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The Epidemiology and Costs of Disease Intervention Specialist Retention

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Background: The COVID-19 pandemic changed the environment in which disease intervention specialists (DISs) operate, as their skills were in demand beyond sexually transmitted disease (STD) control programs. Workforce conditions generally have changed in the last 2 years, imposing additional challenges. Retaining STD DIS has become more difficult in the changed environment.

Materials and Methods: We conducted a landscape scan and obtained data from literature and personal observations to characterize current DIS workforce issues. We used published employment data to characterize current labor market conditions and described how cost-effectiveness analysis could be used to assess potential DIS retention interventions. An example illustrating cost-effectiveness concepts was developed.

Results: Many STD control programs faced difficulties in retaining STD DIS, because competing positions often could be done without field work. Economic and crime issues posed additional challenges. General workforce turnover has increased 33% since 2016. Turnover varies by age, sex, and education. Cost-effectiveness analysis can be used to assess DIS retention interventions, but data on costs and outcomes are needed on an ongoing basis. Changes in the workforce environment could impact both retention and the effectiveness of retention interventions.

Conclusions: Workforce changes have impacted employee retention. Increased federal funding makes expansion of the DIS workforce possible, but the labor market environment will continue to pose challenges to recruitment and retention.

During the COVID-19 pandemic in 2020, persons with disease intervention specialist (DIS) or similar skills were uniquely qualified for an abundance of COVID positions in health departments outside of sexually transmitted disease (STD)/HIV programs.[1] Many public health STD DISs were actively recruited or left their STD positions to join COVID programs to address the great need for case investigation and contact tracing because of high case loads. Many existing DISs were gratified to see their skills valued and anticipated a burgeoning job market with competitive salaries. Most COVID positions allowed staff to work from home full-time with no field follow-up with cases or contacts because of the infectious, airborne nature of the disease.[2,3] However, the marked increase in COVID-19 health department positions, and the missing infrastructure to support, monitor, and supervise left many case investigators and contact tracing staff without a clear understanding of their daily job requirements and no expectations by which to measure their performance.[2,3] As staff waited for clarification, they were paid full salaries without defined performance standards, in contrast to their STD DIS counterparts. To understand how these workforce and workplace environment changes have impacted the DIS workforce and efforts to attract, retain, and train DIS, we sought to characterize the current employment situation for DIS, contextualize it against workforce changes generally, and characterize ways in which cost-effectiveness analyses of potential DIS retention interventions could optimize DIS retention.

MATERIALS AND METHODS

We analyzed published employment data from the US Bureau of Labor Statistics (BLS) and private industry to summarize recent labor market conditions. Job tenure, the length of time an employee has worked for their current employer, can be useful for planning strategies to retain employees. Average tenure, a measure of longevity, may help target interventions to workers at a particular point in their careers, when they may be likely to leave the organization. We examined trends in average tenure by demographic characteristics.

We obtained data on DIS workforce issues from the literature and via personal observations and communications from an author who provides part-time direct assistance to the Philadelphia Department of Health's STD Control Program. We also sought to identify other health-related fields where published evaluations or studies exist.

Cost-effectiveness analyses are tools to achieve health goals as cheaply as possible, or to maximize health gains achievable with a given set of resources.[4] Interventions that can deliver desirable outcomes at lower cost are preferred over interventions that require higher cost inputs that deliver the same outcomes.[4] Identifying and quantifying an outcome for cost-effectiveness analyses of employee retention are challenging. Worker output, average vacancies, and employee movement measures can all be quantified. Disease Intervention Specialist output can be measured using cases investigated, patients treated, and partners notified, but DISs do more, such as patient navigation to health insurance and social services and provider education.[5,6] Quantifying and including (or excluding) these outcomes would impact the cost-effectiveness of DIS and by extension DIS retention.[7] Beyond DIS output, quantifying the health impact of DIS activities presents additional challenges when also considering DIS retention.

To assess how DIS retention might be optimized using cost-effectiveness analysis, we developed a simplified hypothetical example of 2 interventions for a health department with 100 DISs. Although no data were available to populate the example, we chose values that might occur if the potential interventions were implemented and evaluated in a state or local health department

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STD program. We assumed that new DIS started work on January 1 and resignations happened on December 31 to simplify calculations for illustration purposes. Therefore, vacancies were filled the next day (DISs who quit on December 31 of 1 year were replaced by a new hire who started January 1 of the next year). We assumed a recruitment and onboarding cost of $5000 for each new hire. Intervention 1 was a hypothetical increase in annual starting pay of 10% for new DIS in their first year worked, from a baseline of $50,000 to $55,000. We assumed that this would reduce the first-year quit rate from 25% to 10%. Intervention 2 was implementation of a hypothetical mentoring program, which reduced the first-year quit rate of new DIS from 25% to 10% and annual quit rate of experienced DIS from 10% to 8%. Although these numbers are for illustration of the potential of cost-effectiveness analysis only, mentoring programs for nurses have been shown to increase engagement and satisfaction for mentors and mentees.[8] We assumed that the mentoring program had an impact on both first-year and experienced DIS productivity in working cases.

We then applied an alternative scenario to reflect a more challenging recruitment environment: vacancies would take 1 calendar year to fill, whereas recruitment and onboarding costs would double to $10,000. All other assumptions remained the same as in the primary scenario.

Both scenarios ran for 10 years. Results were compared in terms of average staff employed, total cases worked, total cost, and cost per case worked. The primary outcomes were total cases worked and average staff employed. Alternative interventions were compared using the incremental cost-effectiveness ratio, the additional cost per unit of outcome compared with the next most-effective alternative intervention. The cost-effectiveness parameters are shown in Table 1.

RESULTS

Despite COVID-19, some STD control programs (e.g., Philadelphia) never changed their policy on field work but did shift priorities. Staff were still required to perform field investigations. If individuals were located, the DIS would request the individual step outside the residence to speak (with masks, 6 ft apart) or DIS could call the individual from their car. Policies for field follow-up were not discontinued but reprioritized to ensure that assignments of the highest priority were still investigated thoroughly, even if they included field outreach. There continued to be clear expectations for supervisors and DISs, including regular pouch audits, case interview conferences, and chalk talks (most of these activities were conducted virtually). Because many STD DISs moved to COVID or other work-from-home positions, workloads and stress increased for STD DIS (Melinda Salmon and Dawn Broussard, unpublished observations). At the same time, staff were probably hearing from former colleagues about the more relaxed expectations for COVID case investigators and contact tracers, as COVID programs struggled to articulate staff expectations and implement quality assurance protocols.[2,3]

As COVID continued, other external factors continued to influence hiring and retention of STD DIS. Gun violence spiked in cities with high STD morbidity, such as Chicago and Philadelphia. For example, fatal shootings in Philadelphia increased by 23% from 2020 to 2021 and 50% from 2019 to 2020. Shooting deaths in Philadelphia jumped to 95% over a 5-year period, mostly postpandemic onset.[9] This may have contributed to staff concerns about STD follow-up in unfamiliar neighborhoods.

The rise in the cost of gasoline impacted DIS's willingness to do field outreach. This has become another contentious point in programs that require staff to use their privately owned vehicle. In April 2020, gas prices were at the lowest level since December 2008, at approximately $1.65/gallon. By June 2022, gas prices had more than doubled to an average of $4.96/gallon. Through July 2022, despite some fluctuations and the increase in gas cost, mileage reimbursement remained at $0.585/mile. Finally, in an almost unprecedented move, General Services Administration mileage reimbursement changed midyear 2022 to $0.625/mile, which led to increases in local jurisdictions that peg to General Services Administration reimbursement levels.[10]

Other Factors Impacting STD Control Programs and Their Labor Force

Sexually transmitted disease control programs, especially in big cities, have faced dramatic staffing losses for decades. In the late 1980s and early 1990s, the US Centers for Disease Control and Prevention (CDC) placed nonclinical staff, mainly DIS and other frontline staff, in state and local health departments to support STD programs and assist in the elimination of syphilis. Staff were assigned in lieu of cash, in what was called "direct assistance."[11] In addition to supporting local STD prevention efforts, these assignments were an unofficial nonclinical management training program for the CDC. Many of these staff (job title of "public health advisors") were recruited back to the CDC and seemed to have formed a useful managerial infrastructure.

Because the assignees were part of the federal cooperative agreement, many states and local areas depended, in part or fully, on federal support to maintain core program functions.[11] This federal training program may have inhibited local and state STD program capacity, because states may have depended on federal assignees to fill key service delivery and program management positions, limiting the development and training of local or state staff. In the late 1990s, as these direct assignee staff retired or were recruited back to CDC, their positions in state and local programs were not refilled by CDC. No additional funds were provided to cooperative agreement recipients to fill these positions through a local hiring mechanism.[11]

The Great Resignation

These work environment changes occurred during a time of labor shortages across industries and the highest rate of job

TABLE 1. Cost-Effectiveness Example Employee Costs and Performance Parameters

DIS*	Onboard/Recruitment Cost	Annual Salary	Cases Worked Per Year	Quit Rate†	Cost Per Case Worked
New	$5000	$50,000	100	25%	$550
Experienced	N/A	$65,000	200	10%	$325

All staff were assumed to begin work on January 1 of the year in which they were hired and to quit on December 31 in the year in which they quit.

*DISs were classified as new for the first year and experienced after their first anniversary. At the start of the scenario, all DISs were assumed to be experienced.

†The quit rate was defined as the percentage of employees in each classification who were employed at the beginning of the year who quit at the end of the year.

turnover in the last 50 years.[12] Measures of employee retention and turnover give a more complete view of worker movement. The retention rate, a measure of how many employees stay with an organization over a given period, is used to gauge workforce stability. However, it does not track the departures of employees who joined and subsequently left during the tracking period. The turnover rate is a measure of how many employees leave an organization for any reason (e.g., quits, layoffs and discharges, retirement, death, disability, and transfers within the same organization) over a specified time interval. Thus, the turnover rate complements the retention rate by showing the percentage of separations in the same period. Employee turnover is important to organizations because it is expensive to replace trained staff and has repercussions on the morale of remaining employees.

The annual number of total job separations grew over 10 years, reaching its highest level in series history during the COVID-19 pandemic. It increased 20% from 68 million in December 2019 to 81.5 million in December 2020.[13] Not all turnover is the same. Historically, the focus was on involuntary turnover (i.e., employer severs the employment relationship by firing for bad performance or layoffs). However, the focus in our recent hypercompetitive talent labor market is on voluntary turnover (i.e., an employee opts to quit). Reasons include a variety of factors: lack of job training or advancement opportunities, little feedback, job dissatisfaction or unmet job expectations, stress, or compensation. In 2021, quits as a percentage of total separations increased to 69.3%.[14] There were 47.8 million quits in 2021, an increase of 33% from 35.9 million quits in 2020.[14] In April 2021, 4 million workers quit their jobs compared with 1.8 million workers in April 2020, which accounted for only 18% of total job separations (during the time in which many jurisdictions had some level of lockdown).[15] More than 3% of US workers (4.5 million people) quit in November 2021. This was the highest on record in the past 20 years that the BLS has tracked this information, leading to this increase in quitting being dubbed "The Great Resignation."[12,16] In 2022, quits numbered 50.6 million, accounting for 70% of total job separations, the highest annual level in the BLS's survey history.[17]

After 2 years of pandemic-induced disruptions, record-breaking numbers of Americans quit their jobs amid 10.6 million jobs remaining unfilled. Strong employer demand enabled workers to pursue better opportunities. Much job turnover was concentrated in hospitality and other low-wage sectors, where intense competition for employees gave workers the leverage to seek better pay and working conditions.[18] Job-switchers obtained substantially faster pay increases than people who stayed in their jobs.[18] For example, hourly earnings for leisure and hospitality workers increased by 12.3% in November 2021, which exceeded the inflation rate of 6.8% (nearly 4 decades high). Other low-wage service sectors also saw strong earnings gains. Average hourly earnings rose by 4.8% in November, so for workers who could not change jobs as easily or who were in sectors with less demand, pay gains were lower, and lagged price increases.

Biennial data from the BLS on employee tenure indicate a trend toward shorter tenures. The median number of years that wage and salary workers were with their current employer decreased from 4.2 years in January 2018 to 4.1 years in January 2020.[19] Median tenure is affected by numerous factors, including changes on the demand side of the market (e.g., changes in the number of hires and separations) and on the labor supply side (e.g., demographic characteristics such as sex, race, the age profile of workers, and level of education).

Examining how tenure varies helps elucidate important trends both with respect to the overall economy and within specific industries and organizations, often highlighting potential areas for improvement. In 2020, both men and women spent less time in the same jobs than a decade earlier (3.6 months less among women and 2.4 months less among men). In January 2020, median employee tenure for women (men) was 3.9 (4.3) years. Among employees 25 years and older, women had a median tenure of 4.8 years at the same job versus men who stayed slightly more than 5 years.[19]

Employee tenure differs by education: tenure was lowest, on average, among high school graduates without college experience. This factor is more varied when viewed by sex. The more educated male workers are, the longer their tenure at a single job. That relationship is not as strong across female workers (e.g., women with no college education had the same tenure as women with an associate degree). Although employees with a master's degree or a doctorate had the highest tenure, these women spent less time in their roles than men, including a full year less among women with a doctorate or professional degree.

Tenure varies by age. Employees younger than 34 years spend the least amount of time in the same job, and their average tenure decreased in 2020 compared with 2010.[19] High-school and college-aged young adults job hop the most, which is not surprising considering the temporary nature of their jobs—they often work during vacations from school, temporary internships, or apprenticeships, or find jobs around their schedules.[20] Young professionals younger than 34 years tend to stay in jobs a little longer, as they take their time to assess whether a position is a good fit for their skills and professional ambitions. Among 18- to 24-year-olds, average employee tenure in 2020 was 2 months less than in 2010, averaging between 8 months and 1.3 years.[20] Among 25- to 34-year-olds, average tenure was 4 months less over the same 10 years—averaging 2.8 years. Employees aged 35 years and older also spent less time in their jobs in 2020, but their average tenure is substantially higher compared with younger Americans. Employees between 35 and 44 years old spent 4.9 years, on average, at the same job, followed by 7.5 years among 45- to 54-year-olds, and 9.9 years among those between the ages of 55 and 64 years.[20]

Among the major race and ethnicity groups in 2020, the percentages of employees who stayed with the same employer for 10 years or more were 29% of White employees, 23% of Black employees, 26% of Asian employees, and 22% of Hispanic employees.[19]

Cost-Effectiveness of Employee Retention

Although few studies assess the cost and effectiveness aspects of employee retention, nursing is an exception. Numerous studies have assessed the effectiveness of various interventions including structured orientation programs, internships and residencies, transition to practice programs, ensuring adequate staffing, and increasing nurse empowerment and autonomy.[8,21–23] The effect of improving retention rates for existing nursing staff has also been examined.[22] Although some studies have examined cost in varying ways, none have been cost-effectiveness analyses.

Estimates of the cost of employee turnover vary widely. The average cost per hire due to recruitment and training was estimated to be $2300 to $18,800.[24–26] Other estimates are 33% to 50% of base salary.[27,28] The cost of a new hire exceeds the cost of advertising, selecting, and training new employees. Many cost estimates of new hires exclude the potential productivity implications of new employees whose productivity may be lower than experienced employees who were not retained.

For DIS, this is particularly acute. Although the initial formal training may be completed in the first few months of hiring, more important is the informal mentoring and coaching from more senior staff in the months after formal training. Declining retention rates also can cause employee morale to decline, and increasing vacancies and new hires can cause additional retention problems.[22,25]

Table 2 shows the outcomes of the cost-effectiveness analysis using total cases worked as the outcome. At the baseline, over a 10-year period, the average workforce would be 88 DISs each

TABLE 2. Cost-Effectiveness Example Intervention Costs, Outcomes, and Incremental Cost-Effectiveness Ratios

Strategy	Total Cases Worked	Total Cost (Millions)	Cost Per Unit of Outcome*	Avg Staff Employed	ICER†
Cases worked as the outcome					
Mentoring	188,769	$64.27	$340.45	92	
Baseline	189,619	$63.96	$337.32	88	Cost-saving‡
Increased starting pay	191,000	$64.55	$337.96	90	$425.94
Average staff persons employed as the outcome					
Baseline	189,619	$63.96	$72,684.02	88	
Increased starting pay	191,000	$64.55	$71,722.22	90	$294,031
Mentoring§	188,769	$64.27	$69,855.40	92	Cost-saving‡

For each outcome, interventions are ordered from the least to most effective. Costs and outcomes are shown for a 10-year period and are not discounted. All new DISs were assumed to start on January 1, and all staff who resigned were assumed to depart on December 31 of the respective year for calculation purposes. At the start of the scenario for each intervention alternative, the workforce consisted of 100 experienced DIS.

*Outcomes shown are average cases worked per DIS (top half of the table) and average staff persons employed per year (bottom half of the table). The costs shown in the bottom half of the table are the annual costs per average staff person employed.

†The ICER equals the additional cost per additional unit of outcome for each intervention compared with the next most effective intervention.

‡Cost saving means that the intervention produces more units of outcome at lower cost than the next most effective intervention.

§Mentoring is cost-saving compared with increased starting pay when using average staff persons employed as the outcome, meaning that it has lower cost and more average staff persons employed than increased starting pay. Therefore, increased starting pay would be removed from consideration, and the table would be recalculated: Mentoring would produce an increase in average staff persons employed of 4 at an ICER of $76,259 per additional staff person employed over the 10-year period compared with the baseline.[29]

ICER indicates incremental cost-effectiveness ratio.

year. The total number of cases worked would be 189,619 at a cost of $63.96 million (average cost per case worked of $337.32). Mentoring would not be selected because the baseline is cost-saving compared with mentoring: the baseline has more total cases worked at lower total cost than mentoring. Increasing starting pay would increase total cases worked over the 10 years by 1381 cases, at an incremental cost of $425.94 per additional case worked versus the baseline. The cost-effectiveness of the 2 interventions using average staff employed as an outcome is also shown in Table 2. The most effective intervention for maintaining maximum average staff employed is mentoring, but it is more costly than the baseline by $305,034 over 10 years. Mentoring was cost-saving versus increasing starting pay because it had lower cost and more average staff employed than increasing starting pay.[29] Therefore, in this example, increasing starting pay would not likely be considered as an option, although it is shown in Table 2 for illustration purposes.

In this example, the desired outcome would likely impact the selection of the optimal workforce retention strategy. Results for the alternative scenario are shown in Table 3 for both cases worked and average staff employed as outcomes. For both, mentoring would be not only the most effective intervention but also the most expensive. With average staff employed as the outcome, mentoring shows extended dominance over increasing starting pay because the incremental cost-effectiveness ratio for increasing starting pay versus baseline is higher, suggesting that increasing starting pay would not be considered, and if the budget were available, mentoring might be preferred to the baseline. After dropping increasing starting pay from the interventions under

TABLE 3. Cost-Effectiveness Example Intervention Costs, Outcomes, and Incremental Cost-Effectiveness Ratios (Alternative Scenario)*

Strategy	Total Cases Worked	Total Cost (Millions)	Cost Per Unit of Outcome†	Avg Staff Employed	ICER‡
Cases worked as the outcome					
Baseline	173,296	$58.58	$338.01	80	
Increased starting pay	176,116	$59.63	$338.57	83	$373.12
Mentoring	176,543	$60.26	$341.35	86	$1486.40
Staff persons employed as the outcome					
Baseline	173,296	$58.58	$73,220.15	80	
Increased starting pay	176,116	$59.63	$71,841.08	83	$350,660
Mentoring§	176,543	$60.26	$70,073.35	86	$211,611

For each outcome, interventions are ordered from the least to most effective. Costs and outcomes are shown for a 10-year period and are not discounted.

*Under the alternative scenario, all new DIS were assumed to start on January 1 and all staff who resign were assumed to depart on December 31 of the respective year for calculation purposes, but positions vacated were assumed to take 1 year to fill, i.e., the position vacated at the end of a year was vacant for the entire next year. Also, onboarding and recruitment costs doubled per new hire, from $5,000 to $10,000.

†Outcomes shown are average cases worked per DIS (top half of the table) and average staff persons employed per year (bottom half of the table) The costs shown in the bottom half of the table are the annual costs per average staff person employed.

‡The ICER equals the additional cost per additional unit of outcome for each intervention compared with the next most effective intervention.

§Mentoring shows extended dominance over increased starting pay, meaning its ICER is lower than increased starting pay's ICER. Therefore, increased starting pay would be removed from consideration and the table would be recalculated: Mentoring would produce an increase in staff persons employed of 6 at an ICER of $281,160 per additional staff person employed over the 10-year period compared with the baseline.[29]

ICER indicates incremental cost-effectiveness ratio.

consideration, the cost-effectiveness ratio would be recalculated (Table 3).

DISCUSSION

Optimizing retention strategies is made more challenging by the shifting job market. American workers are moving to new opportunities much faster than before, suggesting that their current employers may be failing them in some way. To increase retention, organizations, including health departments, may need to boost incentives; offer more growth opportunities, pay, and benefit options; and offer flexibility with job schedule and location. Although it is difficult to point to a single factor behind increased turnover, one thing is certain, decreasing retention rates are costing the economy tremendously and could have long-lasting impacts.

In 2020, Americans were spending less time in the same jobs compared with 2010.[18] Although certain generations have a reputation of being chronic job hoppers, data show that tenure is more a matter of age group than generational cohort.[20] Younger employees across generations job hop most often. Although younger generations spent less time with the same organizations, Americans of all ages are moving on to new opportunities at a faster rate. Sex and education may also have implications for average employee tenure.[20]

Although cost-effectiveness is a valuable tool to optimize interventions, it is important to quantify costs and outcomes associated with the alternatives under consideration to maximize its contribution to the decision-making process. The hypothetical example in this analysis illustrates some of the potential difficulties and benefits of cost-effectiveness analysis for employee retention questions, even though the example was generated using non–data-driven numbers for DIS productivity and retention. Because employee mobility and the challenges confronting DIS have increased, prior retention interventions may no longer be optimal. Optimizing retention is thus a continuous process that must change as the work environment changes. Data showing DIS productivity and retention under a variety of conditions are essential to fully assess interventions that seek to improve either or both retention and productivity.

In 2021, the Biden-Harris Administration announced plans to invest $7.4 billion from the American Rescue Act to recruit and train public health workers to respond to the ongoing epidemic and prepare for future public health challenges.[30] However, like other organizations, health departments continue to be challenged to find the most efficient and cost-effective ways to recruit and retain workers in the constantly changing labor market environment. Further complicating matters are the challenges with hiring and recruiting within a state, local, or municipal system, where delays are often exacerbated by hiring freezes, understaffed personnel departments, and the need to justify salary increases by participating in time-intensive labor market comparisons.

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