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Changes in Public Health Workforce Composition
Proportion of Part-Time Workforce and Its Correlates, 2008–2013

Jonathon P. Leider, PhD, Gulzar H. Shah, PhD, Brian C. Castrucci, MA, Carolyn J. Leep, MS, MPH, Katie Sellers, DrPH, James B. Sprague, MD

Background: State and local public health department infrastructure in the U.S. was impacted by the 2008 economic recession. The nature and impact of these staffing changes have not been well characterized, especially for the part-time public health workforce.

Purpose: To estimate the number of part-time workers in state and local health departments (LHDs) and examine the correlates of change in the part-time LHD workforce between 2008 and 2013.

Methods: We used workforce data from the 2008 and 2013 National Association of County and City Health Officials (n=1,543) and Association of State and Territorial Health Officials (n=24) profiles. We employed a Monte Carlo simulation to estimate the possible and plausible proportion of the workforce that was part-time, over various assumptions. Next, we employed a multinomial regression assessing correlates of the change in staffing composition among LHDs, including jurisdiction and organizational characteristics, as well measures of community involvement.

Results: Nationally representative estimates suggest that the local public health workforce decreased from 191,000 to 168,000 between 2008 and 2013. During that period, the part-time workforce decreased from 25% to 20% of those totals. At the state level, part-time workers accounted for less than 10% of the total workforce among responding states in 2013. Smaller and multi-county jurisdictions employed relatively more part-time workers.

Conclusions: This is the first study to create national estimates regarding the size of the part-time public health workforce and estimate those changes over time. A relatively small proportion of the public health workforce is part-time and may be decreasing.

Introduction

Most state and local health departments (LHDs) have experienced reductions in budgets and staff since 2008 despite increasing needs for public health services. These losses have important implications for health department operations. Changes in the full- and part-time distribution of the workforce may impact the operational effectiveness of state health agencies (SHAs) and LHDs because part-time workers are associated with decreased staff costs and greater flexibility to meet just-in-time staffing needs. The importance of part-time workers to operations has been well studied in other fields, but less so in public health.

The proportion of the overall U.S. workforce that is part-time has increased steadily over the past 60 years. Prior to the 1970s, the increase was largely attributable to growth of voluntary part-time positions, primarily due to women joining the workforce. However, after the 1970s and especially since 2008, growth of the part-time workforce has mainly been due to involuntary part-time employment, that is, people taking part-time jobs when they actually want full-time work. Involuntary part-time employment has important implications for...
workforce development because, compared to full-time counterparts, part-time workers generally have lower-skilled jobs, less job and financial security, fewer benefits, and fewer opportunities for promotion and training. Studies have also found that part-time workers face greater perceived pressures and job strain than their full-time counterparts. Despite this, workforce research has not demonstrated differences in job performance or satisfaction between part- and full-time employees, although a gap in worker-perceived job involvement has been shown. Regardless of the costs and benefits for workers, employers in other sectors—both public and private—have increasingly used part-time staff because they carry lower payroll costs—especially health insurance costs—and provide greater flexibility in scheduling—particularly in response to short-term employer needs.

The information available about the actual numbers, roles, and impacts of part-time workers in the public health workforce is limited. A recent study found that less than 13% of the public health nursing workforce is part-time. Beyond enumeration, studies in this space have found, for example, that part-time workers are often hired when current staffing is insufficient to meet short-term public health needs, such as giving vaccines or responding to localized disease outbreaks. Other studies found that LHDs often employ clinicians only part-time and sometimes do so to fulfill a requirement that LHDs be headed by a medical officer. Recent studies of public health departments found that part-time workers are often employed in rural jurisdictions and that some of the smallest LHDs have only part-time employees. Interest in the part-time workforce is growing, especially as it relates to impact on cross-jurisdictional sharing and staffing changes overall. The goal of this project is to provide current and comprehensive estimates on the number of part-time workers in the public health workforce.

Methods

We used two major data sets to construct an estimate of the part-time workforce at the state and local levels: the Association of State and Territorial Health Officials (ASTHO) and the National Association of County and City Health Officials (NACCHO) Profile surveys. These data sets report the total number of employees and full-time equivalents (FTEs) for an agency. Neither provides individual-level employee records.

At the state level, we combined workforce data from the 2008 and 2013 ASTHO Profile Surveys. Our final data set included staffing totals from 1,542 of 2,800 LHDs. The inclusion criteria were the same used for the ASTHO data. Nine hundred sixty-three LHDs did not have staffing data for both time periods and 34 additional LHDs reported more FTEs than total employees. We also excluded LHDs that reported employee to FTE ratios that were outliers (beyond three SDs from the mean). Nationally representative statistical weights were created in line with standard methods to account for non-response by LHD population category.

We created models to estimate the number of workers and proportion of the workforce that was part-time. Part-time workers are defined as those employees who work less than one FTE. Full-time workers are defined as those employees who work one FTE. We used a Monte Carlo simulation model to estimate what proportion of the public health workforce was part-time in 2008 and 2013. Specifically, we estimated the number of part-time workers in an agency, given estimates for FTE and employees from the NACCHO Profiles, and assuming parameter a, as represented in the following formulae, provided the number of FTEs is not less than 1:

\[ a = \frac{\text{number of part-time FTEs}}{\text{number of part-time employees}} \]

and

\[ \text{Number of part-time employees} = \frac{\text{total employees} - \text{total FTEs}}{1-a}, \]

where parameter a is the average allocation of FTEs per part-time employee in a given agency. Because the number of part-time employees was not reported uniformly across the NACCHO and ASTHO Profiles, and because parameter a, which could hypothetically be different among LHDs, is not collected, we systematically varied this parameter over five scenarios in a Monte Carlo simulation (10,000 repetitions). In two scenarios, we set parameter a as one of two constants: Scenario 1 represented part-time staff working an average of half-time (a=0.5) and Scenario 2 represented part-time staff working 40% on average (a=0.4). In Scenarios 3 and 4, we allowed a to vary geometrically at random (a=equal probability of selection on the interval [0.4, 0.25], a=equal probability of selection on the interval [0, FTE/employee]). The final scenario allowed a normal distribution with mean and SD of 0.4 and 0.1809, respectively. This distribution mimicked the distribution of part-time workers in governmental health organizations in 2007, the most recent year available from the U.S. Census Bureau’s Census of Governments, which collects these data.

We included demographics and organizational characteristics as independent variables in a multinomial regression using only the NACCHO data. Independent variables are outlined below.

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1 This serves as the mathematic limit of a in a scenario where there are only part-time staff and no full-time staff.

2 In the last scenario, the LHD staff worked at the lower end of a distribution that conformed to that of governmental health workers, collected by the U.S. Census Bureau in 2007. This distribution also incorporated a 15% likelihood of a=0.5 and a 10% likelihood of a=0.25. These two spikes in probability mimic the empirical distribution of the aforementioned Census table, showing that 10% of all local governmental health agencies have part-time staff work 40% on average and 15% have part-time staff work half-time on average.
outcome variable, percentage change in the ratio of employee to FTE, was computed in three steps:

1. ratios of number of total employees to FTEs (full-time equivalents) were computed for 2008 and 2013;
2. ratios for 2008 were subtracted from the 2013 ratios, and those quantities were then divided by the 2008 ratios; and
3. given that the median change was zero,
   a. increases in employee to FTE ratio above the 60th percentile were coded as “Substantial Increases,”
   b. those below the 40th percentile as “Substantial Decreases,” and
   c. changes between the 40th and 60th percentiles were coded as Insubstantial or No change.

We performed multinomial logistic regression for the multivariate analysis of the three-category dependent variable. To estimate unbiased population parameters, we used statistical weights in all analyses generated in line with NACCHO’s previously published methods; these account for disproportionate response rates by LHDs serving different population sizes. We also included other control variables in the model that reflected the level of LHD connectivity with the community, such as having completed the community health improvement plan (CHIP) in the past 3 years or having performed one or more activities in the past 2 years to address health disparities. We also included the 2008 employee to FTE ratio in 2008 as a control variable. We used Stata, version 13, to manage and analyze the data.

Results

Total Staffing Changes
SHAs and LHDs had substantial losses in both part- and full-time employees beginning in 2008. The 1,543 LHDs in our study lost 15,000 employees and 11,000 FTEs (Table 1). We would expect total employee losses to be in excess of 23,000 at LHDs nationally (95% CI=15,983, 30,548) after applying weights to make the estimates nationally representative. The public health workforce at the local level decreased from about 191,000 in 2008 to about 168,000 employees in 2013.

State data were similar. FTEs declined at the state level from 44,000 in 2008 to 41,000 in 2013 among the 24 responding states. Although our study does not reflect all SHA offices (the enumeration study in this supplement estimates over 86,000 FTE SHA workers), our analysis indicates that many of the SHA job losses were among part-time workers (Table 2). These data show that part-time job losses may account for as much as half of total job losses.

Estimated Changes to the Part-Time Workforce
Table 2 shows results from the Monte Carlo simulations for NACCHO and ASTHO data. Each scenario showed a statistically significant decrease in the proportion of part-time workers in state and local public health workforces with the exception of the most conservative scenario (Scenario 2), where the average allocation of FTE per part-time employee is allowed to vary within its mathematical (rather than practical) limits. Among LHDs, the simulations showed that part-time employees comprised less than 25% of the workforce in 2008, decreasing 15%–20% in 2013 (e.g., from 21% to 18% in Scenario 4). All scenarios showed a decrease of approximately 10,000 part-time workers. The simulations also showed a decrease in the proportion of the workforce that was part-time among the 24 SHAs with data for 2008 and 2010. This proportion was approximately half of what estimates showed for LHDs (e.g., decreasing from 9% in 2008 to 5% in 2013 in Scenario 3), or about 2,000 part-time workers between 2008 and 2010 in reporting SHAs.

Results from Multivariate Modeling
Our models found an aggregate decrease in the total proportion of the local public health workforce that was

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Table 1. Total staffing changes at local health departments, 2008–2013

<table>
<thead>
<tr>
<th></th>
<th>Unweighted total (n=1,543)</th>
<th>Weighted total (n=2,794)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees 2008</td>
<td>120,598</td>
<td>190,968</td>
<td>156,443, 225,493</td>
</tr>
<tr>
<td>Employees 2013</td>
<td>105,716</td>
<td>167,702</td>
<td>139,012, 196,392</td>
</tr>
<tr>
<td>Employee changea 2008–2013</td>
<td>−14,882</td>
<td>−23,266</td>
<td>−30,548, −15,983</td>
</tr>
<tr>
<td>FTEs 2008</td>
<td>105,699</td>
<td>167,247</td>
<td>138,084, 196,410</td>
</tr>
<tr>
<td>FTEs 2013</td>
<td>94,732</td>
<td>149,794</td>
<td>122,324, 177,263</td>
</tr>
<tr>
<td>FTE change 2008–2013a</td>
<td>−10,967</td>
<td>−17,453</td>
<td>−21,092, −13,814</td>
</tr>
</tbody>
</table>

*Estimates of change are based on linked data. As such, CIs from the cross-sectional estimates are not determinant of the CIs for the change estimates.
FTE, full-time equivalent

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*Because these data are linked, the 95% CI estimates were tied to a variable generated by subtracting staff and FTE data for 2008 from 2013 and aggregating those changes, rather than comparing the estimates purely cross-sectionally.
part-time. However, these decreases were not split uniformly among health departments. Half of all LHDs had decreases in the number of part-time workers. However, 45% of LHDs had increases in the part-time workforce. Given this dichotomy, we wanted to identify factors that differentiated between these two groups. Bivariate analysis showed that jurisdictions serving fewer than 100,000 residents accounted for 74% of the approximately 675 LHDs in our sample that had increases of the proportion of their workforce that was part-time between 2008 and 2013.

We conducted a multinomial regression analysis to study the correlates of change in the part-time workforce in LHDs, in which we statistically controlled for other independent variables in the multivariate model. Per capita expenditures and expenditures per FTE were positively associated with increases to employee to FTE ratio (Table 3). The number of employees in 2008 and percentage change in FTE, (2013 minus 2008)/2008, were negatively associated with an increase in part-time workforce. We also included a control variable in the model relating to the 2008 ratio of employees to FTEs. Threshold effects were observed where LHDs that were the least full-time in 2008 had significantly greater odds of seeing an increase in their employee to FTE ratio in 2013 compared to LHDs that were the most part-time ($p<0.001$, data not shown).

Other statistically significant predictors of the substantial increase in part-time workforce (versus substantial decrease) were multiple city or county jurisdictions as opposed to single city or county (comparing Substantial Increase versus Substantial Decrease as defined above), and having physicians on staff. Compared to LHDs with single city or county jurisdiction, LHDs with multiple city/county jurisdictions were 1.48 times more likely to have a substantial increase in employee to FTE ratio. Odds of a substantial increase in part-time workforce were 1.38 times greater for LHDs that had completed a CHIP in the past 3 years, 2.39 for LHDs involved in activities to reduce health disparities, and 1.50 times greater for LHDs with physicians on staff. Having a local board of health was not significantly associated with substantial increase in part-time workforce.

**Discussion**

We quantified an important and understudied part of the public health workforce. We found that the proportions of part-time workers at both SHAs and LHDs are relatively low in aggregate and in line with other governmental sectors such as fire protection and education. The part-time public health workforce is much greater in LHDs compared to SHAs (2013, 17%–21% for LHDs versus 5%–7% for SHAs). Additionally, many SHAs have a substantial number of their employees working in LHDs that are sometimes double-counted, especially in states where SHAs and LHDs share financial and public health responsibilities and authority. Given that 40% of employees at SHAs are working at the local level,28 the percentage of part-time employees in the SHA central office is likely to be lower than the 5%–7% our models suggest.

The total number of state and local part-time workers decreased nationally between 2008 and 2013. However, this trend is not uniform, as our model suggests that nearly 45% of LHDs had increases in the proportion of part-time workers. Our models also show that smaller
LHDs and those serving multiple jurisdictions had greater increases in part-time employment than larger, single-jurisdiction LHDs.

The reasons that health departments might favor employing part-time workers vary, but potential advantages include decreased costs and increased flexibility.\(^7\) Part-time employees may be a good fit for LHDs serving very small jurisdictions or departments serving smaller populations that do not require full-time public health specialists such as epidemiologists or public information officers. In fact, a 2013 NACCHO report showed that 38% of LHDs reported sharing a staff member with another LHD, an increase from the 25% of LHDs reporting this type of arrangement in 2010.\(^19\)

Our analysis showed that during the studied time period, more part-time than full-time workers lost jobs in LHDs, which is especially noteworthy because part-time workers represent a relatively small proportion of the workforce. The drivers of these staffing changes are unclear. More information is needed to understand what kinds of part-time positions were eliminated and why, as well as whether state or local policy (e.g., collective bargaining agreements) provide more protections for part-time workers. These analyses could guide public health officials in building a better, more sustainable public health workforce.

### Limitations

This study has limitations that should be considered with respect to both internal validity and generalizability. The data used from the NACCHO and ASTHO Profiles Surveys are self-reported and were not collected with enough granularity to support a comprehensive study of the public health workforce. We used top-level measures of staffing and FTE counts and eliminated records that were outliers or likely reported in error.

Results from the Monte Carlo simulation should be interpreted with caution, as some health departments may have a part-time composition that does not conform to any of the scenarios we used. We developed Scenario 2 to allow estimates to vary across their arithmetic limits; this scenario likely has estimates of total part-time workers larger than what we would expect to observe in reality (as average allocation likely conforms to the limits prescribed by other scenarios).

Only half of SHAs responded with employee and FTE data for both years of interest, limiting the generalizability of our results at the SHA level. Our regression model was unable to account for state-based clustering because many states had only a few LHDs reporting. However, accounting for jurisdiction size is a widely utilized approach with the NACCHO data, and has been

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**Table 3. Multinomial logistic regression of change in employee to FTE ratio of LHD workforce from 2008 to 2013**

<table>
<thead>
<tr>
<th>LHD characteristics</th>
<th>Substantial increase versus substantial decrease in employee to FTE ratio</th>
<th>p-value</th>
<th>Insubstantial change versus substantial decrease in employee to FTE ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population size</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.61</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.58</td>
</tr>
<tr>
<td>Proportion of revenue from state (including federal pass-through)</td>
<td>1.00 (1.00, 1.01)</td>
<td>0.12</td>
<td>0.99 (0.99, 1.00)</td>
<td>0.06</td>
</tr>
<tr>
<td>Number of employees in 2008</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.11</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.41</td>
</tr>
<tr>
<td>Per capita expenditures</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.45</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.63</td>
</tr>
<tr>
<td>Expenditures per FTE</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.01</td>
<td>1.00 (1.00, 1.00)</td>
<td>0.83</td>
</tr>
<tr>
<td>Percentage change in FTE from 2008 to 2013</td>
<td>0.54 (0.37, 0.80)</td>
<td>&lt;0.01</td>
<td>0.37 (0.22, 0.61)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Governance category (state versus shared)</td>
<td>0.73 (0.43, 1.23)</td>
<td>0.23</td>
<td>0.51 (0.29, 0.92)</td>
<td>0.02</td>
</tr>
<tr>
<td>Local versus shared</td>
<td>1.60 (1.01, 2.55)</td>
<td>0.05</td>
<td>0.84 (0.50, 1.39)</td>
<td>0.49</td>
</tr>
<tr>
<td>LHD has a local board of health (yes versus no)</td>
<td>1.16 (0.81, 1.68)</td>
<td>0.41</td>
<td>1.26 (0.84, 1.91)</td>
<td>0.27</td>
</tr>
<tr>
<td>Jurisdiction type (multiple city/county/other versus single city/county)</td>
<td>1.48 (1.13, 1.93)</td>
<td>&lt;0.01</td>
<td>1.06 (0.76, 1.48)</td>
<td>0.72</td>
</tr>
<tr>
<td>CHIP in past 3 years (yes versus no)</td>
<td>1.38 (1.06, 1.81)</td>
<td>0.02</td>
<td>1.34 (0.96, 1.85)</td>
<td>0.08</td>
</tr>
<tr>
<td>One or more activities performed in the past 2 years to address health disparities (no versus yes)</td>
<td>2.39 (1.71, 3.34)</td>
<td>&lt;0.01</td>
<td>2.02 (1.33, 3.05)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>LHD had physician on staff (yes versus no)</td>
<td>1.50 (1.17, 1.93)</td>
<td>&lt;0.01</td>
<td>1.12 (0.83, 1.53)</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Note: Values are AOR (95% CI for exp[B]) unless otherwise noted. Boldface indicates statistical significance (p < 0.05).

CHIP, community health improvement plan; FTE, full-time equivalent; LHD, local health department
shown to be reasonable.\textsuperscript{4,5,21} With these considerations in mind, our approach combines longitudinal data with flexible modeling assumptions that all yield a similar finding: the part-time workforce at SHAs and LHDs is relatively low and has declined since 2008.

Conclusions

This is the first study to create national estimates regarding the size of the part-time public health workforce and estimate those changes over time. We find that the proportion of the part-time workforce in LHDs is relatively low, perhaps one-fifth of the total, and that this proportion is declining over time. The proportion of part-time workers in SHAs is even lower, at about 10%. Our analysis brings greater attention to the need for studying the characteristics of the part-time workforce in public health. A more complete understanding of part-time workers in public health offices could help identify and define new strategies for public health management, including approaches that could be more in line with the budget challenges and programmatic needs public health faces today and in the coming decades.

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