INTRODUCTION

Over the past decade the number of medical students going into primary care has steadily declined, even as the need for primary care physicians continues to increase [1]. Accounting for population growth, aging, and the current rate of production of primary care physicians, the projected national shortage of primary care physicians by 2025 is over 35,000 [2]. Further, it is likely that expansion of health insurance coverage under the Affordable Care Act will require a greater number of primary care physicians and likely exacerbate this projected shortage [3,4].

Primary care providers serve as the first and sometimes only contact with our health care system for many individuals [5,6]. Evidence supports the importance of both access to primary care providers, and receipt of primary care services for the prevention of early morbidity and mortality, especially for vulnerable populations [7-10]. Therefore, it is imperative to identify programs that increase the likelihood of trainees going into primary care and practicing in underserved communities.

Health centers play a crucial role in delivering comprehensive primary care services in designated health professional shortage areas, yet they continue to face challenges recruiting primary care providers [11-15, 16]. Many participate in health professionals training programs, such as physician residency programs, or pipeline programs, such as Area Health Education Centers (AHEC), designed to encourage individuals to pursue careers in health care and work in underserved areas. Prior studies suggest that health center affiliation with such programs is a potential solution for the mal-distribution of primary care providers [17-21]. For example, Morris et al surveyed a regional network of family medicine residents and found family physicians that trained at health centers were twice more likely to work in underserved areas than those who did not [17]. Nottingham et al demonstrated positive effects of West Virginia AHEC, on provider recruitment and retention [21]. However, studies to date are limited to either providing theoretical frameworks in support of the workforce benefits of health center training and pipeline programs or to findings from local studies that may lack generalizability.

The Affordable Care Act includes several provisions for...
expanding the role of such health professional programs in an effort to address future primary care workforce needs [22]. However, there lacks sufficient knowledge of the prevalence and impact of these programs. Therefore, we conducted a national survey to identify health centers with professional training and pipeline programs, and evaluated their effects on primary care provider recruitment and retention.

MATERIALS AND METHODS

Survey sample and administration

In partnership with the National Association of Community Health Centers (NACHC), we developed a self-administered survey to evaluate the effects of health center professional training and pipeline activities. Survey questions elicited dose-ended responses on health center professional programs: 1) descriptive characteristics 2) funding sources 3) experiences with participation and 4) provider recruitment and retention. We adapted questions from a previously operationalized 2007 NACHC survey of health centers and created additional questions informed from key informant interviews and literature review. The survey was pilot tested for clarity and face validity. We fielded the online survey from March to June 2010, to executive directors/designee of 976 of 1084 federally funded health centers with active email addresses in 2009 Uniform Data System (UDS), excluding only 108 health centers that previously opted out of survey solicitations. We sent out reminders on average twice a week to non-responders and to encourage participation employed a lottery-based incentive of 500 dollars for ten selected health centers that completed the survey. We linked our data to the 2010 Uniform Data System (UDS), which provides a range of information on the operations and performance on all federally-funded health centers (n=1124). The Human Studies Committee of Harvard Medical School approved this study.

Survey questionnaire

Our primary predictors were the presence or absence of 1) health professional training programs 2) Area Health Education Center programs (AHEC) and 3) career ladder programs. Health professional training programs include any training program for health professional students or providers affiliated with health centers. Examples include medical residency training programs, clinical electives for medical students, or nurse practitioner training programs. Level of health center involvement in training could range from hosting a one month elective to hosting/ managing the primary care residency program, the latter termed a 'teaching health center' (THC) [18,23]. AHECs implement community-based training programs in health careers for students and continuing education for healthcare providers in effort to improve supply and distribution of healthcare professionals, with a statewide or regional focus [24-26]. Career ladder programs offer further training or education to any employee with the opportunity of promotion and career advancement within the health center upon completion. Training and educational opportunities with career ladder programs include, but are not limited to advanced degrees in administration, finance, dentistry, or nursing. For example, a registered nurse (RN) is becoming a Nurse Practitioner (NP) or a physician acquiring a Masters in Business Administration (MBA) [27]. Additional covariates include hospital/medical school affiliation and receipt of Title VII funding for primary care training, previously shown to be associated with primary care providers working in health centers or other National Health Service Corps (NHSC) sites [28,29].

Our primary outcomes were difficulty in primary care provider recruitment and retention in the past five years, measured with a scaled response (no/minimal, some, great). We defined 'provider’ to encompass primary care nurse practitioners, physician assistants, and physicians (MD/DO). We defined provider retention as health care providers who have stayed with the health center beyond three years of hire. Federal loan repayment and J-1 visa waiver programs require a minimum of two to three years of service in designated provider shortage areas and many providers fulfill this obligation at health centers [30]. A cited goal for health centers is to retain providers at least one year beyond this obligatory period; therefore, we defined retention as longer than three years [31].

Uniform Data System (UDS)

We obtained the following health center characteristics from the 2010 UDS: 1) urban versus rural location; 2) census region; 3) the percent of health center patients/users by categories of income level, race/ethnicity, and insurance status; 4) the number of clinical delivery sites;5) patients seen at least once during the 12 month reporting period; and 6) medical providers (total number of full time equivalent (FTE) primary care providers per health center) [32] (Table 1).

Statistical analysis

We compared survey respondent characteristics to all health centers in the 2010 UDS, using t-tests or chi-square tests as appropriate to determine if our sample was nationally representative. In ordinal logistic regression models, we evaluated the association between health center professional programs and degree of difficulty in recruitment and retention of primary care providers, adjusting for urban versus rural location, census region, hospital affiliation, receipt of Title VII funding total number of sites, patients seen annually, number of providers’ full time equivalents (FTE), percent minority patients, percent uninsured, and percent of patients with incomes 100% below the federal poverty line (FPL). We added interaction terms to our models to determine any significant combined effects of our predictors on workforce outcomes. We also estimated associations between the level and type of involvement of health centers in professional training programs (e.g. hosting one-month primary care resident elective vs. managing a residency program) and workforce outcomes, adjusting for the same health center characteristics detailed above. When the proportional odds assumption was not met, we ran partial proportional odds models [33].

We restricted our analysis to US health centers and excluded responses from health centers in US territories (n=14). We utilized STATA 12 for analyses. We report two-tailed p values and 95 percent confidence intervals for all statistical tests; p<0.05 was considered statistically significant.

RESULTS AND DISCUSSION

We received completed surveys from 391 (40%) of the
reported no/minimal difficulty in recruiting primary care providers, while 114 (32.8%) reported great difficulty in provider recruitment. In unadjusted analysis, 3% more centers with career ladder programs reported minimal difficulty in recruiting primary care providers than those without. (Table 2) Conversely, a smaller number of centers with AHEC programs reported having minimal difficulty in primary care provider recruitment. (Table 2) In addition, health centers managing their own residency programs had a greater odds of reporting minimal difficulty in recruitment of primary care providers [OR (95% CI): 3.6 (1.2 - 10.9)] then non-'teaching health centers’ in unadjusted models.

Adjusted analyses revealed that 7% more centers with career ladder programs reported minimal difficulty in recruitment of primary care providers compared to those without (p=.01) (Table 3). After adjustment, we also found urban centers reporting significantly less difficulty in provider recruitment than rural centers. (Table 3) We did not find any significant interactions between our key predictors for provider recruitment.

**PROVIDER RETENTION**

Health centers reported less difficulty with provider retention as compared to recruitment, with 113 (33.5%) reporting no/minimal difficulty in retaining providers beyond a 3 year period, compared with 54 (16%) reporting great difficulty. Unadjusted analysis demonstrated about 15% more centers with career ladder programs reported no/minimal difficulty in provider retention, compared to those without such programs (Table 2). After adjustment, about twice as many centers with career ladder programs versus those without, reported no/minimal difficulty in retention of primary care providers (p<.001) (Table 3). Other significant covariates include health center location and percentage minority patients served. Urban health centers were more likely to report minimal difficulty with provider retention than rural centers (Table 3). Health centers with a greater percentage of minority patients were less likely to report no/minimal difficulty in retaining providers. [Adjusted OR (95% CI): 0.99 (0.98, 0.99); p=.02] We did not find any significant interactions between our key predictors for provider retention.

**CONCLUSION**

In this national assessment of health center training and pipeline programs, we found 54% of health centers had career ladder programs for their employees that significantly enhanced their ability to both recruit and retain providers.

We did not detect differences in workforce outcomes between centers with and without AHEC affiliations; however, we found a positive association between AHEC affiliation and pediatric primary vaccination rate. Previous evaluations of AHEC, conducted within a decade of its inception, demonstrated benefit on the supply and distribution of providers in shortage areas [25]. Three decades later, our findings underscore the importance of continued assessment of these programs.

While 90% of health centers engage in some form of training health professionals, only 6% at the time of this survey would be characterized as ‘teaching health centers’ that host/manage their own primary care residency programs. These health centers
Table 2: Number and Percent Health Centers Reporting Degree of Difficulty in Provider Recruitment and Retention by Key Predictors

| Health Centers with Key Predictors | Degree of Difficulty in Provider Recruitment | Degree of Difficulty in Provider Retention | p Value
<table>
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<tbody>
<tr>
<td></td>
<td>Minimal</td>
<td>Some</td>
<td>Great</td>
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<tr>
<td>Health Professional Training n (%)</td>
<td></td>
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<tr>
<td>Presence</td>
<td>48 (15.7)</td>
<td>160 (52.5)</td>
<td>97 (31.8)</td>
</tr>
<tr>
<td>Absence</td>
<td>4 (11.4)</td>
<td>15 (42.9)</td>
<td>16 (45.1)</td>
</tr>
<tr>
<td>AHEC n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence</td>
<td>16 (10.4)</td>
<td>96 (62.3)</td>
<td>42 (27.2)</td>
</tr>
<tr>
<td>Absence</td>
<td>32 (19.2)</td>
<td>73 (43.7)</td>
<td>62 (37.1)</td>
</tr>
<tr>
<td>Career Ladder n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence</td>
<td>31 (16.9)</td>
<td>105 (57.1)</td>
<td>48 (26.1)</td>
</tr>
<tr>
<td>Absence</td>
<td>21 (13.8)</td>
<td>67 (44.1)</td>
<td>64 (42.1)</td>
</tr>
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SOURCE: All information derived from Authors' computations using survey response data.

Notes: Health center responses regarding key predictors do not include missing or ‘other’ and therefore, percent health center with and without each key predictor may not add up to 100.

* Using Chi-sq. exact tests and univariate ordinal logistic regression models to compare reported difficulty in provider recruitment between health centers with and without each key predictor.

Table 3: Adjusted Predicted Probabilities for Reported Degree of Difficulty in Provider Recruitment and Retention among health centers by Significant Binary Predictors

| Significant Predictors | Degree of Difficulty in Provider Recruitment | Degree of Difficulty in Provider Retention | p Value
<table>
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<tbody>
<tr>
<td>Career Ladder Programs</td>
<td>Minimal</td>
<td>Some</td>
<td>Great</td>
</tr>
<tr>
<td>Presence</td>
<td>17.6</td>
<td>56.0</td>
<td>26.5</td>
</tr>
<tr>
<td>Absence</td>
<td>10.6</td>
<td>50.1</td>
<td>39.2</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>18.6</td>
<td>56.2</td>
<td>25.2</td>
</tr>
<tr>
<td>Rural</td>
<td>10.6</td>
<td>50.0</td>
<td>39.4</td>
</tr>
</tbody>
</table>

SOURCE: All information derived from Authors’ computations using survey response data.

* Adjusted for key predictors and census region, location (urban vs. rural), hospital affiliation, title 7 funding, number of sites, patients seen annually, and providers (FTE), percent minority patients, percent uninsured, and percent of patients with incomes 100% below FPL.

† Predicted probabilities (marginal effects) for reported degree of difficulty in provider recruitment and retention for health centers with significant binary predictors when holding remaining covariates at their means.

‡ Partial proportional odds model applied with listed significant predictors meeting the proportional odds assumption for ordinal regression model.

§ Proportional odds assumption met for this ordinal regression model.

informed the 2010 ACA legislation that created the teaching health center graduate medical education (THCGME) program [22,34]. We found a significant unadjusted benefit for provider recruitment amongst the 6% of ‘teaching health centers’ Evidence demonstrating physicians from rural health residency training tracks practice in rural areas [35], as well as local studies of the workforce benefits of health center residency programs [19], lends support to our findings. Continued investment in the THCGME program [36], will allow for further evaluation of the effects of teaching health centers on primary care provider supply and distribution.

Factors driving primary care provider supply and distribution are complex with a lack of consensus on how best to determine future workforce requirements [37-42]. However, agreement exists on the mal-distribution of primary care providers and the reliance on health centers in medically underserved areas [43]. Therefore, policymakers have continued to create and sustain programs to bolster the health center workforce, but there lacks coordination, evaluation, or publication of these efforts [44]. Two separate studies found benefit with Title VII programs on provider recruitment, with the Title VII funded physicians having 1.2 to 1.3 times the odds of working in CHCs or other medical underserved communities, compared to those without [28,29]. We revealed health centers with career ladder programs have 1.8 times the odds of reporting minimal difficulty in provider recruitment compared to those without these programs.
Few studies have established promising provider retention strategies. Evaluations of the National Health Service Corps (NHSC), a federal program that provides scholarships and loan repayment incentives in exchange for service in shortage areas, reveal about 1 in 4 of every new primary care physician entering a health professional shortage area in the late 1980s [6], and that 1 in 5 physicians practicing in rural communities were brought there by NHSC [45]. However, in a 9 year cohort study Pathman et al determined that significantly fewer NHSC than non-NHSC physicians remained in their index practices, index communities, or rural practice settings after three years and every year thereafter [46]. In contrast, we found that health centers with career ladder programs compared to those without had 2.4 times the odds of reporting minimal difficulty retaining providers beyond three years.

We conducted a nationally representative survey identifying previously unknown effects and characteristics of health center professional training and pipeline programs. Despite these strengths, our study had some limitations. In this cross-sectional study, we could not make any causal inferences. Both key predictors and primary outcome variables were assessed in the same survey and may have been subject to selection bias and with our outcomes potentially recall bias; however, these variables could only be determined by health center reporting.

Our study reveals that career ladder programs, in particular, represent a promising model for developing the primary care workforce within health centers. These findings call for ongoing research in this area to advance, integrate, and expand programs that prove effective in addressing the mal-distribution of primary care providers nationwide.

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Conflict of Interest

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REFERENCES


