ORIGINAL RESEARCH

Primary Care Provider Demographics and Engagement in Interprofessional Collaboration

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Introduction: **Interprofessional care contributes to all components of the quadruple aim. While previous research has identified many facilitators and barriers to the provision of interprofessional care, whether demographic differences might influence the extent to which providers collaborate interprofessionally remains unknown.**

Methods: **Using electronic health record data, we characterized the level of primary care providers' (PCPs') interprofessional collaboration based on the percent of their patients who had a visit with an interprofessional team member over a 14-month period. We then obtained demographic data, including gender, years in practice, and provider type, from the electronic health record and publicly available sources. Subsequently, we used linear regression to predict the PCPs' level of interprofessional collaboration based on demographic indicators.**

Results: **The median of each PCP's patients who had a visit with an interprofessional team member during the study period was 12.6%. After controlling for the average age of the PCP's patient panel, the PCP's years in practice, and the PCP's clinic, when compared with male PCPs, approximately 2% more of patients cared for by female PCPs had a visit with an interprofessional team member.**

Conclusion: **Female providers are more likely to share their patients with an interprofessional team. (J Am Board Fam Med 2022;00:000–000.)**

Keywords: **Demography, Gender Differences, Interdisciplinary Health Team, Linear Regression, Patient Care Team, Primary Health Care, Workforce**

Background

Interprofessional collaboration is recognized as an important mechanism for achieving the quadruple aim. The World Health Organization's "Framework for Action on Interprofessional Education and Collaborative Practice" characterizes collaborative practice as happening when "multiple health workers from different professional backgrounds provide comprehensive services by working with patients, their families, carers and communities to deliver the highest quality of care across settings."[1] Notably, interprofessional collaboration has been shown to improve patient outcomes,[2,3] decrease cost,[2] improve patient satisfaction,[4] and promote care team well-being.[5] Overall, the literature suggests many benefits of interprofessional collaboration,[5] which has led to its promotion by institutions such as the World Health Organization.[1] Further, interprofessional collaboration is viewed as essential for serving the nation's primary care needs in light of workforce shortages.[6] These findings have led policy experts and health care administrators to recommend that care be provided in teams,[6] which has in turn witnessed a dramatic increase in the number of practices that are interprofessional.[7]

Unfortunately, simply colocating team members in the same clinic does not necessarily lead to increased collaboration.[8] Individuals may be resistant to collaborate interprofessionally due to their

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own uncertainty of the potential benefits of interprofessional care, underappreciation of other professionals' contributions, or differing professional cultures.[9] Prior work has suggested multiple strategies to promote interprofessional work for both organizations and individuals. For example, organizations can promote a team culture[10] and incentivize interprofessional collaboration.[9] Most existing research investigating barriers and facilitators to interprofessional collaboration, however, has looked at the health care environment rather than the individual health care professional's engagement in interprofessional collaboration.[7]

Within this context, demographic differences may be an important influence on the extent to which a health care provider participates in interprofessional collaboration. There is evidence to suggest that health care students have varying levels of interest in working interprofessionally, based on their demographic background. More specifically, female students across health care fields show more interest in teamwork than their male counterparts.[11] When disciplinary differences are examined, nursing students seem more interested in teamwork relative to medical students.[11] These differences may be related to differences in professional cultures.

Despite demographic differences among student interest, there is little evidence about whether and how practicing health care providers of different backgrounds may embrace interprofessional collaboration. Knowing any differences in demographics among providers who are more engaged in interprofessional work may allow for targeted interventions to sustain or increase the level of such collaboration. In this study, we aim to explore potential demographic differences in primary care providers (PCPs) who are highly engaged in interprofessional collaboration versus those who are not.

Methods

Data Source

The study was conducted using electronic health record (EHR) data from 324 PCPs across 53 clinics from a large academic health system based in Minnesota. PCPs were defined as nurse practitioners, physicians, and physician assistants who worked in internal medicine or family medicine with an adult population. We excluded pediatricians because the health care needs of pediatric patients are likely to differ from those of adults (eg, type 2 diabetes is less prevalent in children), which may result in systematic differences in how pediatric PCPs collaborate interprofessionally relative to those who care primarily for adults. In particular, we believe including pediatric PCPs may skew the data so that PCPs working in that area would seem to be low collaborators. The number of visits for each PCP's patient with a pharmacist, diabetes educator, behavioral health specialist, or care coordinator between January 2019 to February 2020 was obtained from the EHR. We focused our attention on these professionals because they are well represented in the health system we studied, and each provides a complementary service to the PCP. The EHR data were also used to identify the average patient age for each PCP's patient panel.

We used the National Provider Identifier (NPI) recorded in the EHR to determine the provider's reported gender from the National Plan and Provider Enumeration System (NPPES). NPPES data were downloaded from the Centers for Medicare & Medicaid Services (CMS) website. Physician Compare Data, provided by CMS, were used to determine the PCP's graduation year.

Analysis

Characterizing Interprofessional Collaboration

To determine the extent to which PCPs engaged in interprofessional care, we used a method similar to that developed and validated by Barnett and colleagues.[12] Barnett's team examined medical claims data to identify the number of shared patients among pairs of physicians. Through a survey of the physicians, they determined that the number of shared patients can be used as a "diagnostic test" to predict relationships among physician pairs.[12] Similarly, in a different study, Franks and colleagues calculated the "observed referral rate," which they defined as "the proportion of the PCP's patients seen by the PCP that were referred to and seen by a specialist during the year."[13] Following the approach of both Barnett et al and Franks et al, we began by identifying shared patients between pairs of health care providers. In contrast to these previous studies,[12,13] however, our analysis examined a broader scope of providers (not just physicians) and used completed encounters (which might not all be billable and therefore are not always

represented in claims data), thereby giving us a novel lens on interprofessional teams.

Using these data, we calculated the proportion of patients seen by the PCP during the study period who also completed a visit with an interprofessional team member. This was similar to the "observed referral rate" calculated by Franks and collegues.[13] In our study, if a PCP saw 1000 patients during the study period and of those patients 200 had a visit with either a pharmacist, diabetes educator, behavioral health specialist, or care coordinator, the percent of patients completing an interprofessional visit for the PCP would be 20. We will refer to this as the "interprofessional collaboration rate."

We used the interprofessional collaboration rate as a proxy for interprofessional collaboration instead of number of referrals because referral rates may misrepresent collaboration (eg, referral rates would not account for a provider helping a patient make a same day appointment with an interprofessional team member instead of placing a referral in the chart, and referrals may not result in an actual visit). We determined the median interprofessional collaboration rate and divided PCPs into high collaborators or low collaborators based on whether they were above or below the median, respectively.

Influence of Demographics on Collaboration

We performed *t*-test and Pearson's χ^2 tests (as appropriate given the distribution of the underlying variables) to evaluate for differences among the values of each variable between high-collaborating and low-collaborating groups.

To gauge the conditional effects of provider gender, years since graduation, and provider type (nurse practitioner, physician, or physician assistant), we estimated linear regression models, wherein interprofessional collaboration rate was the dependent variable.* The independent variables were provider gender, provider type, and years since graduation. We estimated 4 different models. In each model, we controlled for average age of patient per provider in an effort to account for increased medical needs (which may lead to more interprofessional care) that are often associated with aging.

The University of Minnesota institutional review board (IRB) determined that this study was exempt from IRB review.

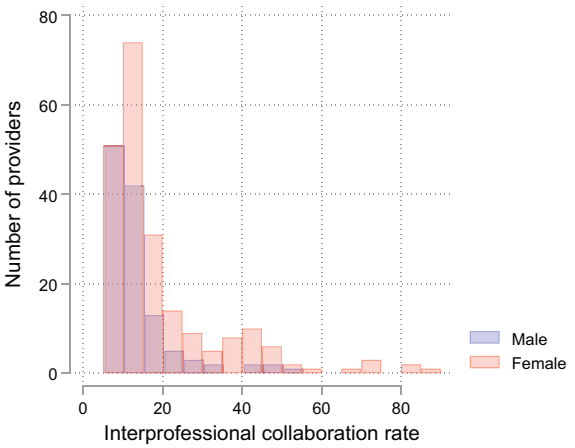
Results

During the study period, 340,253 unique patients were seen by sample PCPs. Of those patients, 4.8%, 5.1%, 4.5%, and 0.7% had a visit with the pharmacist, care coordinator, behavioral health therapist, and diabetes educator, respectively, during the study period.

Interprofessional collaboration rates varied across PCPs (Figure 1). The median interprofessional collaboration rate was 12.6% (mean: 17.7%, SD 13.7%). The high-collaboration group had interprofessional collaboration rate levels that ranged from 12.6% to 88.6% (mean: 25.7%, SD 15.7%) and the low-collaboration group from 5% to 12.5% (mean: 9.7%, SD 1.6%). This means that if a PCP saw 1000 unique patients during the study period, 126 of those patients would need to have at least 1 visit with an interprofessional team member during that same period for the PCP to be in the high-collaboration group.

There were differences among the high and low-collaboration groups based on provider gender, provider type, and the average age of patient per provider (Table 1). Women and nurse practitioners were more likely to be in the high-collaboration group; physician assistants were more likely to be in the low-collaborator group. PCPs in the high-collaboration group cared for patients with a higher average age than PCPs in the low-collaboration group.

Figure 1. Histogram of collaboration rate.



*Because our dependent variable is a percent, and therefore has a lower bound of 0 and an upper bound of 100, we also considered estimating Tobit regressions. However, we found that all of the predicted values generated by our models were in the [0,100] range, and therefore we decided to use simpler, ordinary least squares regressions.

Table 1. Descriptive Statistics for Primary Care Provider (PCP) Sample

	High Collaboration	Low Collaboration	*P* Value
PCPs (n)	170	169	
Provider gender			0.015
Male, n (%)	50 (41)	71 (59)	
Female, n (%)	120 (55)	98 (45)	
Years since graduation	18.1 ± 10.4	19.4 ± 10.5	0.286
Provider type			
Physician, n (%)	99 (49)	102 (51)	0.691*
Nurse practitioner, n (%)	64 (68)	30 (32)	<0.001*
Physician assistant, n (%)	7 (16)	37 (84)	<0.001*
Average age of patient per provider	57.4 ± 15.7	45.1 ± 8.4	<0.001

*The reference category is other two provider types combined.

We used linear regression to estimate 4 different models. Model 1 demonstrated that female PCPs are more likely to collaborate with an interprofessional team compared with their male counterparts. In addition, although the coefficient estimates did not reach statistical significance at the $P < .05$ level, the model suggests that nurse practitioners may collaborate more and physician assistants may collaborate less interprofessionally (when compared with physicians, $P < .1$). Lastly, the model indicates those who graduated more recently may be more likely to collaborate with the interprofessional team, but again the results were not statistically significant at the conventional level of $P < .05$ (although they were at the $P < .1$ threshold).

In contrast to model 1, in model 2, we controlled for the clinic of the PCP, using indicator variables (coefficient estimates are not reported). Controlling for the clinic allowed us to account for differences in interprofessional team culture that might exist among clinics. After the inclusion of this control, the coefficient estimate for PCP's years since graduation is no longer significant. Interestingly, the coefficient estimate for nurse practitioner meets the common significance threshold of $P < .05$ after controlling for clinic, but the sign is in the opposite direction (ie, after controlling for clinic, nurse practitioners are significantly less likely than physicians to collaborate interprofessionally).

We observed high correlations among some of the independent variables. A Chi-square test demonstrated that provider type and provider gender are significantly correlated ($P < .001$), as were provider type and years since graduation ($P < .001$) (based on a 1-way analysis of variance). Since these correlations may introduce multicollinearity, we removed the variable provider type in models 3 and 4 (Table 2) (which are otherwise analogous to models 1 and 2). As in models 1 and 2, women remained significantly more likely to collaborate interprofessionally. In contrast to our previous findings, in model 3, we now observe a statistically significant inverse relationship between years since graduation and interprofessional collaboration; however, this relationship is not robust to the inclusion of clinic controls (model 4).

Across our models, it seems that the interprofessional collaboration rate is 1.8% (model 4) to 5% (model 3) greater for female PCPs when compared with male PCPs. In interpreting this difference, it is important to note that this is the absolute difference in percent. Given that the median is 12.6%, a 1.8% to 5% difference is large. When we look at years since graduation, we note a negative correlation with interprofessional collaboration rate. More specifically, in model 3, for instance, we see that for every additional year postgraduation, the interprofessional collaboration rate decreases by approximately 0.2%. This means that for every 10 years past graduation, 2% fewer of a PCP's patients will have a visit with an interprofessional team member.

Our R^2 values ranged from 0.310 to 0.332 in models where we did not control for clinic and from 0.896 to 0.898 in models where we did, suggesting that a comparatively high proportion of variance was explained by the included covariates. Thus, the models perform well at predicting interprofessional collaboration.

Discussion

Our study demonstrates that female PCPs are more likely to share their patients with an interprofessional

Table 2. Linear Regression Models of Interprofessional Collaboration

	Model 1	Model 2	Model 3	Model 4
PCP demographics				
Female	4.324*** (1.472)	2.259*** (0.630)	5.041*** (1.413)	1.898*** (0.608)
Years since graduation	−0.144* (0.0743)	−0.0254 (0.0338)	−0.171** (0.0659)	<0.001 (0.0315)
Provider type				
Nurse practitioner	3.262* (1.838)	−1.665** (0.815)	—	—
Physician assistant	−3.790* (2.101)	−0.902 (0.902)	—	—
PCP's patients				
Average patient age (years)	0.472*** (0.0488)	0.154*** (0.0466)	0.520*** (0.0469)	0.163*** (0.0460)
Controlling for clinic?	No	Yes	No	Yes
Observations	324	306	324	306
R^2	0.332	0.898	0.310	0.896

Abbreviation: PCP, primary care provider.
The reference category for provider type is physician.
Standard errors in parentheses ***$P < .01$, **$P < .05$, *$P < .1$.

team than their male counterparts. Possible explanations are that women tend to spend more time in patient visits[14,15] and may be more patient-centered than male providers.[15,16] This increased time with the patient and patient-centered approach may help to explain women's greater tendency toward collaboration with an interprofessional care team.

Our findings are in line with past research, which demonstrates that female physicians are more likely to refer their patient to physician specialists.[13] In our study, we did not look at collaboration with other physicians but focused instead on collaboration with the interprofessional team. Our findings, when combined with those of Franks and colleagues,[13] demonstrate that overall, female providers may be more collaborative (both with physician specialists and interprofessional health care providers) in the care of their patients.

Increased levels of interprofessional care team engagement from female physicians may help to explain previously identified differences in patient outcomes related to the gender of the PCP. For instance, studies have demonstrated that patients experience better clinical outcomes when they are cared for by a female physician versus a male physician.[17–19] More specifically, patients of female providers have improved diabetes management,[17,19] are more likely to have recommended screenings,[19] and have lower mortality and hospital readmission rates.[18] These studies did not account for differences in the providers' patterns of interprofessional collaboration. However, multiple studies have demonstrated that interprofessional care leads to better outcomes.[2,3] Female providers' engagement in interprofessional care may, to some extent, influence the improved outcomes their patients experience.

Beyond female PCPs being more likely to collaborate with interprofessional team members, we also found in some of our models that PCPs who had graduated more recently were more likely to collaborate interprofessionally. However, when we controlled for the clinics where the PCPs worked, we found the graduation year of the PCP was no longer significantly associated with interprofessional collaboration. Therefore, it is possible that PCPs who have graduated more recently are drawn toward clinics where there is a greater interprofessional presence and the culture of collaboration is high. Many health care professional programs are training their learners to work in interprofessional teams, but this sort of training is new. Increased exposure to interprofessional care can influence trainees' desires to work in an interprofessional setting.[9,20] Differences in collaborative tendency based on when the PCPs graduated might also result from seasoned PCPs having traditionally worked without an interprofessional team and more recent graduates having only trained or worked in clinics with a larger team available. Imprinting—the idea that learners will replicate what they have witnessed in practice[21]—may

influence interprofessional collaboration practices among PCPs. Prior work has demonstrated that physicians' spending patterns are impacted by the institution where they trained.[22] This imprinting during medical training may also impact other practice characteristics.[21] Providers who have graduated more recently and therefore are more likely to have trained in an interprofessional environment might be drawn to practice in a more interprofessional environment.

Our descriptive statistics demonstrate that nurse practitioners are more likely to be in the high-collaborator group and conversely physician assistants are more likely to be in the low-collaborator group, compared with other PCPs. However, our regression analysis demonstrated that when we control for the clinic of the provider, nurse practitioners are actually less likely to collaborate interprofessionally. This pattern of results may be explained by nurse practitioners tending to differentially practice in more collaborative clinics. Put a different way, if nurse practitioners seem to collaborate more interprofessionally than physicians, it may be simply because they may seek out or are hired by clinics in which interprofessional care is stronger.

Our models demonstrated that the clinic where the PCP worked was an important predictor of their interprofessional collaboration rate. This is made clear from the R^2 values, which were higher in the models where we controlled for the clinic. Some clinics in our sample have interprofessional team members on-site, whereas other clinics do not. If the interprofessional team member is not on site, it is likely that the PCP may not have a strong relationship with that team member, and therefore might not refer as many patients. In addition, patients may be reluctant to travel to an unfamiliar clinic when referred to an interprofessional team member who does not practice on-site with their PCP.

There were several limitations to our study. We defined collaboration based on the number of shared patients that PCPs had with interprofessional team members. Although similar methods have been validated in claims-based analysis,[12] they have not been applied in studies (like ours) that rely on EHR data, nor have they been systematically validated in the interprofessional context. Our analysis could overrepresent collaboration (ie, two professionals may see the same patients but not collaborate) or underrepresent collaboration (ie, two professionals may be highly collaborative, but their collaboration is not captured through viewing patient visits). In addition, we chose 4 different provider types to represent the interprofessional team. These different professionals were chosen because they each provide a complementary service to the PCP, but they are not an exhaustive list of interprofessional providers. In addition, there may be differences in the patient panels of the various PCPs that could not be measured. In our study, we controlled for average patient age since patients generally experience more medical conditions as they age. We were unable to account for other potential differences. We recognize that there are important demographic factors that were not included in our study such as race and ethnicity of the PCPs. Unfortunately, we were limited by the data available to us at the time of study. Further, PCPs may have had different direct access to an interprofessional team; we attempted to control for this by controlling for the PCP's clinic.

Our findings are based on observational data and therefore should not necessarily be interpreted as causal. Women, for example, may generally treat more complex patients. More complex patients benefit from more interprofessional referrals. We attempted to control for this by adjusting our models for patient age and clinic but acknowledge that there may be unmeasured, within-clinic differences relating to the complexity of the PCP's panel of patients. Nevertheless, the differences we observe suggest that a PCP's gender may be related to level of interprofessional collaboration and are worthy of further research.

These findings raise the question: Do health care systems need to recognize PCPs for their engagement in interprofessional care? We are not aware of health systems currently tracking this metric. However, given the positive outcomes that interprofessional care is associated with, perhaps this metric should be both tracked and recognized. Based on our study, women seem to be participating in interprofessional care more, but according to previous literature female providers are not paid as much as their male counterparts.[23]

Conclusion

Our study demonstrates that female PCPs are more likely to collaborate with an interprofessional team. In addition, it seems that newer practitioners and nurse practitioners might be drawn to clinics with a

strong interprofessional presence. Understanding these differences in practice patterns is important since interprofessional collaboration often is connected with better patient outcomes.[2,3]

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To see this article online, please go to: http://jabfm.org/content/35/6/000.full.

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