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The Impact of Local Health Department Consolidation on Non-Local Public Health Revenues: Evidence from Ohio

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Abstract

This study examines the effects of Local Health Department (LHD) consolidations, occurring in Ohio, on the level of revenues generated from non-local sources. Twenty LHD consolidations were identified as being completed during the years between 2001 and 2011. We obtained data on both total and non-local revenues from annual financial fillings required by the State of Ohio and through original data collected in interviews conducted with senior local health officials. Our findings indicate that consolidating health departments experienced a reduction in the percentage of total revenue generated from non-local sources of approximately 41 percent ($p = .002$) in the immediate post-consolidation period, but that this decrease appears to be transitory.

Given that previous literature suggests that higher levels of non-local revenue may be associated with organizations of larger size and scale, the findings from our initial model specification differ from the hypothesized relationship. Sensitivity analyses, conducted on the regression model, appear to indicate that the decrease in these non-locally generated revenues, observed in the first year post consolidation, is no longer statistically significant after year two. While data limitations prevent us from being able to establish the reason for this transitory effect our interviews with Local Health Officials (LHOs) and previous work suggests that this may be due to disruption effect that occurs during the process of implementing LHD consolidations. Conceivably, disruption effects may inhibit, at least in the short-term, LHD staffs from effectively pursuing non-local revenues such as state and federal grants. This pattern is also consistent with disruptions in revenue observed in the nonprofit healthcare sector when introducing significant organizational changes.

Our results raise questions on the conception that consolidations may yield immediate growth in non-local revenues. However, they also suggest that the inhibiting effects of consolidation on external revenue growth may be short lived. Further research is needed to examine the extent to which our findings apply to LHD consolidations in other states and to better understand the longer term effects of LHD consolidation on non-local revenue sources.

Introduction

Local Health Departments (LHDs) play a central role in coordinating the nation's public health system and are the leading direct provider of public health services throughout the United States (US). The Institute of Medicine's landmark 1988 report, *The Future of Public Health*, clearly documented the chronic problem of underfunding faced by all levels of the US public health system.[1] Contemporary economic events have served to compound the financial pressures that continue to plague state and local government budgets, placing even greater strain on the funding of LHDs. In the wake of the recent recession (2008 to 2010), budget cuts and program reductions were widespread among LHDs. In 2010, 49.4% of LHDs reported cuts to their budgets and 54.9% indicated that they had reduced services in at least one programmatic area.[2] By 2013, budget cuts were not as pervasive as in prior years, but fiscal pressures continued to negatively influence LHD operations.[3] Corresponding with these budget reductions, the LHD workforce (in FTEs) decreased by an estimated 12% between 2008 and 2013.[3] As financial and human resources are further stretched, LHDs face hard decisions in order to maintain the scope and quality of the services they provide to their communities.

In an effort to "do more with less", LHDs around the country have turned to a wide array of approaches such as collaborations with network partners and organizational restructurings. These initiatives, intended to restrain costs while maintaining or enhancing capacity, span across a spectrum from loosely integrated approaches such as resource-sharing arrangements to more tightly aligned strategies such as joint provision of services and health department organizational consolidation.[4]

Recent studies support the idea that consolidating LHDs may increase efficiency, improve the effectiveness of public health services, and reduce expenditures. In his examination of LHD financial data from Connecticut, Santerre (2009) suggests that economies of scale achieved through health department consolidation may improve cost effectiveness of service provision. [5] Mays et al. (2006) analyzed public health performance information from multiple states and concluded that consolidation may improve the "performance of essential [public health] services".[6] Hoornbeek and colleagues (2012 and 2015) reported evidence of expenditure reductions, as well as other perceived benefits associated with the consolidation of LHDs both in northeast Ohio and throughout the State of Ohio.[7,8]

One dimension of consolidations, which has not been explored in the public health systems literature, is the impact of LHD consolidation on the generation of non-local revenues. Non-local revenues refer to dollars generated from sources that are not directly tied to a LHD's service area either through its source (i.e. local tax revenues) or through the provision of services (i.e. inspection fees and fees for clinical services). This means that non-local revenues are essentially comprised of Federal and state grant dollars Due to increased capacities associated with organizations of larger size and scale, such as having experienced grant writers on staff, one might expect that LHD consolidation would be associated with increased non-local revenues. However, this issue has not yet been investigated empirically across multiple LHD consolidations.

In this study, we share results from the first systematic statewide study that we are aware of focusing on the impacts of LHD consolidation on non-local revenue generation within an entire

state. Ohio has witnessed at least 20 consolidations of LHDs serving more than 2.6 million Ohioans since 2001. These consolidations, combined with statewide reporting systems documenting LHD finances, provide an opportunity to improve our understanding of the impacts of LHD mergers on post-consolidation revenues.

Our findings reveal results that are different from what one might expect. We find that consolidating health departments in Ohio during the first decade of the twenty-first century experienced a quantitative reduction in non-local revenues post-consolidations. While we cannot report the reasons for this effect with absolute certainty, our interviews with Local Health Officials (LHOs) and prior literature[7] suggests that this effect may be due to disruptions that occur during the process of implementing LHD consolidations. Quantitative analyses showing that the effect of consolidation on non-local revenues appears to disappear after two years, post-consolidation, provides further support for this possible explanation.

Methods

This study uses a mixed method data collection and analysis approach. We use quantitative data retrieved from statewide organizations in Ohio to investigate the hypothesis that LHD consolidation yields an increase in the proportion of total revenue generated through non-local sources. We also interviewed Local Health Officials (LHOs) who were involved in the LHD consolidations that occurred in Ohio between 2001 and 2011 in order to triangulate the influence of consolidation on health department revenues.

Data

Data used in our analyses come from five sources:

1) Annual Financial Reports (AFR) submitted by LHDs to the Ohio Department of Health (ODH), which were used for the outcome measure in the quantitative analyses[9];

2) the Ohio State Auditor's office, which provided city and government financial data[10];

3) the Ohio Municipal League (OML), which collects information on local government structures[11];

4) the US Census Bureau for demographic information which may influence the delivery of public health services[12]; and;

5) interviews with LHOs of recently consolidated Ohio LHDs.[13]

The Kent State University and University of Arkansas for Medical Science Institutional Review Boards reviewed the design of the study and approved it.

Samples

Based on information made available through the ODH and discussions with experienced LHOs in Ohio, we identified 20 LHD consolidations occurring between 2001 and 2010 in Ohio. All 20 consolidations resulted from voluntary agreements between county and city health districts. Of

these 20 consolidations, the necessary financial data to run full quantitative analyses were available for 11 consolidated city-county LHDs.

The control group for our study included county and city LHDs in counties containing city LHDs that had not consolidated from 2001-2010. We limited controls to this group because all of the consolidations within our sample frame involved city and county LHDs. Of the 141 Ohio LHDs that existed in 2001, we excluded 56 county LHDs with no city LHD in the county, and 7 LHDs (5 city, 2 county) with insufficient data available in the AFR. Our final analytic sample totaled 78 city and county LHDs tracked over the nine-year analytical window of the study period. A secondary effect of limiting the study sample to only areas of the state where independent city health departments operate was the exclusion of all rural counties in Ohio. Only areas designated by the U.S. Census Bureau as metropolitan or micropolitan communities had at least one independent city health department operating in the county during the study period.

We also reached out to LHOs involved in all 20 consolidations that occurred between 2001-2011, and conducted interviews with LHO's involved in 17 of the 20 (85%) consolidations to ascertain their perceptions on the motivations for, and impacts of, LHD consolidation. In these interviews, we pursued and obtained information on their perceptions regarding revenue changes associated with the consolidation.

Analytical approach: modeling the relationship between consolidation and LHD expenditures

A significant concern with modelling phenomena such as consolidation is the potential for selection bias to influence the results. Selection bias would result if consolidating LHDs were substantively different from LHDs that did not consolidate in ways that were not captured in the model's control variables. To control for potential selection bias effects, we used a Heckman Two Step regression model. The Heckman model conceptualizes selection bias as arising from the presence of unobserved factor(s) that influence both a choice, and the outcomes resulting from that choice. In this case, the choice is the decision to consolidate, and the outcome is the portion of total revenues generated from non-local sources. Implementing this analytical approach involves running two interrelated regression models. [14, 15]

The first stage model uses a probit function and creates a measure of the propensity of an LHD to consolidate. The variables in this model include factors that are thought to be related to the decision to consolidate. This model's assessment of the probability of consolidation is then used to adjust the estimates produced in the second (linear regression) model to account for the influence of selection bias. To carry out this analytical strategy, we had to develop an understanding of not only factors that influenced the impacts of consolidation on revenues, but also factors that might influence the decision to consolidate. Standard regression diagnostics were applied in determining model selection for both stages of the modeling process.

First Stage Model:

Our analyses operationalize consolidation as a dichotomous variable, which reflects whether or not the LHD consolidated at any point during the study period. Because of a lack of prior research on the factors driving LHD consolidation in Ohio at the time and the practice-based focus of our research, we drew upon insights from LHOs in Ohio and focused on city-related factors and their

LHDs in the first stage model. This focus on city-related factors was verified during our interviews, as 12 of the 17 (71%) LHOs interviewed reported that the cities were involved in initiating conversations regarding consolidation. A more in-depth discussion of the factors associated with decisions to consolidate LHDs in Ohio can be found elsewhere in the literature.[16]

Because of the variable identification processes described above, we focused on the following factors as potential drivers of LHD consolidation:

1. LHD financial condition, as defined by the extent to which reserved funds are used over time;

2. Financial condition of city governments within which city LHDs operated, as defined by whether the city had run a negative general fund balance;

3. A "Strong Mayor" system of city government, a form of government characterized by an elected Mayor who has responsibility for city taxes and expenditures;

4. Total population of the LHD jurisdiction, and;

5. Population density in the LHD's jurisdiction.

Our probit model, which included measures of the above variables, was then used to produce probabilities of consolidation that we incorporated into the second stages of the Heckman models.

Second Stage Model:

In the second stage of the model, our outcome of interest was the post-consolidation change in the percent of LHD revenues generated from non-local sources. The proportion of total revenue attributable to non-local sources was selected as the key outcome variable in this study because it presents a measure of the relative impact of non-local revenues on an LHD's financial position where as changes in per capita or changes in total non-local revenue do not. We conducted sensitivity analyses to ascertain the relative influences of changes in non-local and local revenues on changes in total revenue (the denominator in our outcome measure).

Overall, the data measure longitudinal impacts of LHD consolidation on the portion of total revenue generated from non-local sources. We analyzed these data through a two-stage Heckman regression model with year level fixed effects. We coded consolidating LHDs as '0' for the years prior to consolidation, and as '1' in the year of consolidation and afterwards. This denotes the year of consolidation as the first post-consolidation year. We coded city and county LHDs that did not consolidate at any point during the study period as '0' for every year. In this way, the LHDs coded as '0' in any given year serve as the control group against which we compare the jurisdictions that had consolidated. The unit of analysis is the LHD service area, which is served by two LHDs prior to consolidation and one LHD after consolidation.

The control variables used include proxies for community need for public health services, including total size of the population, population density, proportion of African-American and Hispanic residents in the community, and poverty rate. Dichotomous variables were used to control for influences associated with an LHD located in either a metropolitan or micropolitan area, and

whether it was a city or county LHD. Additionally, we incorporated dummy variables into the model to address trends associated with influence of time (the tendency of LHDs to economize on resources over time, for example).

Collecting and Analyzing Interview Data

For the interview portion of our study, we conducted telephone interviews with LHOs involved in 17 of the 20 consolidations. Using an interview script developed with input from public health practitioners in Ohio, we interviewed senior-level LHOs: Health Commissioners, former Health Commissioners, and LHD Administrators. By relying on guidance from the public health practitioners, we were able to focus on the concerns and experiences of LHOs regarding the motivation for consolidations as well as their impact on revenues.

We used a structured questionnaire format for the interviews and took notes. Those interviewed had the opportunity to comment on our notes in typed form. We then summarized the data by question. While many of the responses were quantifiable, we received and recorded other insights and ideas in narrative form presented in this article.

Results

Below we present descriptive findings comparing populations (Table 1) and pre and post consolidation revenues for consolidating and non-consolidating LHDs in the year before and the year after consolidation (Table 2). We then present the results of our multivariate Heckman models and information from our interviews with LHOs.

Descriptive Findings on Revenues in Consolidating and Non-Consolidating LHD

Table 1 presents a comparison of the population sizes of the different jurisdictions that chose to consolidate versus those that did not consolidate during the study period. These data indicate that consolidations were more likely to occur between small cities and larger counties.

Table 1. Comparing Ohio Jurisdictions - Consolidating and Non-consolidating LHDs

Type of Health Jurisdiction and Health Department	Mean Population	Median Population	Minimum Population	Maximum Population	Percent "Small" Jurisdiction
City					"Small" = 20,000 or less
Consolidating (n=17)	30,583	11,523	5,648	216,695	65%
Non-consolidating (n=36)	67,155	20,997	6,664	704,367	41%
County					"Small" = 100,000 or less
Consolidating (n=14)	205,579	111,305	27,863	886,980	50%
Non-consolidating (n=11)	123,993	75,235	25,571	528,357	66%

Table 2 presents mean per capita total and non-local revenues as well as the average percent of total revenue generated from non-local sources among consolidating and non-consolidating LHDs between 2001-2011, based on a comparison of revenue generation levels one year before and one year after consolidation. Descriptive results show that unadjusted per capita total revenues increased among consolidating LHDs while non-consolidating health departments saw no appreciable change. By contrast, both per capita non-local revenues and the percentage of total revenues generated from non-local sources decreased. Again, non-consolidating LHDs experienced no substantive change in non-local revenues.

Table 2. Pre-and Post-Consolidation Mean Per Capita LHD Revenues – One Year Before & One Year After Consolidation.

	Per Capita $ Total Revenues		Per Capita $ Non-local Revenues		% Non-local of Total Revenues	
	Consolidating LHDs[a]	Non-consolidating LHDs[b]	Consolidating LHDs[a]	Non-consolidating LHDs[b]	Consolidating LHDs[a]	Non-consolidating LHDs[b]
Pre-consolidation year	31.10	55.89	8.70	12.08	21.86	17.77
Post-consolidation year	33.14	55.83	7.73	12.09	18.91	17.80
Change pre-post consolidation	2.04	-0.06	-0.97	0.01	-2.95	0.03

Source: Annual Financial Reports (AFR) of Ohio Local Health Departments

[a] N = 11LHD consolidations between 2001-2011 for which 1 year of pre and post consolidation data were available

[b] N = 56 LHDs in 22 counties with more than 1 LHD (ie. Counties with at least 1 City LHD)

Multivariate Findings on Revenues

Results from the model presented in Table 3 indicate that consolidation is associated with a statistically significant 41.7 percent *decrease* in the percent of revenues generated through non-local sources in the year immediately following consolidation. Population density was also found to exert a small negative influence on the portion of non-local revenue obtained by a health department, while the population total is associated with a very small increase in that percent.

Table 3.
Heckman Regression Results:
Percent Non-Local Revenue, All Years Post-Consolidation (controlling for 1st stage selection)

Variable	Coefficient	P > [z]	95% Confidence Interval	
Dependent variable: Percent of total revenue from non-local sources				
Post Consolidation	-0.417	0.002	-0.682	-0.151
*Defined as 1 for the year of consolidation onward				
Poverty %	0.092	0.201	-0.026	0.159
Minority %	-0.002	0.971	-0.076	0.073
Metropolitan Service Area	0.051	0.652	-0.170	0.272
Micropolitan service area (reference)	--	--	--	
Population Total (log)	4.17e-06	0.000	2.88e-06	5.47e-06
Population Density	-0.0009	0.000	-0.001	-0.0006
Year 2000	-0.0087	0.892	-0.133	0.116
Year 2001	0.019	0.702	-0.080	0.119
Year 2002	0.024	0.576	-0.133	0.116
Year 2003	0.057	0.082	-0.080	0.119
Year 2004	0.006	0.910	-0.061	0.110
Year 2005	0.064	0.759	-0.007	0.120
Year 2006	0.033	0.834	-0.103	0.116
Year 2007	0.056	0.850	-0.1092	0.079
Year 2008	-0.015	0.659	-0.074	0.092
Year 2009	0.009	0.832	-0.042	0.099
Year 2010	0.004	0.879	-0.108	0.080
Year 2011 (reference)	--	--	--	
N	577	--	--	
Lambda (Mills Ratio)	0.310	0.050	0.001	0.621
Wald X^2	58.23	0.0001	--	

* Population is natural log transformed to improve model fit. First stage (results not shown) variables included whether the city government was run by a strong or weak mayor system, the presence of a city government deficit, the LHD's financial condition, the total population of the service area, and the population density of the service area. The mayoral system was dichotomized based on whether or not a municipality was classified by OML as a "Strong Mayor system ("Strong Mayor" local government systems have an elected mayor who is empowered to perform the executive functions of government). The city government deficit variable was dichotomized based on whether the city had a deficit any year during the study period. The LHD financial condition variable was defined as the weighted propensity of the local health department to spend reserve funds. Weighting was operationalized by multiplying the health department's proportion of years of reserve spending by the proportion of years the health department represented of the total number of years for all health departments in the study sample.

The statistically significant *negative* finding regarding the impact of consolidation on the percent of total revenue generated from non-local sources is somewhat surprising. Conceptually, larger health departments, formed through consolidation, may be in a better position to leverage resources, such as experienced grant writing staff, to capture greater amounts of non-local sources of funding.

One explanation may lie in the turbulence that often follows consolidation. Hoornbeek, et al (2012) found at least a temporary disruptive effect in the operations of a health department that has recently consolidated.[7] Part of the decrease in the percent of non-local revenue may be an artifact of work process disruptions created when health department staff are involved in dealing with consolidation issues and are therefore not fully pursuing their normal functions that include grant writing and other activities that generate non-local revenue.

We conducted two sets of additional statistical tests of AFR data to investigate this explanation. First, we focused solely on the first two years post-consolidation, and found an even larger negative effect on the percentage of non-local revenues than when considering all years post-consolidation. The results of this alternative model specification are displayed in Table 4. The statistically significant 47.7 percent decrease in the percent of non-local revenue is notably higher than the effect observed in the original model. This suggests that consolidation exerts a stronger influence on the percent of non-local revenue in the years immediately following the consolidation event.

Table 4.
Heckman Regression Results:
Percent Non-Local Revenue, Two Years Post-Consolidation (controlling for 1st stage selection)

Variable	Coefficient	P > [z]	95% Confidence Interval	
Dependent variable: Percent of total revenue from non-local sources				
Post Consolidation	-0.477	0.000	-0.7212	-0.2332
*Defined as 1 for year of consolidation and 1 year after				
Poverty %	0.092	0.201	-0.026	0.159
Minority %	-0.002	0.971	-0.076	0.073
Metropolitan Service Area	0.087	0.475	-0.1511	0.3242
Micropolitan service area (reference)	--	--	--	
Population Total (log)	3.298e-06	0.892	3.01e-06	4.94e-06
Population Density	-0.001	0.702	-0.0013	-0.0008
Year 2000	-0.0087	0.892	-0.133	0.116
Year 2001	0.019	0.702	-0.080	0.119
Year 2002	-0.008	0.892	-0.133	0.116
Year 2003	0.019	0.702	-0.080	0.119
Year 2004	0.024	0.576	-0.061	0.110
Year 2005	0.057	0.082	-0.007	0.120
Year 2006	0.006	0.910	-0.103	0.116
Year 2007	0.064	0.759	-0.1092	0.079
Year 2008	0.033	0.834	-0.074	0.092
Year 2009	0.056	0.850	-0.042	0.099
Year 2010	-0.015	0.659	-0.108	0.080
Year 2011 (reference)	--	--	--	
N	508	--	--	
Lambda (Mills Ratio)	0.4785	0.010	0.1164	0.8407
Wald X^2	34.81	0.0001	--	

* Population is natural log transformed to improve model fit. First stage (results not shown) variables included whether the city government was run by a strong or weak mayor system, the presence of a city government deficit, the LHD's financial condition, the total population of the service area, and the population density of the service area. The mayoral system was dichotomized based on whether or not a municipality was classified by OML as a "Strong Mayor system ("Strong Mayor" local government systems have an elected mayor who is empowered to perform the executive functions of government). The city government deficit variable was dichotomized based on whether the city had a deficit any year during the study period. The LHD financial condition variable was defined as the weighted propensity of the local health department to spend reserve funds. Weighting was operationalized by multiplying the health department's proportion of years of reserve spending by the proportion of years the health department represented of the total number of years for all health departments in the study sample.

To further examine the plausibility of a "disruption effect" explanation for the decrease in percent of non-local revenues, we re-estimated the model using a post consolidation period that was shifted to begin two years after the consolidation occurred. This caused 3 of the 11 (27%) included consolidations to drop from the analysis, as they had occurred in 2010, leaving only two years of post-consolidation data. There are statistical power concerns with changes in the specification of a model that result in a reduction in sample size, as was the case here. Nevertheless, findings from this re-specified model are presented in Table 5 and provide further support for the idea that transition disruptions may account for at least some of the post consolidation reduction in the percentage of the revenues accruing from non-local revenue sources reported above.

Table 5.
Heckman Regression Results:
Percent Non-Local Revenue, Delayed Post-Consolidation (controlling for 1st stage selection)

Variable	Coefficient	P > [z]	95% Confidence Interval	
Dependent variable: Percent of total revenue from non-local sources				
Post Consolidation *Defined as 1 in year 2 after consolidation	-0.019	0.878	-0.2650	0.2265
Poverty %	0.092	0.201	-0.026	0.159
Minority %	-0.002	0.971	-0.076	0.073
Metropolitan Service Area	0.1042	0.333	-0.1067	0.3150
Micropolitan service area (reference)	--	--	--	
Population Total (log)	4.01e-06	0.892	2.93e-06	5.08e-06
Population Density	-.0013	0.702	-0.0016	-0.00096
Year 2000	-0.0087	0.892	-0.133	0.116
Year 2001	0.019	0.702	-0.080	0.119
Year 2002	-0.0087	0.892	-0.133	0.116
Year 2003	0.019	0.702	-0.080	0.119
Year 2004	0.024	0.576	-0.061	0.110
Year 2005	0.057	0.082	-0.007	0.120
Year 2006	0.006	0.910	-0.103	0.116
Year 2007	0.064	0.759	-0.1092	0.079
Year 2008	0.033	0.834	-0.074	0.092
Year 2009	0.056	0.850	-0.042	0.099
Year 2010	-0.015	0.659	-0.108	0.080
Year 2011 (reference)	--	--	--	
N	553	--	--	
Lambda (Mills Ratio)	0.310	0.050	0.001	0.621
Wald X^2	57.32	0.0001	--	

* Population is natural log transformed to improve model fit. First stage (results not shown) variables included whether the city government was run by a strong or weak mayor system, the presence of a city government deficit, the LHD's financial condition, the total population of the service area, and the population density of the service area. The mayoral system was dichotomized based on whether or not a municipality was classified by OML as a "Strong Mayor system ("Strong Mayor" local government systems have an elected mayor who is empowered to perform the executive functions of government The city government deficit variable was dichotomized based on whether the city had a deficit any year during the study period. The LHD financial condition variable was defined as the weighted propensity of the local health department to spend reserve funds. Weighting was operationalized by multiplying the health department's proportion of years of reserve spending by the proportion of years the health department represented of the total number of years for all health departments in the study sample.

When we shifted the post consolidation period to begin two years after the consolidation occurred, the coefficient for pre-post differences in the percent of non-local revenue, while still negative in sign, became smaller and statistically insignificant. The shift from a significant negative association in the previous two models to a small and insignificant coefficient estimate in this model supports the concept

that consolidation itself may disrupt the short-term ability of health departments to pursue non-local revenues, but as time passes this influence appears to diminish or disappear.

Sensitivity Analyses for Percent Non-local Revenue Specification

To assess the potential for changes in both the numerator and the denominator of our primary outcome measure (percent non-local revenue) to influence the value of our dependent variable, we ran three additional Heckman models for each of the three consolidation windows (presented in Tables 3 thru 5). These models examined pre and post consolidation changes for three new outcome measures; per capita total revenue, per capita non-local revenue and per capita local revenue. The same covariates that were used in the previous models were retained in these sensitivity analyses.

Results of our sensitivity analyses consistently indicated that when controlling for other factors in the model, there were no significant changes in per capita total revenues. Small but significant increases were observed in per capita local revenue for the one year and delayed consolidation windows while results for the two-year consolidation window were positive but not statistically significant. Changes in per capita non-local revenue were consistently statistically significant and of substantially greater magnitude than the increases seen in per capita local revenue. Taken together, the results of these sensitivity analyses appear to indicate that while opposing changes are occurring in the post consolidation non-local and local revenues, the changes in our primary outcome variable (percent non-local revenue) are to a substantial degree being driven by changes in non-local revenue. We would however recommend that any interpretation of the overall magnitude of the decrease in the percent non-local revenue be done with caution.

LHO Perceptions of the Impacts of Consolidation

We also asked our sample of senior county health officials about revenue flows after their consolidation. Table 6 summarizes what we learned regarding the perceptions of those we interviewed.

Table 6.
Perceptions of Senior Local Health Officials of Post Consolidation Changes in Revenues.

	Perceived Revenue Change Within One Year after Consolidation: Proportions of Respondents (%)		
Type of Revenue	Revenue Increased	Revenue *did not* Increase	I don't know/No Response
External Grant Revenue	3/17 (18%)	11/17 (65%)	3/17 (18%)
Program Revenue	6/17 (35%)	9/17 (53%)	3/17 (18%)
Overall Revenue	6/17 (35%)	8/17 (47%)	3/17 (18%)

Of 17 LHO's interviewed, 6 (35%) indicated that total revenues flowing into the consolidated public health system increased in the year following consolidation, and 6 (35%) perceived that their program revenues increased in the year after consolidation. However, only 3 (18%) indicated that grant revenues increased in the year following consolidation. These results lend further evidence suggesting that non-local revenues are – at a minimum -- less positively influenced by consolidation than other forms of LHD revenues in the year immediately following consolidation.

The above findings appear consistent with the statistical results above, as less than 20% of the LHO's we interviewed asserted increases in grant funding in the year following consolidation. Some of those we interviewed also pointed out that implementing the process of consolidation was disruptive, and one post-

consolidation assessment of two consolidations in Summit County, Ohio provides rather detailed documentation regarding some of these disruptive effects[7].

Discussion

In recent years, discussions about consolidating LHDs have become more common, as researchers have documented potentially beneficial effects of consolidation associated with economies of scale[17], opportunities for enhanced efficiency[5] and reduced expenditures[8], and potential public health service improvements[6]. In some areas of the country, like Ohio, we appear to be seeing trends toward taking advantage of these kinds of benefits through LHD consolidation and other forms of shared services arrangements. It is in this context of growing interest in LHD consolidation that our study results are of interest.

While it is theoretically reasonable to hypothesize that increased organizational size and scale is linked to increases in the generation of non-local revenues, our results indicate that in the context of LHD consolidations, the relationship may be more complex. Contrary to our expectations, consolidation appears as though it may yield *reductions*, rather than increases, in the percentage of total revenues generated from non-local sources to local public health systems -- at least within the immediate period after consolidation. However, our findings also suggest that this decrease in non-local revenue may be a temporary fluctuation, possibly induced by disruptive effects associated with the transition to the newly consolidated health department structure. These findings are also supported by our interviews, which suggest that a lack of increase in external revenue is relatively common in the time period immediately following consolidation, when organizational transitions hold the potential to disrupt normal external revenue generating operations. These findings are of use because they expand upon our existing knowledge base concerning the impacts of LHD consolidation, while also providing helpful insight to those involved in LHD consolidations and those contemplating them.

As with all studies, our findings must be interpreted with a recognition of methodological and data limitations. First, while we have included data on a number of key variables in our models, data limitations prevented inclusion of all potentially useful variables in our quantitative analyses. Second, while the longitudinal design we use is advantageous in many ways, the data that were available to us do not cover time periods that are long enough to address impacts of consolidation on longer term external revenue generation. Third, our sample size was limited both by the small number of consolidations that occurred in the time period studied, and by the availability of data on the consolidating LHDs. This limits the power of the study to detect impacts associated with consolidation. Fourth, it is possible that the LHDs for which we were unable to obtain AFR data were substantively different from the LHDs included in our analysis. Considering community level factors such as total population, there do not appear to be striking differences between groups, but they may have differed on organizational or other characteristics. Fifth, while the Heckman Two-Step Model is a well-known approach for dealing with omitted variable situations that result in potential selection bias, it does not address all endogeneity issues that could potentially be present with these analyses. Future work should involve enhancing the analytical methods used here, possibly introducing instrumental variables and/or more sophisticated modeling approaches. In addition, while transitional disruptions associated with LHD consolidations appear to be a likely reason for our empirical findings, further research is appropriate to further explore this explanation. Finally, while we believe that our results provide a useful picture of the impacts of LHD consolidations in Ohio on external revenue generation during the time period covered by this study, the findings may not generalize to other states. Variations exists in the structure of LHDs across states, so conducting similar research in other states is advisable. In general, however, the combination of small city LHDs and larger county LHDs in our Ohio sample suggests that the results may be most applicable to cases where smaller LHDs combine with larger ones.

Conclusion

In spite of the limitations outlined above, the results presented here suggest that LHD consolidation – while potentially beneficial in many respects – is not a panacea in all respects. At least some LHD's going through this process appear likely to lose external revenue in the short term, even as they may begin to benefit from cost efficiencies and service improvements. At the same time, however, the findings presented are not inconsistent with the idea that consolidated LHDs may still provide *longer term* advantages with respect to external revenue generation.

What these and other results appear to suggest more conclusively, is that when existing LHDs experience consolidations, the results are likely to be multi-faceted and complex, with impacts that may vary in their desirability across differing kinds of effects as well as over time. It is our hope that this work and the findings presented yield greater understanding of at least some of these financial and economic complexities, so they can be accounted for in decision-making relating to consolidation and managed effectively when communities pursue this kind of effort to enhance their public health systems and services.

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Human participation protection

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Key words

Practice Based Research Network (PBRN), local health department consolidation, health department revenues, shared services, collaboration, and local health department mergers.

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