside activities may be especially common among patients living in small rural communities who might intermittently use local specialty providers, urgent care, and emergency departments for convenience and proximity. A third limitation, a possible flaw in our weighting scheme, is that each visit was counted equally. There may be value in incorporating relative value units associated with visits and procedures, since that could better account for differences in work between various encounters. However, there are some concerns about the ability of relative value units to objectively reflect differences in work because of differing accuracy and coding variability among different providers.[28,29] Another limitation is that the nature of work is changing associated with

policies brought about by the Affordable Care Act and insurance exchanges and increased copayments for patient office visits. Our organization has observed a decrease in face-to-face office visits, and an increase in non-face-to-face work such as telephone calls and use of electronic messaging, which is not completely captured in our current weighting model. Lastly, because our patient satisfaction survey is only distributed to patients who have had an appointment, we do not have data from patients who may have been unable to access to care.

Despite these limitations, weighted panels have significantly informed decision-making at this organization and may inform others based upon their model of care. One example specific from this organization is resource allocation; time studies of RNs triaging a specific number of patients through the phone or patient portals per weighted panel allowed the calculation of the number of RNs needed to staff these efforts across clinics. The organization has also used the weighting to decide how many receptionists, medical assistants, additional physicians, or advance practice providers are needed, as a practice site nears capacity.

In conclusion, better defining a patient panel is critical to effectively managing a population of patients. By refining the PCP field in the EHR and using age, gender, and payer as a panel weighting mechanism, our organization was able to create panels that accounted for equitable, resource-appropriate workloads based among different types of patients. We have been able to use weighted panel size to help make decisions around work force planning, create staffing models for primary care clinics, provide outreach to patients, and adjust physician compensation. Other organizations should consider adopting similar EHR-based empanelment processes to inform and improve their population-based care.

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