

Exploring the geospatial variations in the public health workforce: implications for diversifying the supply of potential workers in governmental settings

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Abstract

The US public health workforce has markedly declined, falling from 500 000 individuals in 1980 to 239 000 by 2022, a trend exacerbated by economic instability and an aging demographic. There was a temporary surge in staffing through emergency hires during the COVID-19 pandemic, but the permanence of these positions remains uncertain. Concurrently, public health degree conferrals have sharply increased, creating a mismatch between the growing number of graduates and the actual needs of health departments. This study analyzes the distribution of the potential public health labor supply within a 50- and 150-mile radius of health departments, revealing a significant regional imbalance. Most regions experience substantial differences in the concentration of public health graduates when accounting for population size, reflecting geographic disparities in workforce distribution. These findings underscore the necessity for structured partnerships between health departments and educational institutions and advocacy for adaptive policy changes to align educational outputs with labor market demands, essential for a resilient public health workforce.

Key words: public health workforce; workforce distribution; public health education.

Introduction

The governmental public health workforce, a key component of the US public health infrastructure, bears the critical responsibility of promoting and protecting the health of populations across the nation. Despite its immense importance, historical evidence indicates a persistent shortfall in staffing within this sector. There has been a marked decline in workforce numbers over the past several decades, from ~500 000 individuals in 1980 to 448 000 in 2000, and a further reduction to 239,000 by 2022.^{1,2} This workforce shrinkage has been exacerbated by factors such as the COVID-19 pandemic, fluctuating economic conditions, and the retirement of the baby boomer cohort, leading to an unparalleled increase in retirements within the public sector.³⁻⁵ In response to evolving health needs over this time period, many jurisdictions spun off community health centers so that local health departments (LHDs) might focus more on population-based services. Even after accounting for these shifts and splits, the public health sector materially lost substantial portions of its workforce across the country.^{6,7}

The COVID-19 pandemic led to a temporary increase in workforce numbers, primarily through temporary hires. This surge can be attributed to changes in federal public health funding, which allocated significant resources to combat the pandemic. However, the long-term inclusion of these temporary

hires in the sector remains uncertain. At the same time, the academic landscape in public health has witnessed a significant surge in both public health degrees and programs conferring them,⁸ presenting somewhat of an apparent paradox between supply and demand for a degree that was started for public health practice. The number of public health degree conferrals from 1992 to 2016 experienced an increase exceeding 300%, positioning public health as the field with the fifth-highest growth in degree conferrals among graduate disciplines. Additionally, the number of institutions offering graduate-level public health programs also increased significantly, growing from 74 in 1992 to 310 in 2016, a more than 4-fold increase.⁹ In the 2020-2021 academic year, more than 40 000 undergraduate and graduate degrees in public health were awarded.^{10,11} While it is not clear that a COVID-related boom in public health will continue, the number of undergraduate and graduate degrees conferred each year remains significantly higher than even a decade prior. This discrepancy between the shrinking of the public health workforce and the surge in public health degree graduates highlights a significant void in understanding the geographical dispersion of potential workforce “supply” (ie, graduates) relative to the demand posed by public health departments, recognizing that most alumni presently do not join a health department as their first job post-graduation.¹² Our research endeavors to bridge this gap.

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Data and methods

The conceit of this analysis was that current data show (1) the public health graduate base is growing,⁸ while (2) recent graduates are largely pursuing jobs outside public health¹² despite workforce shortages. This project aims to assess the upper potential limit of graduates, locally and regionally, as an input to workforce supply. Leveraging geospatial analysis techniques, we studied the regional and local variations in the potential supply of public health workers across the United States as measured by the number of graduates from post-secondary institutions. **Figure 1** illustrates the geographic dispersion of LHDs, State and Territorial Health Agencies (SHAs), and educational institutions proffering public health degrees. We drew buffers around each health department and educational institution, defined by the geographical coordinates of the 2425 LHDs, 51 state and 7 territorial health agencies, 411 of 576 federally recognized tribes (the remainder did not have any colleges within the buffer or population information), and 628 colleges and universities offering bachelor's or master's degrees in public health. An important aspect of our research involved determining an optimal buffer radius that would reflect a feasible distance for a health department to source public health graduates. After evaluating factors such as average commuting

and relocation distances, job market dynamics, and the likelihood of graduates relocating for employment, we opted for creating two radii, one of 50 miles and another of 150 miles. These distances provide a balance, ensuring our findings remain locally pertinent while also encompassing potential sources of public health labor.

Our methodology utilized data from multiple sources. For LHDs, information was obtained from the 2022 National Association of County and City Health Officials (NACCHO) Profile. SHA data were sourced from the 2022 Association of State and Territorial Health Officials (ASTHO) Profile. Data pertaining to federally recognized tribes were from the Bureau of Indian Affairs (BIA).

The integration of data from the National Center for Education Statistics (NCES), covering the years 2017-2021, provided essential geospatial coordinates (latitude and longitude) for higher education institutions, and the number of bachelor's and master's degree students across all majors. Doctoral degrees are relatively uncommon in health departments, especially at the local level, and thus were not included in the analysis. This allowed for the computation of the average number of public health graduates over a 5-year period from each university, as well as a model of an expanded supply of additional staff types. These estimates represented the

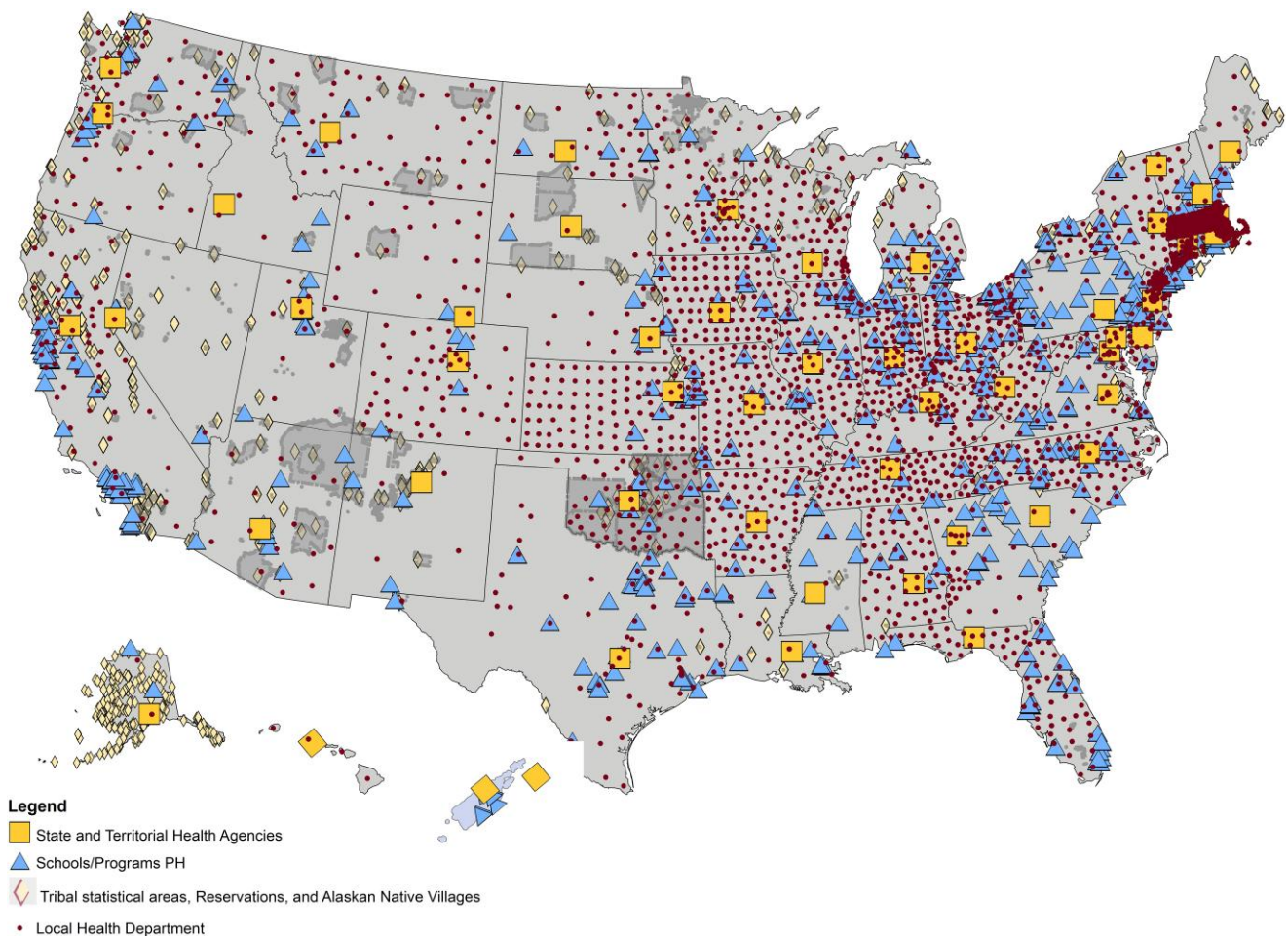


Figure 1. Geographic distribution of local health departments, state and territorial health agencies, and public health degree-granting institutions. Source: Data on LHDs from the 2022 NACCHO Profile, SHAs from the 2022 ASTHO Profile, federally recognized tribes from the BIA, and educational institutions from the NCES covering 2017-2021. Notes: Not pictured are American Samoa, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, Guam, the Marshall Islands, and the Republic of Palau. Additionally, non-Federally recognized Tribes and Tribal governments without Tribal Health Organizations are not depicted.

theoretical upper bound of new graduates from a jurisdiction, with the explicit understanding that most currently do not take a public health job out of school.

Assessing the distribution of potential labor supply

In the realm of economic theory, the distribution of potential labor supply to health departments is shaped by several key factors: organizational capacity, the competitive nature of the market, and the geographic distribution of available labor. To thoroughly assess competitive market conditions, it is ideal to consider the proximity of health degree-conferring programs, historical hiring rates of health departments, the diversity of public health services offered, and even the compensation packages of each department. While recognizing these factors as critical determinants of a health department's ability to attract and retain talent, we nonetheless faced the constraint of incomplete data across these variables.

To mitigate this, we established 50- and 150-mile buffer zones around each academic institution offering public health degrees and quantified the number of health departments within these defined areas. These departments are considered competitors for the pool of potential graduates, assuming these individuals are prepared to engage with these employers. To model this competitive environment, we used the number of staff as a proxy to approximate the size and capacity of each health department, which in turn influences the distribution of potential labor from the educational institutions.

We categorized health departments into three size-based groups—"small," "medium," and "large"—based on staff size quartiles. To streamline our analysis, we merged the second and third quartiles to form the "medium" category, reducing the original four-tier system to a more manageable three-tier framework that accurately reflects the various capacities of health departments to attract graduates. Specifically, the "small" category includes departments in the first quartile with the fewest staff, the "medium" comprises those in the middle two quartiles, and the "large" encompasses departments in the highest quartile, which are typically better-positioned to attract a larger share of graduates due to their greater resources and capacities. More information on the weights employed is available in the [Appendix](#).

Notably, we encountered an absence of publicly available staff data across Tribal health departments (THOs). To estimate staffing levels for THOs, we used a comparative method based on the staff-to-population ratios observed in LHDs with similar population sizes. First, we categorized LHDs into three distinct population groups: those with populations less than 2000, those with populations between 2001 and 9999, and those with populations over 10 000. The upper population bounds were chosen to make LHDs comparable to THOs. For each category, we calculated the mean population based on Census and BIA data and the corresponding mean number of staff members. Next, we identified comparable population bands for THOs. Using the calculated staff-to-population ratios from the LHD data, we applied these ratios to estimate the staff numbers for THOs. We report methodological limitations of this approach below.

Additionally, considering that enrolled members of tribes may not necessarily reside on Tribal lands or reservations, and may or may not receive services from their affiliated tribes—and given that not all tribes have a THO—our estimates might represent an overestimation of the actual staff

needs for some Tribal governments, and an underestimate for others. Due to this uncertainty, we conducted a sensitivity analysis excluding Tribal data, the results of which are also detailed in the [Appendix](#).

Statistical analyses and data processing were conducted using R version 4.1.0.

Results

From 2017 to 2021, the landscape of public health education across the United States revealed significant disparities in the distribution of degree conferrals. In total, there were 34 555 degrees awarded, with undergraduates earning 17 100 and masters' graduates tallying up to 17 455. This overall average captures a substantial number of new entrants to the field, albeit unevenly spread across the country.

Degree conferrals vary when examined by Health and Human Services (HHS) regions, as depicted in [Figure 2](#). Region 4 had the highest average at 6,615, compared with 999 in Region 7.

Potential labor supply: public health degree conferrals

[Table 1](#) shows the weighted distribution of potential public health labor supply to SHA Central Offices, LHDs, THOs, and tribes within 50- and 150-mile radii. Within these distances, Puerto Rico stands out as the sole territorial health department at the 50-mile radius with public health programs present, while both Puerto Rico and the Virgin Islands are considered within the 150-mile radius, though geographic barriers between the islands complicate the result.

At SHA Central Offices, the average count of public health graduates stands at 32.6 within a 50-mile radius, which decreases to 21.9 within 150 miles from added competition. THOs have a lower availability, with 9 graduates within 50 miles and 8.3 within 150 miles. LHDs had an average of 16.9 graduates within 50 miles and 12.8 within 150 miles.

In stark contrast to all of these, the Puerto Rico health department reports significantly higher numbers, with an average of 234 graduates within 50 miles, and even when expanded to include both Puerto Rico and the Virgin Islands, the count remains high at 117 graduates within 150 miles.

Breaking down the distribution by degree type, SHA Central Offices receive an average of 16.5 bachelor's and 15.1 master's graduates within 50 miles, which reduces to 11.2 bachelor's and 10.7 master's graduates within the broader 150-mile radius. LHDs attract 8.4 bachelor's and 8.6 master's graduates within 50 miles, and fewer still—6.3 bachelor's and 6.6 master's graduates—within 150 miles. THOs are estimated to attract lower numbers compared to LHDs, with 4.9 bachelor's and 4.1 master's graduates within 50 miles. These figures decrease slightly to 4.8 bachelor's and 3.5 master's graduates within 150 miles. This observed decline in the average number of graduates within the 150-mile radius, despite encompassing a larger pool of potential labor supply, is primarily due to increased competition among a greater number of health departments. Additionally, SHA Central Offices benefit significantly from their larger staff sizes, which, under the weighted distribution system, enable them to attract a higher proportion of available public health talent.

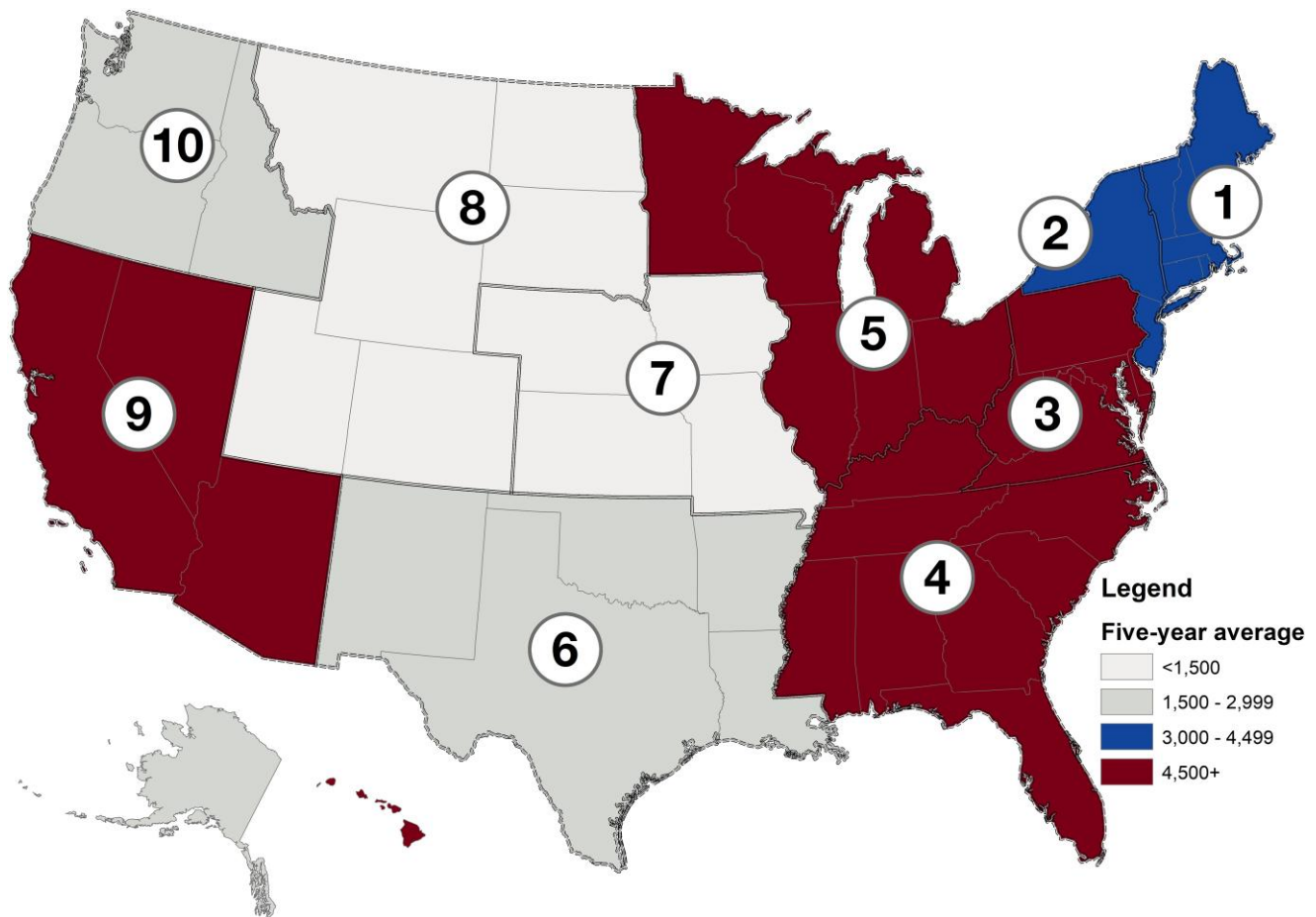


Figure 2. Five-Year average (2017-2021) public health conferrals by HHS region. Source: Data on the number of public health degree conferrals (bachelor's and master's) were collected from the NCES for the years 2017-2021. Notes: This figure presents the average number of public health graduates over 5 years by HHS region, highlighting regional variations in the potential labor supply.

Potential labor supply: public health degree conferrals among LHDs

Table 2 presents the weighted distribution of potential public health labor supply to LHDs, categorized by the population sizes they serve—small, medium, and large. This categorization reveals a clear gradient in the availability of public health graduates. Within a 150-mile radius, 1410 small, 792 medium, and 149 large LHDs had at least one graduate. Within a 50-mile radius, 998 small, 680 medium, and 143 large LHDs had an institution with at least one public health graduate. The average counts of public health graduates within 50 miles are 7.8 for small LHDs, 21 for medium LHDs, and 61.1 for large LHDs. Similarly, within 150 miles, the averages are 8 for small LHDs, 17.5 for medium LHDs, and 33.4 for large LHDs.

Discussion

In analyzing the landscape of public health degree recipients and graduates from related fields, it becomes evident that regional disparities play a significant role in determining the competitive dynamics across SHAs, LHDs, and THOs. Specifically, the geographical nuances have led to varied levels of competition, with certain regions experiencing heightened intensity due to multiple health entities vying for a limited pool of graduates, while others have a relatively tempered

competitive scene because of their unique geographic and infrastructural constraints.

However, it is crucial to understand that mere proximity to academic institutions does not guarantee a direct influx of graduates into the workforce. Estimates from our analyses represent (unrealistic) potential supply—the reality is that very few graduates enter the field, even in regions with large numbers of graduates. This disparity raises a pressing question: how can regions with relatively more graduates devise mechanisms to effectively convert these potential candidates into employees? Conversely, for areas with a scarce graduate supply, what strategies can amplify this pool—perhaps external talent acquisition or development of local educational programs? One of the recurrent challenges faced by public health entities is their overreliance on informal networks and connections for placing graduates into positions. Such systems rely heavily on personal relationships and are often contingent upon the support of specific individuals within the organization, known as champions, or are dependent on the organization's shifting priorities. These pathways lack resilience because they can collapse if key individuals leave or if the institution changes its focus. For a more sustainable solution, establishing a formalized approach to graduate placement is essential.

For example, health departments can tap into the workforce supply of public health graduates by formalizing partnerships with academic institutions via an academic health department

Table 1. Potential labor supply: public health degree conferrals within 50 and 150 miles.

		Undergraduates degree in PH		Graduates degree in PH		Total degree in PH	
		Mean	Median	Mean	Median	Mean	Median
SHA-COs	50 Miles	16.5	5.8	15.1	7.4	32.6	13.4
	150 Miles	11.2	6.1	10.7	9	21.9	14.1
LHDs	50 Miles	8.4	3.1	8.6	3.8	16.9	7.4
	150 Miles	6.3	3.4	6.6	4.5	12.8	8.8
Puerto Rico	50 Miles	31.8	31.8	202	202	234	234
Puerto Rico and Virgin Islands	150 Miles	15.9	15.9	101	101	117	11.7
Tribes	50 Miles	4.9	1.8	4.1	1.1	9	3
	150 Miles	4.8	1.9	3.5	1	8.3	3

Table 2. Potential labor supply: public health degree conferrals within 50 and 150 miles.

		Undergraduates degree in PH		Graduates degree in PH		Total degree in PH	
		Mean	Median	Mean	Median	Mean	Median
LHDs—small	50 Miles	3.8	2	4	2.3	7.8	5.5
	150 Miles	3.7	2.6	4.4	3.6	8	5.9
LHDs—medium	50 Miles	10.3	4.8	10.7	5.3	21	11.5
	150 Miles	8.8	6.2	8.7	7.3	17.5	13.6
LHDs—large	50 Miles	30.8	15.7	30.4	21.3	61.1	45.7
	150 Miles	17.7	12.5	15.7	11.3	33.4	29

Note: All health departments are included when proportionally distributing the potential labor supply by size. The mean and median values are then calculated specifically for LHDs.

partnership,^{13,14} creating student internship programs, or serving as host sites for external internship programs.^{15–17} Moreover, it is crucial to delve deeper than mere numerical data. While our investigation has provided an initial understanding in terms of graduate numbers, these figures represent only potential ceilings. Numerous variables, including personal interests,^{18–20} organizational culture and benefits such as professional development, job security, and competitive benefits,^{18–20} the depth of expertise, and the efficacy of recruitment strategies, significantly impact the actual supply of graduates poised to enter the public health workforce. It is this intricate interplay of factors, beneath the surface of raw numbers, that truly determines the real potential and challenges in public health recruitment.

One consideration brought to light in this analysis is workforce supply issues particular to Tribal governments. As sovereign governments that also receive federal funding to carry out certain health and healthcare activities, Tribes with THOs face significant workforce challenges.¹⁹ This analysis is the first to place the needs of THOs in the context of the broader national supply and finds raw availability issues similar to those faced by rural LHDs. Whether THOs and rural LHDs are in fact competing for public health workers is worthy of further investigation, given that both deliver relatively more direct healthcare services than the remainder of the public health system.^{21–23}

With respect to overall degrees conferred and workforce availability, our findings reveal that averages for master's degrees often exceed those for bachelor's degrees, reflecting the historical development of public health education primarily at the master's level. Bachelor's degrees in public health represent a more recent addition to academic offerings in this discipline, indicating a shift in the educational pathways that mirrors the evolving landscape of public health workforce development. Notably, a study by Plepys et al.¹² shows that graduates with a bachelor's degree are more likely to be

unemployed compared with those with a graduate degree. This underscores the ongoing challenges and transitions within the public health education sector as it adapts to meet the evolving needs of public health departments and the changing nature of the workforce.

Limitation

Our analysis exhibits several inherent limitations. A principal assumption of our methodology is the constant hiring demand within each health department. This assumption fails to account for variability in hiring needs, as not all health departments are actively recruiting at any given time. This oversight could lead to an upward bias in our demand estimates.

To address this limitation, we utilized a unique job posting dataset from Light Cast, targeting bachelor's, master's, and PhD-level public health graduates from January 2017 to January 2022. [Appendix Figure SC1](#) illustrates a general upward trajectory in the data, with a particularly noticeable increase in job postings since early 2020, likely reflecting expanded demand during the COVID-19 pandemic. This trend underscores the dynamic nature of public health workforce needs and challenges our initial assumptions about constant demand. Additionally, the data reveal seasonal fluctuations in job postings, indicating periodic peaks and troughs that are tied to hiring cycles or industry-specific activities.

Moreover, [Appendix Figure SC2](#) demonstrates the distribution of job postings across various industries, revealing a competitive landscape where public health departments compete not only among themselves but also with private and for-profit entities. This broader competition suggests a more complex hiring environment than our initial model accounted for, indicating that our method may underestimate the scope and scale of competition for public health graduates.

Despite its utility, the demand dataset presents challenges, primarily due to the absence of detailed geographic data. This limitation hinders our ability to precisely match job demand with graduate supply geographically, constraining our capacity to refine workforce planning strategies effectively and to align them with real-time labor market dynamics comprehensively.

Additionally, our analysis primarily focuses on the supply of public health graduates, which represents only one discipline among several typically present in health departments. We acknowledge that health departments employ a diverse array of professionals, including those trained in medicine, nursing, business administration, and other fields. By focusing predominantly on public health graduates, our analysis may not fully capture the multidisciplinary nature of workforce dynamics in these departments.

Furthermore, the results of the analysis represent the number of graduates, an unrealistic expectation of how many will pursue careers within the public health sector. Readers may adjust downward these estimates to form a conjecture, for their region, an applied estimate of potential supply. Recent data suggest a diversification of career paths among these graduates, with many choosing roles in unrelated fields influenced by factors such as perceived job security, competitive salaries, or personal interests.²⁴

This diversification implies that the actual pool of graduates available to the public health workforce may be smaller than anticipated.

Lastly, while we use jurisdiction size as a proxy for labor demand, this measure is overly simplistic. It does not consider other significant factors such as the average age of the workforce, current vacancy rates, and compensation packages, which could greatly influence a jurisdiction's capacity and attractiveness to potential graduates—all information largely unavailable for this analysis. By acknowledging these limitations, we underscore the complexity of accurately assessing the potential labor supply and demand in the public health workforce. An enhanced analysis would benefit from integrating these additional dimensions to more comprehensively understand the dynamics at play.

Conclusion

Supply for public health staff is acknowledged as a critical concern in a COVID-19 recovery landscape. Turnover has been challenging for decades, and it has been made worse by recent macroeconomic and demographic dynamics. In examining geospatial variation, it is apparent some regions in the United States have relatively few public health degree conferrals each year. However, even in those regions with relatively more, the total number of graduates a given agency could theoretically employ may be modest, and competition from other sectors is substantial. Clearly, the market for public health graduates is, and is likely to remain, challenging.

Supplementary material

Supplementary material is available at *Health Affairs Scholar* online.

Conflicts of interest statement

Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

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Data Availability

Our methodology incorporated data from a variety of sources. For Local Health Departments (LHDs), we sourced information from the 2022 National Association of County and City Health Officials (NACCHO) Profile. State Health Agency (SHA) data were obtained from the 2022 Association of State and Territorial Health Officials (ASTHO) Profile. Additionally, data pertaining to federally recognized tribes were collected from the Bureau of Indian Affairs (BIA). We also integrated data from the National Center for Education Statistics (NCES). All datasets utilized in our study are publicly available.

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