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Original Articles

An Empirical Assessment of Cases Experienced during Inpatient Family Medicine Resident Training in a Rural Community Hospital of the Shizuoka Family Medicine Training Program in Japan

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Background: Despite emerging national interest in training family physicians to improve access to medical services in health care shortage areas, empirical data on inpatient resident learning experiences in rural community settings has been lacking. This research sought to understand the breadth of diagnoses, patient demographics, and comorbidities experienced by family medicine residents while training in a newly launched family medicine training program in a rural area in Shizuoka prefecture.

Methods: The design employed secondary dataset analysis from a 260-bed hospital in rural Shizuoka. Using the hospital administrative database, a dataset was developed of all patient admissions from 9/1/2011 to 8/31/2012 including the Diagnosis Procedure Combination (DPC) code, patient age and gender, and the physician of record. The main outcome measures were frequency and distribution of diagnostic groups and diagnoses in family medicine residents. Secondary outcomes included three or more comorbidities and hospital readmissions.

Results: There were 3474 admissions (males/females 1867/1607) and 8 residents who were the physician of record for 220 cases (mean 27.5 cases/resident, range 10–56), about 6.3% of the total hospital admissions during this timeframe. The mean age of resident cases was 71 years of age (range 0–101 years). Distribution by diagnostic groups included: gastrointestinal (61), pulmonary (41), cardiovascular (28), and neurological (25). The most common diagnoses included: pneumonia (34), congestive heart failure (21), stroke (16), intestinal obstruction (15), and urinary tract infection (10). Seventy-seven percent (170/220) of cases had one or more comorbidities and 36% of cases had three or more comorbidities which were significantly less than hospital as a whole (46% of cases with three or more comorbidities).

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Conclusions: The community hospital setting provides an excellent training environment for family medicine residents because the setting and the care experienced reflects content of what the training program aspires for the residents to provide in the future. Community hospital training serves policy maker's agenda for developing a systematic primary care training system appropriate for health care shortage area community-based care.

Background

Japan is a rapidly aging, low birth-rate society with the percent of population over 65 years old expected to peak at 39.9% in 2060.[1] Demographically, much of the young adult population has shifted to major cities.[2] Physicians also have a tendency to localize in such high density regions.[3] The already serious problem of health care shortage areas has grown worse over the past two decades.[4] While there is a preponderance of individuals in rural health care shortage areas who are elderly, there still remain many children and women of childbearing age. The low density of children and women of childbearing age in rural areas challenges pediatricians or obstetrician gynecologists to survive financially. In contrast, a family physician trained in womb-to-tomb care can provide routine care to all age groups and still survive financially. For many decades, pioneers in Japan[4] and abroad[5,6] have been laying the groundwork and advocating for family medicine (FM). Nationally, there is growing recognition that FM embodies an ideal model for helping to address the rural health care shortage problem in Japan. FM is the only specialty that systematically prepares resident physicians to provide "womb-to-tomb" care.[5]

The Japanese government has announced it will formally recognize general medicine as specialty in 2017.[7] With recognition of the importance of the new specialty of family medicine must also come a shift in thinking about the problems of selection bias of patients in academic medical centers. Due to selection bias, the vast majority of patients seen in academic and other tertiary medical settings are extremely atypical from the patients seen in primary and secondary care settings. The scientific basis informing the value of family medicine resident training in the community comes from an understanding of the ecology of medical care. Over 50 years ago, Kerr White et. al. published landmark research on the ecology of medical care.[8] The purpose of this research was to understand the "proportions of defined populations who, within a relatively short period of one month, are 'sick,' consult a physician, are referred by him to another physician, are hospitalized, or sent to a university medical center." This research illustrates from a population perspective that there is considerable selection bias among patients seen in academic medical centers. White et. al. concluded that only about one in 750 patients who experienced illness or injury in a month was seen at an academic medical center! The approximate proportions in the ecology of care discovered by White et. al. was confirmed in the US 40 years later in 2001.[9]

Remarkably, Fukui and colleagues investigated the ecology of care in Japan, and largely found similar findings in 2005.[10] Using diaries recorded by the general population, they estimated that in the course of a month among 1,000 persons that 862 report symptoms, 307 visit a physician's office, 88 visit a hospital outpatient clinic, 49 consult a complementary or alternative medical care provider, 10 visit an emergency department, 7 are hospitalized, 6 visit a university hospital outpatient clinic, and 3 receive home care.[10] From their data, it can be inferred that patients hospitalized in in academic medical centers comprise less than 1% of all patients with illness. Thus, selection bias that occurs among the population of patients seen in primary, secondary, and tertiary care settings renders patients in academic and tertiary care hospitals to be extremely atypical of the kinds of patients and illnesses seen in the community.

While not well known in Japan, the vision of research examining how services are provided across the population described by White and others is called Health Services Research. AcademyHealth, the professional organization of health services research field defines the field of health services research as, "the multidisciplinary field of scientific investigation that studies how social factors, financing systems, organizational structures and processes, health technologies,

and personal behaviors affect access to health care, the quality and cost of health care, and ultimately our health and well-being. Its research domains are individuals, families, organizations, institutions, communities, and populations."[11] The Agency for Healthcare Research and Quality is a federal agency in the U.S. that works within the U.S. Department of Health and Human Services and supports health services research for producing evidence to make health care safer, of higher quality, more accessible, equitable, and affordable.[12]

The concepts of Health Services Research can dramatically change understanding of health care and education. In 1963, Two years after his landmark research on the ecology of medical care, White then explicitly considered the role of family medicine and the academic medical center. Based on the ecology of care model, White spoke to the problems of training in academic medical centers where patients only reflect a fraction of all the patients who are receiving medical care. He implored academic medicine to take responsibility in several areas including: "…the continued need to redefine the problems of health and disease in communities-local, regional, national, and international, served by the medical school" and "…to define with considerable precision the broad content of the doctor's job. Not only the job as reflected in the small and biased sample of patients seen in university teaching hospitals, but also the job as reflected through problems brought to all practicing physicians…".[13]

These ideas hold true today. Fifty years later, in the article, "Medical schools are no place to train physicians", Josh Freeman explains why, more than ever, academic medical centers are problematic for training the vast majority of physicians. He characterizes academic medical centers as having reached "…enormous size, concentrating huge basic research facilities … and tertiary and quarternary medical services — high tech, high complexity treatment for rare diseases or complex manifestations of more common ones. They have often lost their focus on the health of the actual community of which they are a part."[14] Critics of Japanese academic medical centers are likely to echo the same sentiments. Indeed, the recent decision to implement a mandatory two-year preliminary training program (shoki kenshuu), as well as the push for a general medicine specialty have come in part from erosion of trust in the medical training system, and the desire by the public for physicians who can provide general medical care.[15]

Despite the theoretical and intuitive understanding about the importance of training family medicine physicians in rural settings, empirical data on inpatient resident learning experiences and the value of training in rural community hospitals has been lacking. The science of where to train, and the importance of the training environment, represents a paradigm shift in Japan as resident training over most recent memory has occurred predominantly in academic and tertiary care centers. Unfortunately, data to support community-based training has been lacking.

In April of 2010, the Shizuoka Family Medicine Training Program (SFM) was established by the cities of Iwata, Kikugawa, and Morimachi to resolve the serious physician shortage and restore the deteriorating community healthcare system in the Chutoen (literally Great Middle East) Medical Service District of Shizuoka Prefecture.[16] This project is supported by Shizuoka Prefecture and funded by the Community Healthcare Revival Fund. In the project, Iwata City Hospital (500 beds), Kikugawa General Hospital (260 beds) and Morimachi Public Hospital (131 beds) work collaboratively with the University of Michigan, Department of Family Medicine and the Japan Institute of Family Medicine — a general incorporated foundation. In addition to these three training hospitals, the program features two recently built independent family medicine outpatient training centers,[17] the Kikugawa City Family Medicine Center called the Akatchi Clinic, and the Morimachi Family Medicine Center. An academic partnership between the Shizuoka Family Medicine Training Program and Hamamatsu University School of Medicine has evolved. Hamamatsu University School of Medicine now has a contract department (*kifu kouza*) of Family and Community Medicine that was established in 2014. The aim of the international collaboration with the University of Michigan is to train family physicians and deliver family medicine health care in Japan informed both by local expertise and global standards.

The Kikugawa General Hospital serves as the primary site for inpatient training of the residents who have their continuity clinic at the Kikugawa City Family Medicine Clinic. The hospital provides general medical care including 24 hour emergency care services, birth care and newborn care. In addition, the hospital has a relative specialization in mental health care with 58 beds dedicated to the service of patients with psychiatric illness. An unopposed residency program, family medicine residents have no competition for patients from any other hospital-based residency programs. The hospital does intermittently take residents from other established residency programs, but their numbers historically have been very low, around 0–1 per year for electives. During the inpatient training period, FM residents also have their continuity family medicine clinic training as a "half-day-back"; and one half day per week is spent at the family medicine clinic to provide longitudinal care for patients as a family physician.

Given the scientific basis and rationale for training in the community,[8–10] the purpose of this research was to understand the breadth of diagnoses and comorbidities, as well as the demographic distribution of patients cared for by family medicine residents during their inpatient training in the affiliated community-based Kikugawa General Hospital. This study also aims to determine how the FM resident cases compare to the hospital practice as a whole during a one-year window.

Methods

By design, the project utilized secondary dataset analysis. The Kikugawa City General Hospital, a community hospital (260 beds) located in Kikugawa City served as the setting for the research. The local community is home to green tea farming and production and other light industry. All patients admitted to the hospital from 9/1/2011 to 8/31/2012 were the target population of the investigation and there were no exclusion criteria. With regard to human subjects, the project was conducted under auspices of the University of Michigan Human Subjects Review Board (ID HUM00047926), as an IRB exempt study (under Exemption #1 of 45 CFR 46.101).(b). In addition, the hospital deemed formal review by the hospital ethics committee as unnecessary since the data were de-identified.

Using the hospital administrative records that are primarily utilized for billing, a database of pertinent study variables was created and included fields such as the dates of admission and discharge, hospitalization duration, readmission details, patient age, patient gender, Diagnosis Procedure Combination (DPC) code, and physician of record. As the database only included the primary responsible physician (*shujii*), the cases attributed to FM physicians do not reflect all cases that received care from FM physicians, e.g., non-family medicine attending. The cases of a FM fellow were included with the FM resident categorization. The fellow had joined the FM program after other specialty training elsewhere. The fellow's role in the hospital did not differ from other residents based on his status as a fellow. Because FM faculty do not provide inpatient care, patients not cared for by FM residents/fellow represented patients who were cared for by other specialists. The main outcome measures were frequency and distribution of diagnostic groups and diagnoses. Secondary outcome measures included comorbidities and hospital readmissions. Comorbidities are defined as the existence of the diseases other than main admitting diagnosis. According to the data of the number of diseases that patients had at the time of admission, we generated the number of comorbidities, which is the number of diseases that patients had other than main diagnosis. We conducted statistical analyses to examine the difference of the proportions of patients having three or more comorbidities between those seen by FM physicians and hospital physicians as a whole. The analytics focused on description and comparison of hospital and resident outcomes. For analyses, student's *t* test was used for continuous variables, and chi-square test for dichotomous variables.

Results

Eight family medicine (FM) physicians (including one fellow) who provided inpatient care during the one-year period were included in the study. By year of advanced training status, there were two FM year-one residents, four FM year-two residents, one FM year-three resident, and one fellow who provided inpatient

Figure 1. A comparison of age and gender distribution of all patients admitted to the study hospital as a whole and by family medicine residents in a one-year period

Figure 1A. All patients admitted to the hospital

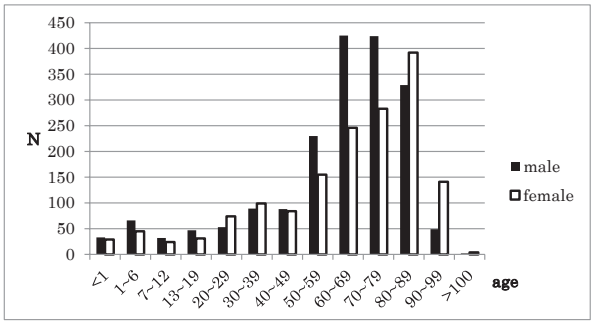
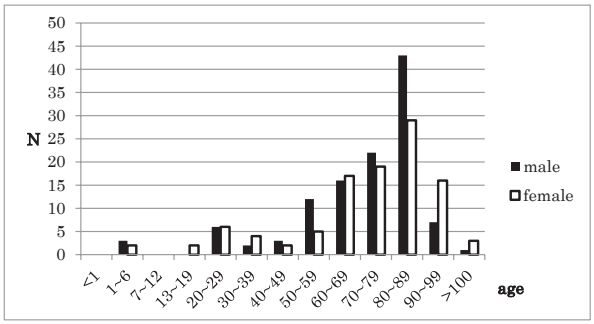


Figure 1B. Patients with a family physician resident as the responsible physician*



*Includes one family medicine fellow

care during the study period. The mean number of patients per physician was 28 and the number of patients per physician during the study period ranged from 10 to 56. Since the residents could have additional patients before or after the cut points of the study period, or have provided care to patients under another attending of record, the range does not necessarily reflect fully the mean number of patients per physician but it does give an approximate estimate.

Over the study period, there were 3474 admissions including 1867 males and 1607 females. FM residents were the physician of record for 220 cases, about 6.3% of the total number of hospital admissions. The mean age of FM physicians' cases was 71 years of age and included a range of 0 years to 101 years old (**Figure 1**). The mean age of patients in the hospital was 62 years of age and included a range of 0 years to 103 years old. There were relatively few resident-attended patients under the age of 30 years old, though there were also fewer patients in this age range for the hospital as a whole. There were no statistical differences in patient gender distribution between groups ($p = 0.672$).

As illustrated in **Figure 2**, distribution of the 220 FM resident cases included: gastrointestinal 61 (28%), pulmonary 41 (19%), cardiovascular 28 (13%), neurological 25 (11%), endocrine 19 (9%), and nephrological 17 (8%). As illustrated in **Table 1**, the most common admitting diagnoses included: pneumonia 34 (16%), CHF 21 (10%), stroke 16 (7%), intestinal obstruction 15 (7%), and urinary tract infection 10 (5%). Compared to the hospital as a whole, there were fewer musculoskeletal, breast, and psychiatry illnesses attended by family medicine residents. In addition, FM physicians cared for relatively few patients with gastrointestinal malignant tumors; patients seen by FM residents and other physicians were 3.6% and 15.1%, respectively, among the total patients seen by them.

Table 2 provides a comparison of the number of three or more comorbidities for the family medicine residents and the hospital as a whole. With regard to the percentage of patients with three or more comorbidities, there were significantly fewer 35% (79/220) FM resident cases than hospital cases, 46% (1585/3474) of all hospital admissions that had three or more comorbidities. Compared to the hospital as a whole, there were statistical differences ($p = 0.005$). Length of stay and readmission rates for patients cared for by FM residents and the hospital as a whole are illustrated in **Table 2**. At 17 days, the length of stay for patients cared for by FM residents was about two and half days shorter than the hospital as a whole, and ranged from 1 to 124 days. In contrast, length of stay for the hospital overall ranged from 1 to 585 days. Compared to the FM resident readmission rate of 3.2%, the overall hospital readmission rate 12.1% was nearly three times higher.

Discussion

To our knowledge, these are the first data from Japan demonstrating empirically how patients cared for by family medicine residents align with the patients in the hospital as a whole. While many policy makers and FM educators have understood intuitively the value of training in community hospitals, these data empirically demonstrate why the community hospital is a great place to train FM residents.

Figure 2. Distribution of medical diagnoses for family medicine resident cases and the hospital as a whole

Figure 2A. Distribution of the 220 family medicine resident cases

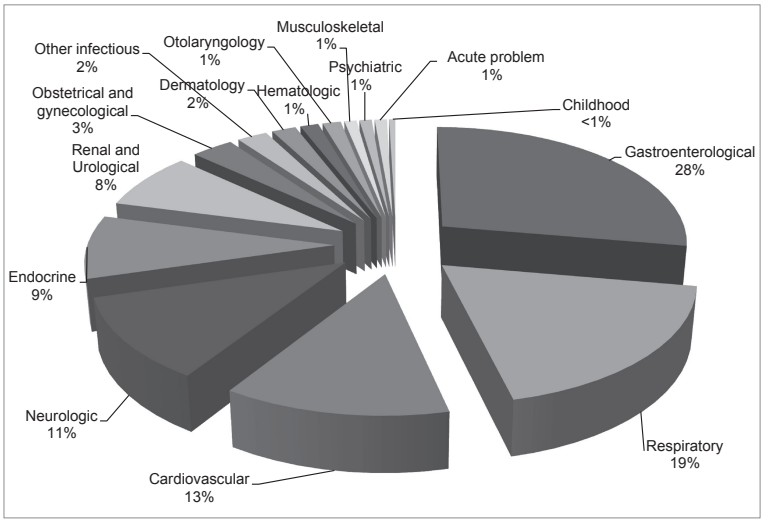
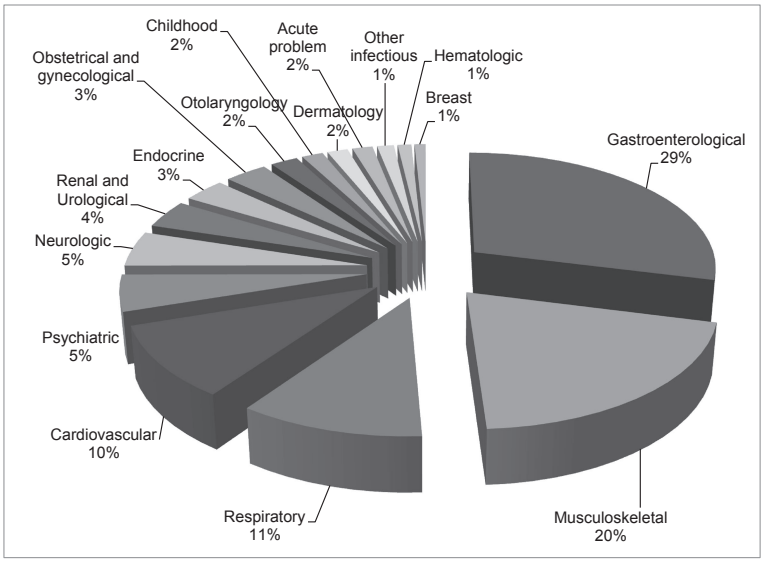


Figure 2B. Hospital as a whole



First, the FM residents provided care to patients with a similar range of diagnoses to the overall hospital patients. This means residents are preparing for independently providing care for the most common kinds of patients. While the FM residents on average provided care to patients with fewer co-morbid conditions than the hospital overall, this is appropriate, especially for less experienced FM residents who should have gradually increasing responsibility for complex patients over the course of residency. FM residents had fewer sub-specialty patients (e.g., lower number of cancer patients). Thus, residents are exposed to this care, and have opportunities to learn about these conditions. But they are not taking care of a disproportionate number of patients appropriate for referral to other specialists. While Japan will continue to need to train organ specialists, it also needs doctors trained in general medical care as happens here.

Second, the resident cases were similar in many ways, both to the general hospital cases and to national averages. For example, in 2011, the total number of hospital admissions in Japanese public hospitals during the one-year period was 1,341,000 people, and the mean duration of hospitalization was 20.7 days. This

Table 1. Admitting diagnosis of patients admission as a whole, seen by family physician residents and fellow, and except for family physician residents and fellow in a one year period (9/1/2011–8/31/2012)

	Hospital as a whole	patients seen by FM residents	patients except for FM residents
	N = 3474	N = 220	N = 3254
	n (%)	n (%)	n (%)
Main diagnosis of admission	Numbers	Numbers	Numbers
Gastroenterological	N = 1005 (29.0)	N = 61 (27.7)	N = 944 (29.0)
intestinal obstruction	41 (1.2)	15 (6.8)	26 (8.0)
hemorrhagic peptic ulcer	25 (0.7)	10 (4.5)	15 (0.5)
cholecystitis and cholangitis	94 (2.7)	8 (3.6)	86 (2.6)
malignant tumor	499 (14.4)	8 (3.6)	491 (15.1)
others	346 (10.0)	20 (9.1)	326 (10.0)
Respiratory	N = 370 (11.0)	N = 41 (18.6)	N = 329 (10.0)
pneumonia	271 (7.8)	34 (15.5)	237 (7.3)
obstructive lung disease	14 (0.4)	4 (1.8)	10 (0.3)
others	85 (2.4)	3 (1.4)	82 (2.5)
Cardiovascular	N = 351 (10.0)	N = 28 (12.7)	N = 323 (9.9)
heart failure	95 (2.7)	23 (10.5)	72 (2.2)
ischemic heart disease	159 (4.6)	3 (1.4)	156 (4.8)
others	97 (2.8)	2 (0.9)	95 (2.9)
Neurologic	N = 168 (5.0)	N = 25 (11.4)	N = 143 (4.4)
cerebral infarction	70 (2)	16 (7.3)	54 (1.7)
cereberal hemorrhage	14 (0.4)	2 (0.9)	12 (0.4)
others	84 (2.4)	7 (3.2)	77 (2.4)
Endocrine	N = 112 (3.0)	N = 19 (8.6)	N = 93 (2.9)
diabetes mellitus	51 (1.5)	9 (4.1)	42 (1.3)
fluid and electrolytes disorder	38 (1.1)	8 (3.6)	30 (0.9)
others	23 (0.7)	2 (0.9)	21 (0.7)
Renal and Urological	N = 134 (4.0)	N = 17 (7.7)	N = 117 (3.6)
urinary tract infection	42 (1.2)	10 (4.5)	32 (1.0)
renal failure	32 (0.9)	7 (3.2)	25 (0.8)
others	60 (1.7)	0	60 (1.8)
Obstetrical and gynecological	N = 112 (3.0)	N = 7 (3.2)	N = 105 (3.2)
Other infectious	N = 44 (1.0)	N = 5 (2.3)	N = 39 (1.2)
sepsis	34 (1.0)	5 (2.3)	34 (1.0)
Others	N = 1091 (31.4)	N = 16 (7.3)	N = 1075 (33.0)
Hematologic	36 (2.0)	3 (1.4)	33 (1.0)
Dermatology	54 (1.0)	4 (1.8)	50 (1.5)
Otolaryngology	72 (2.0)	3 (1.4)	69 (2.1)
Musculoskeletal	697 (20.0)	2 (0.9)	695 (21.4)
Psychiatric	175 (5.0)	2 (0.9)	173 (5.3)
Acute problem	59 (1.7)	2 (0.9)	57 (1.8)
Childhood	N = 56 (2.0)	1 (0.5)	N = 55 (1.7)
Breast	N = 29 (1.0)	0	N = 29 (0.9)

Table 2. Comparison of characteristics between patients seen by FM and hospital as a whole

Characteristic	Patients seen by FM (N = 220)	Hospital as a whole (N = 3474)	P value
Age (years)	70.9 ± 21.7	62.0 ± 24.0	<0.001
Male gender	115 (52.3)	1867 (53.7)	0.672
Mean length of stay (days)	16.7 ± 14.9	19.1 ± 28.3	0.027
Readmission rate in 30 days after discharge (percent)	3.2	12.1	<0.001
3 or more comorbidities*	79 (35.9)	1585 (45.6)	0.005

Data are mean ± SD or n (%)

For analyses, Student' *t* test was used for continuous variables, and chi-square test was used for dichotomous variables.
*The number of diseases other than main diagnosis that patients had.

figure is only slightly longer in duration than the resident and overall hospital cases. The proportion of patients over the age of 65 years seen by FM residents was 71%, also similar to the hospital as a whole while a little higher than the 68% national average in 2011. Gender distribution among resident cases, 51% female, was similar to the hospital average as well as the national mean of 54.2%.[18] The mean readmission rate 30 days after discharge for FM patients 3.2% was slightly better than the national average of 3.3%.[19] The lower rate of readmissions among FM cases compared to the hospital overall may be related to the overall lower rate of three or more comorbidities among FM resident cases. In short, overall, the residents had clinical training experiences with patients "typical" of the vast majority of patients seen in Japan's health care system.

So what is the value of training in community settings? While debate in Japan has been lacking, in 2002, the leadership of 7 national family medicine organizations in the US initiated the Future of Family Medicine (FFM) project. Their goal was to develop a strategy to transform and renew the discipline of family medicine.[20] The report states,

> "the focus on community by family medicine is one of its best kept secrets. In addition to communicating more effectively the commitment to community and population-based medical care, it is important that family medicine reemphasizes the teaching of community medicine in the broadest terms, devises effective methods to teach community medicine, and identifies metrics by which to evaluate such teaching."[20]

From rural Montana in the US[21] to urban Hong Kong,[22] family medicine leaders are building community-based training programs. On July 17, 2014, the US Department of Health and Human services awarded $83.4 million to train new primary care providers to support 60 community-based teaching health centers across the country.[23] These examples illustrate the historical and current global understanding of the merits of training in community-based settings such as community hospitals.

One of the key values of training in the community is physician retention. Accumulating evidence illustrates that residents who train in communities are much more likely to stay in those communities than residents who do not.[24] In the quest to address the serious imbalance of physician distribution in Japan between rural and urban areas, we believe much greater emphasis and support of training in community settings is needed.

A fundamental tenet of medical education is that a learner should train in the care that closely matches the actual care where the learner will practice after completion of training. That care is inextricably related

to the environment as scientifically illustrated by White in 1961 and many others since that time. Consequently, if the goal is to prepare FM graduates to provide care to patients in rural settings, then these data confirm that training residents in these settings is scientifically well grounded and appropriate. With three years of training in such an environment, at completion of their residency training, FM residents would be expected to be able to care for similar patients.

In Japan, there has been controversy as to whether the new "general medicine" specialty should include women's health.[25] These data from a community hospital demonstrate that FM residents can appropriately train in and provide women's health and child health care. Still, compared to adult medicine cases, there were relatively fewer inpatient women and child cases in the hospital as a whole, and among the FM resident cases. Like many rural community hospitals affected by the rapidly aging, low birth-rate society, having fewer such cases is not surprising, but it does highlight the need for hospitals that train FM residents to consider how to incorporate supplemental training in women's and children's health if the overall volumes are low. In the SFM program, the women's health care training needs are supplemented through other rotations.

There are potential limitations of this study. While we observed all admissions for a one-year period, analysis of data collected prospectively, or over longer periods of time might provide more precise estimates of the types of patients seen. In addition, the number and types of patients varied somewhat by the FM resident charged with care of the patients. This variation could be accounted for differences due to the year of training, time of the year, and overall comfort with the volume and types of patients. As we had no data on specifics of severity, as a surrogate measure, we presented three or more comorbidities. We believe these factors are unlikely to change our conclusions. It is often stated that good research often identifies more new research questions than the research answers. Other factors not addressed in the current study, but are ripe for future inquiry include: the need for research on a larger scale to better understand variations in community hospital training, comparison of FM resident experiences with residents from Urban and Academic Hospitals, exploration of whether advanced residents are seeing more difficult patients or not, why FM residents can experience a variety of patients (i.e., is this just from being an unopposed residency), comparison how FM residents in Japan differ in traning goals from those in other countries, patient satisfaction with FM resident care, the impact on hospital charges when care is provided by FM residents, and the perception of the community about having FM physicians in training.

In conclusion, the range of diagnoses, as well as age, gender and hospital duration in this community hospital were very similar to local hospital and national means. Japan needs to prepare physicians for practicing in rural communities with the greatest needs due to physician shortages. These findings illustrate why the community hospital setting provides an excellent training environment for FM residents and supports policy initiatives for developing a systematic primary care training system appropriate for community-based care.

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Conflict of interest: Authors declare none.

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