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FINAL REPORT

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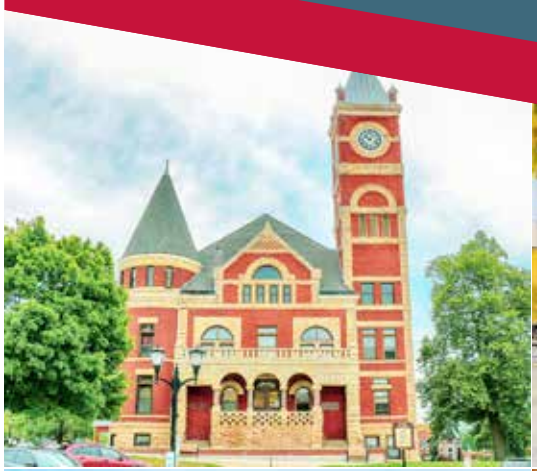
Cost-benefit analysis of 9-1-1 call center consolidation

PUBLIC AFFAIRS 881: BENEFIT-COST ANALYSIS



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Executive Summary

This cost-benefit analysis assesses the feasibility of 9-1-1 call center consolidation in Green County, the City of Monroe, and the City of Brodhead by estimating anticipated fiscal impacts and non-monetized costs and benefits. Based on our estimates of net benefits of four policy alternatives, we recommend three-part consolidation with minimum staffing. This alternative has $3.2 million in expected net benefits over ten years—the largest net benefits among the four alternatives. Outside of consolidation, we recommend that the agencies update their GIS data and standardize the dispatch workflow to improve overall efficiency.

Local governments often provide 9-1-1 emergency dispatch services for their communities, which gives local law enforcement agencies autonomy in managing their own emergencies and in addressing their unique needs. However, resource constraints and increasing equipment costs limit agencies' ability to serve their communities. A growing trend throughout the country is consolidation of 9-1-1 call centers. Consolidating 9-1-1 call centers can increase service capacity while reducing costs because resources are utilized more efficiently. However, 9-1-1 call center consolidation poses challenges including startup costs and loss of local knowledge.

Currently, Green County and the Cities of Monroe and Brodhead, located within the County, each operate their own 9-1-1 call centers. The clients' primary motivation for this project is to determine whether 9-1-1 dispatch consolidation is financially feasible. We consider four consolidation alternatives: two-part consolidation and three-part consolidation, each with minimum and maximum staffing options. Under two-part consolidation, the Green County and Monroe call centers would consolidate into a single operation located in the Green County Sheriff's Office building, connected to the jail. In this alternative, minimum staffing would

require 10 full-time dispatchers and maximum staffing would require 12 full-time dispatchers. Under three-part consolidation, all three call centers would consolidate into a single operation. In this alternative, minimum staffing would require 12 full-time dispatchers and maximum staffing would require 16 full-time dispatchers. Three-part consolidation with maximum staffing would require renting a new facility due to space constraints at the three existing facilities. Under all four consolidation alternatives, the existing Monroe call center would remain as a backup in case of an equipment failure or evacuation.

We consider three distinct categories of costs: one-time costs, recurring costs, and avoided costs. One-time costs are incurred for moving and retraining. Recurring costs are staff compensation costs and the cost of a new space. Avoided costs are costs of equipment (consoles and phone system upgrades) and the value of released space. We also consider two distinct categories of non-monetized benefits: positive non-monetized benefits and negative non-monetized benefits. Unlike costs, which are measurable using existing agency budgets and market prices, these benefits are uncertain and difficult to monetize. Positive non-monetized benefits are reduced dispatch processing time and consistency of operations. Negative non-monetized benefits are local knowledge of Brodhead and the Brodhead Elderly Emergency Monitoring System program.

We use a Monte Carlo simulation to quantitatively account for uncertainty under each consolidation alternative. A Monte Carlo simulation is a statistical model that calculates net benefits in scenarios with uncertainty about estimated parameters by drawing from specified distributions for each parameter. We projected values over a 10-year period and evaluated net benefits using a social discount rate of 3.5 percent. According to this simulation, the mean net benefits for two-part consolidation with minimum staffing are $1.7 million; $674,000 for two-

part consolidation with maximum staffing; $3.2 million for three-part consolidation with minimum staffing; and three-part consolidation with maximum staffing would have a mean loss of $73,000 but would allow Brodhead to retain the popular Brodhead Elderly Emergency Monitoring System.

Introduction

As the link between residents and first responders, the 9-1-1 call centers in Green County, the City of Monroe, and the City of Brodhead serve a vital public safety function: the dispatchers in these centers serve as the first line of communication for emergencies, and work closely with law enforcement, fire, and emergency medical services (EMS) to ensure callers' safety 24 hours per day.[1] The three call centers have varying capacities, staffing structures, and levels of service, but they share a history and culture of cooperation.

The population of Green County, including the City of Monroe and City of Brodhead, is marginally growing with an increasing number of elderly individuals living within the community.[2] See Appendix 2 for details. This trend suggests that call volume in the county and cities could increase in coming years. Consequently, maintaining capacity to support growing call volume is a potential challenge for the call centers. One option to increase capacity while controlling costs is to consolidate the call centers.[3]

Our clients' primary motivation for this project is to determine whether 9-1-1 dispatch consolidation is fiscally feasible. The clients are also interested in understanding how to best improve the efficiency of operating 9-1-1 services. However, each of the call centers have their reservations regarding the potential for consolidation and its implementation. Green County is concerned that full consolidation would result in increased costs for the Sheriff's Office after absorbing the smaller city call centers. In addition, there are concerns in Monroe and Brodhead about integrating into a larger operation and still successfully serving their smaller, tight-knit

[1] "Green County Sheriff's Office 2017 Annual Report" (Monroe, 2018).
[2] United States Census Bureau, "Census.Gov," accessed December 2, 2018, https://www.census.gov/.
[3] Andrew Sancton, "Reducing Costs by Consolidating Municipalities: New Brunswick, Nova Scotia and Ontario," *Canadian Public Administration* 39, no. 3 (1996): 267–89.

communities. Despite these concerns, the clients are interested in a cost-benefit analysis of policy alternatives that assess the fiscal and social net benefits of consolidation.

This report seeks to produce a cost-benefit analysis of a possible 9-1-1 dispatch consolidation between Green County, Monroe, and Brodhead. We provide the rationale for the study, four consolidation alternatives, and the anticipated costs and benefits of consolidation. We review the methodology for forecasting the net social benefits of the policy alternatives and explain the technique utilized for the sensitivity analysis. To conclude, we provide a recommendation to our clients based on the analysis.

Study Rationale

As population growth and increasing equipment costs outpace municipal budgets in many parts of the country, 9-1-1 call centers face greater responsibilities and costs often with less financial support. In order to minimize the impact of budgetary constraints on agencies, some municipalities have consolidated their call centers.[4]

Emergency dispatch service is a type of public good called a "common-pool resource," which means that it is both rivalrous and non-excludable and therefore easily congested.[5] See Appendix 1 for defined terms. The service is rivalrous because it is consumed independently—each dispatcher can only serve one caller at a time. The service is non-excludable because it is provided to anyone who requires the service—dispatchers cannot turn away any caller. The service is easily congested because the service becomes unavailable once all dispatchers are occupied, resulting in a queue of callers. Because they provide a common-pool resource, 9-1-1

[4] Roger Schroepfer and Joel Dunning, "Strategies to Successfully Navigate 911 Consolidation," 2018, www.woldae.com.
[5] National Research Council, *The Drama of the Commons* (Washington, DC: The National Academies Press, 2002).

call centers must maintain sufficient capacity to avoid queueing during periods of high call volume, even though the full capacity of the service is rarely utilized.[6]

Sufficient staffing is essential for timely emergency response. Call centers must have the necessary equipment and personnel in order to deal with sudden and unexpected increases in demand—for example, a major event or catastrophe in the community. Call centers operating below necessary service capacity run the dangerous risk of increasing response times, which can cost lives. Our clients each expressed concern that their centers might have insufficient capacity due to understaffing.[7]

Consolidating 9-1-1 call centers can reduce the number of idle dispatchers during periods of low call volume, while maintaining the number of available dispatchers needed to avoid queueing during periods of high call volume. First, consolidation allows jurisdictions to share their staff, equipment, and other resources, allowing more efficient utilization of resources. Economies of scale can reduce administrative costs, disperse expenses over additional revenue streams, and reduce or eliminate inefficiencies in overlapping services and redundant capital projects.[8] Additionally, given an investment in high-quality equipment, facilities, and staff, the level and quality of service provided by a consolidated call center should exceed those currently being supplied by communities. Consolidating 9-1-1 call centers can therefore avoid costs while improving quality of service.[9]

Despite its potential benefits, call center consolidation presents specific challenges: startup costs, conflicts of interests, and loss of local knowledge. First, the startup costs of

[6] Erwin Chen et al., "Cost-Benefit Analysis of EMS Services Consolidation in Dane and Jefferson Counties," 2017.
[7] Client meeting, October 5, 2018.
[8] Andrew Sancton, "Reducing Costs by Consolidating Municipalities: New Brunswick, Nova Scotia and Ontario," *Canadian Public Administration* 39, no. 3 (1996): 267–89.
[9] Daila Shimek et al., "Feasibility Study of Consolidating Public Safety Answering Points in South Euclid, Beachwood, Euclid, Shaker Heights, and University Heights, Ohio," 2013.

consolidation (moving and retraining) are often significant.[10] Second, because each law enforcement agency has its own budget, enforcement capabilities, and equipment, consolidation can result in conflicts of interest or increased communication costs.[11] When governments consolidate a public good from multiple, overlapping jurisdictions, conflicts of interest can lead to the misallocation of the public good or excessive public spending to compensate for imperfect allocation. An analysis of legislative decision-making in a centralized government found that spillover effects and differences in preferences for public spending had the greatest impact on a centralized government's ability to distribute public goods.[12] Third, dispatchers in consolidated centers might not be able to achieve the level of local knowledge needed to meet the needs of local residents living in lager geographic areas, resulting in allocative inefficiencies.[13]

Previous analyses of consolidating 9-1-1 call centers in Midwestern counties have found positive net benefits. A cost-benefit analysis of consolidating three call centers in Milwaukee County found that by consolidating the municipalities could reduce their combined number of dispatch staff and, therefore, annual operating expenditures by approximately 34 percent; and avoid the cost of replacing two or three dispatch consoles within five years—an estimated cost savings of about half a million dollars.[14] A feasibility study of further consolidating public safety answering points within a centralized Milwaukee County command center predicted net benefits.[15] A feasibility study of consolidating public safety answering points in Ohio found that

[10] Tim W. Cannon, "Consolidation of Law Enforcement Dispatch Operations in Harris County Texas," *The Bill Blackwood Law Enforcement Management Institute of Texas*, 2013.
[11] David D. Woods and Richard I. Cook, "Perspectives on Human Error: Hindsight Bias and Local Rationality," in *Handbook of Applied Cognitive Psychology* (Chichester: Wiley, 1999), 141–71.
[12] Timothy Besley and Stephen Coate, "Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Approach," *Journal of Public Economics* 87, no. 12 (2003): 2611–37.
[13] Benedict S. Jimenez and Rebecca Hendrick, "Is Government Consolidation the Answer?," *State and Local Government Review* 42, no. 3 (2010): 258–70.
[14] Davida Amenta and Rob Henken, "Modeling a Consolidated Dispatch Center for Milwaukee County's South Shore," *Public Policy Forum*, 2012.
[15] Rob Henken, "Get Connected: An Analysis of Public Safety 911 Call Taking, Dispatch, and Command Center

consolidation would improve services and decrease costs between $117,500 and $396,000.[16] A feasibility study of call centers in Illinois found positive net benefits.[17]

Yet, consolidation of public services does not guarantee net benefits.[18] Previous efforts to consolidate local government services in Wisconsin, including dispatch services, have had mixed success. A study of Wisconsin local service consolidation projects between 1987 and 2009 used a longitudinal analysis to find that overall expenditures increased in some circumstances and expenditure reductions were only associated with capacity management.[19] While our clients recognize the potential cost savings and service quality improvements associated with consolidation, a recommendation of whether or not to consolidate requires strong and objective analysis that clearly assesses the costs and benefits of consolidation.[20] This report provides greater certainty regarding estimated impacts of the 9-1-1 call center consolidation and considers key issues of concern.

Operations under Current Policy

The Green County Sheriff's Department, Monroe Police Department, and Brodhead Police Department each operate its own 9-1-1 call center. The Green County call center provides 24-hour coverage for most of Green County and parts of Lafayette County; the Monroe call

Services in Milwaukee County," 2016.

[16] Dalia Shimek, Kyle Johnson, and E.L. Kramer, "Feasibility Study of Consolidating Public Safety Answering Points in Berea, Broadview Heights, Brook Park, North Royalton, Olmsted Falls, Seven Hills, and Strongsville, Ohio" (Cleveland, 2014).Shimek and Johnson, 2014.

[17] Matrix Consulting Group, "Report on the Consolidated 911 / Dispatch Feasibility Study Cities of Highland Park, Lake Bluff and Lake Forest, Illinois," 2013.

[18] Mark Holzer and John Fry, *Shared Services and Municipal Consolidation: A Critical Analysis* (Public Technology Institute, 2011).

[19] Craig S. Maher, "A Longitudinal Analysis of the Effects of Service Consolidation on Local Government Expenditures," *Public Administration Quarterly* 55, no. 1 (2015): 393–425.

[20] Schroepfer and Dunning, "Strategies to Successfully Navigate 911 Consolidation."

center provides 24-hour coverage for the City of Monroe; and the Brodhead call center provides 24-hour coverage for the City of Brodhead. See Appendix 5 for details on current compensation.

The Green County call center is located within the jail at the Green County Sheriff's Office in downtown Monroe. This call center dispatches police, fire, and EMS, and works with 26 different agencies throughout the county. As shown in Table 1, six dispatcher full-time equivalents (FTEs), including a primary supervisor, staff this call center on rotation. Dispatchers in this call center also have non-call related duties including entering warrant information.[21] The Green County call center took 17,527 calls in 2017.[22] See Appendix 4 for details.

The Monroe call center is located within the City of Monroe Police Department, also in downtown Monroe. This call center dispatches only police, not fire or EMS. As shown in Table 1, six dispatcher FTEs staff this call center on rotation. Beyond dispatch, these staff are charged with administrative duties including management of the payment of parking tickets, license plate renewals, and taking complaints from walk-in visitors.[23] Dispatchers have varying lengths of service (from 2 to 23 years).[24] The Monroe call center took 9,925 calls in 2017.[25] See Appendix 4 for details.

The Brodhead call center is located within the City of Brodhead Police Department. This call center dispatches police, fire, and EMS. As shown in Table 1, four dispatcher FTEs, including a supervisor, and three part-time dispatchers staff this call center on rotation. Beyond dispatch, these staff provide services including the collection of municipal court fees and oversight of a prescription drug disposal bin—both of which must be provided after business

[21] Client meeting, November 9, 2018.
[22] "Green County Sheriff's Office 2017 Annual Report."
[23] Client meeting, October 5, 2018.
[24] Email from Chief Kelley, December 3, 2018.
[25] "Green County Sheriff's Office 2017 Annual Report."

hours under law.[26] Dispatchers have varying lengths of service (from 1 to 26 years).[27] The Brodhead call center took 7,317 calls in 2017.[28] See Appendix 4 for details.

Table 1: Call Center Staffing, Call Volume, and Size

Call center	FTEs, including supervisors	Part-time dispatch staff	Calls taken in 2017	Size (sq. ft.)
Green County	6	0	17,527	364
City of Monroe	6	0	9,925	420
City of Brodhead	4	3	7,317	256

Sources: Information provided by Sheriff Rohloff, Chief Kelley, and Chief Hughes; Sheriff's Office 2017 Annual Report, provided by Sheriff Rohloff.

The Brodhead call center also runs the Brodhead Elderly Emergency Monitoring System (BEEMS), a program that serves aging and disabled residents of Brodhead at a subsidized rate of $15 per month.[29] Members of the program connect to dispatchers in Brodhead by pushing an alert button (either on a pendant or a water-resistant wristband).[30] The dispatcher sees the program member's name and address before picking up the call. BEEMS provides an outside key box installed so that community service officers (CSOs) and other officials can enter the caller's home, and collect "in case of emergency" contacts.[31] BEEMS also provides a monthly check-in visit from a CSO. During their visits, the CSOs check for safety hazards in the members' homes, replace batteries in fire alarms, and talk with the members to determine their state of well-being.[32] This popular program helps its members live at home independently longer and avoid

[26] Client meeting, November 9, 2018.
[27] Email from Chief Hughes, December 3, 2018.
[28] "Green County Sheriff's Office 2017 Annual Report."
[29] Client meeting, November 9, 2018.
[30] "BEEMS Program," accessed February 12, 2018, http://www.cityofbrodheadwi.us/departments/police_department/beems_program.php.
[31] Ibid.
[32] Ibid.

moving into a retirement or assisted living community. Last year, the program accounted for 410 calls to the Brodhead call center; 192 of these calls were made intentionally and 218 of these calls were made unintentionally.[33] The BEEMS program meets accreditation requirements that qualify the Brodhead Police Department for grant funding, which contributes to CSO wages. CSO duties not related to BEEMS include part-time dispatching and providing security for city events.[34]

The flow of calls varies among the three centers. Calls placed in most parts of Green County, including the City of Monroe, are routed to the Green County call center.[35] Calls originating from Monroe are received by the Green County call center; the county dispatches fire and EMS, if needed, and then transfers the call to the Monroe call center which dispatches law enforcement.[36] Calls from Brodhead are generally routed directly to the Brodhead call center (as long as they are placed from home phones with the local 897 exchange, or from cellular phones in or near Brodhead).[37] The three agencies use the same dispatch software and related database.[38] This enables dispatchers and law enforcement officers to share information about residents and individuals traveling across jurisdictions. Additionally, the call centers serve as backups for one another: if one call center loses power, needs to shut down, or experiences an unmanageable volume of calls, that agency's phone traffic is redirected to one of the other call centers.

Consolidation Alternatives

This report considers four consolidation alternatives: two-part consolidation with minimum staffing, two-part consolidation with maximum staffing, three-part consolidation with

[33] "BEEMS Calls for Service" (Brodhead, 2018).
[34] Client meeting, November 9, 2018.
[35] Client meeting, October 5, 2018.
[36] Ibid.
[37] Ibid.
[38] Ibid.

minimum staffing, and three-part consolidation with maximum staffing. In each alternative, equipment from the current Monroe call center would remain in the Monroe Police Department and that space would serve as backup in the event of equipment failure or evacuation of the consolidated call center.

Two-Part vs. Three-Part Consolidation

Under two-part consolidation, the Green County and City of Monroe call centers would merge into a single call center located in the Green County Sheriff's Office. The City of Monroe would have to hire an administrative assistant to support the front desk and administrative duties currently handled by dispatchers.

Under three-part consolidation, the Green County, City of Monroe, and City of Brodhead call centers would combine into a single call center located either in the Green County Sheriff's Office or a new space, depending on the level of staffing. Both the City of Monroe and City of Brodhead would hire an administrative assistant to support the front desk and administrative duties currently handled by dispatchers. Three-part consolidation would require only one supervisor.

Minimum vs. Maximum Staffing

In order to provide staffing options under consolidation, we consider minimum and maximum staffing levels for two-part and three-part consolidation. Based on the basic minimum and maximum staffing estimates for the Green County call center (provided to Green County by an outside consultant) and last year's call volume for each center, we calculated the minimum and maximum number of staff for two-part and three-part consolidation. See Appendix 9 for details. Throughout this analysis, we assume that wages and fringe benefits would be brought up to the highest schedule among the current call centers. See Appendix 10 for details.

While both staffing levels provide adequate service capacity, each level has its own advantages and disadvantages. Minimum staffing provides the greatest savings in recurring compensation costs but might cause more rapid burnout among employees, leading to higher turnover rates and utilization of employee sick days.[39] With fewer dispatchers in the workplace, employees are required to work more hours and often manage a greater number of tasks. Considering the stressful and psychologically draining nature of the profession, these added responsibilities only contribute to increased burnout among dispatchers. In contrast, the maximum staffing alternatives would not endure as much burnout and turnover. In addition, maximum staffing further reduces dispatch processing time, and the likelihood of delayed emergency responses. Reduced dispatch time can have a significant impact on both public health and safety (as discussed in the Costs and Benefits section).[40] Therefore, maximum staffing prioritizes reduced dispatch times, while minimum staffing prioritizes financial savings.

Under two-part consolidation, the minimum staffing alternative would require 10 FTEs, while the maximum staffing alternative would require 12 FTEs. Under three-part consolidation, the minimum staffing alternative would require 12 FTEs, while the maximum staffing alternative would require 16 FTEs. The three-part consolidation alternative with maximum staffing would include BEEMS because this alternative would provide sufficient capacity to maintain the program, assuming Brodhead could still meet the accreditation requirements for grant funding under consolidation.

For each consolidation alternative, the number of overall staff would decrease. We anticipate this reduction would occur through a combination of attrition and layoffs, the latter of

[39] Steven L Herrin, "Public Safety Communications Center Staffing : Do We Have an Emergency ? By" (University of Nevada, Las Vegas, 2005).
[40] Ibid.

which would require deliberation among the agencies. Because this implementation issue must be decided upon by our clients, it is outside of the scope of this report. See Appendix 10 for details of avoided compensation costs.

Costs and Benefits

Overview

As shown in Table 2, we consider three distinct categories of costs: one-time costs (costs incurred during the implementation period), recurring costs (incremental costs incurred after the implementation period), and avoided costs (costs forgone under consolidation). As shown in Table 2, one-time costs are moving costs and staff retraining costs. Recurring costs are the cost of a new space and staff compensation costs. Avoided costs are costs of equipment (consoles and phone system upgrades) and the value of released space. Recurring costs and avoided costs are calculated over a 10-year period in our Monte Carlo simulation. (See the Results section and Appendices 12 and 13 for more information about this statistical model.)

As also shown in Table 2, we consider two distinct categories of non-monetized benefits: positive non-monetized benefits (benefits incurred under consolidation) and negative non-monetized benefits (benefits forgone under consolidation). Unlike costs, which are measurable using existing agency budgets and market prices, these benefits are uncertain and difficult to monetize. We are unable to include non-monetized benefits in our Monte Carlo simulation, but we consider them in forming our recommendation. Positive non-monetized benefits are reduced dispatch processing time and improved consistency of operations. Negative non-monetized benefits are loss of local knowledge of Brodhead and discontinuing BEEMS.

Table 2: Estimated Incremental Costs and Benefits

	Two-part, minimum	Two-part, maximum	Three-part, minimum	Three-part, maximum	Appendix
One-time costs					
Moving costs	N/A	N/A	$800	$1,700	6
Staff retraining costs	$9,600	$11,300	$11,300	$14,800	7
Recurring costs					
Cost of a new space (monthly)	N/A	N/A	N/A	$12,000	8
Change in compensation costs (annual)	($207,000)	($83,000)	($329,000)	($80,000)	9, 10
Avoided costs					
Equipment costs (every 10-15 years)	N/A	N/A	$517,000	$267,000	11
Value of released space (monthly)	N/A	N/A	$1,200	$2,800	8
Positive non-monetized benefits					
Reduced dispatch processing time for Monroe callers	Gain	Gain	Gain	Gain	N/A
Consistency of service	Gain	Gain	Gain	Gain	N/A
Negative non-monetized benefits					
Local knowledge of Brodhead	No change	No change	Loss	Loss	N/A
Brodhead Elderly Emergency Monitoring System	No change	No change	Loss	No change	N/A

Source: Authors.

One-Time Costs

Moving Costs

Under the three-part consolidation alternatives, at least one of the current call centers would move. This would require hiring a moving company to pack up equipment, transport it, and unload it. Based on the square footage, distance of the move, and quantity of equipment, we estimate moving costs of roughly $800 under three-part consolidation with minimum staffing and $1,700 under three-part consolidation with maximum staffing. See Appendix 6 for details.

Staff Retraining Costs

Consolidation would require comprehensive staff retraining for the use of new systems, equipment, and workspaces. Moreover, staff must quickly adapt to new operations and organizational culture, as well as maintain consistent dispatch communication.[41] As each agency involved in consolidation possesses its own unique set of interests and modes of operation, up-front retraining can hedge against potential conflicts or inconsistencies that may arise following consolidation.[42] Also, retraining can help establish expectations and create a greater sense of camaraderie among staff from different agencies.[43] To estimate retraining costs, we consulted agency budgets and account for the number of personnel and hours of retraining. We estimate $9,600 in retraining costs under two-part consolidation with minimum staffing; $11,300 under the two-part consolidation with maximum staffing; $11,300 under three-part consolidation with minimum staffing; and $14,800 under three-part consolidation with maximum staffing. See Appendix 7 for details.

[41] Cannon, "Consolidation of Law Enforcement Dispatch Operations in Harris County Texas."
[42] Woods and Cook, "Perspectives on Human Error: Hindsight Bias and Local Rationality."
[43] Dalia Shimek, Scott Winograd, and Kimberly Renee Vining, "City of Ashland, City of Wooster, and Wayne County Consolidated Dispatch Feasibility Study: Ohio Case Studies" (Cleveland, 2011).

Recurring Costs

Cost of a New Space

Under three-part consolidation with maximum staffing, the consolidated center would need to rent new office space in Monroe to accommodate the four workstations required. Based on our calculations, the new space would require 650 square feet to comfortably house four workstations. See Appendix 9 for details. Based on the current real estate rental market in Monroe, we estimate that the cost of a new space is $12,000 per month. See Appendix 8 for details.

Staff Compensation Costs

Although consolidation requires more staff to work in a single facility, fewer staff overall are needed to achieve an adequate service capacity. However, according to the literature, consolidation does not always involve large staff reductions.[44] Therefore, we examine both minimum and maximum staffing levels. To estimate the required number of staff under each alternative, we use call volumes. See Appendix 9 for details. We estimate staff compensation over a 10-year period. While all three call centers currently offer different wage and benefit schedules, consolidation would require a consistent compensation schedule to ensure that no dispatcher is compensated less than a colleague with similar experience. We base our estimates on the wage and benefits structure of the highest compensating agency—Green County. We anticipate that this change in wages might result in an increased cost relative to those now incurred in Monroe and Brodhead, which currently compensate at a lower level. See Appendix 10 for details.

[44] L.R. Kimball, "911 Consolidation Study Prepared for the State of Iowa," 2016.

Avoided Costs

Equipment Costs

Three-part consolidation allows the agencies to avoid equipment costs because consolidation negates the need to update several units of expensive equipment over the course of 10 to 15 years. Equipment costs consist of costs to update consoles and costs to update phone systems.

Because each workstation requires one console, and three-part consolidation would reduce the number of workstations needed, three-part consolidation would avoid costs of updating consoles. The consoles that dispatchers use include monitors, specialized wiring, call-taking equipment, and specialized chairs.[45] As described in Appendix 9, both two-part consolidation alternatives and the three-part consolidation alternative with minimum staffing would require a total of five workstations, while the three-part alternative with maximum staffing would require six. In both two-part consolidation alternatives, there would be no reduction in the number of consoles from the current level. In three-part consolidation with minimum staffing, two fewer consoles would be used. In three-part consolidation with maximum staffing, one fewer console would be used. A single console costs between $200,000 and $300,000 and needs to be updated every 10 to 15 years.[46] We assume that the three agencies' consoles are at least 5 years old and therefore will need to be replaced within 10 years.

Three-part consolidation would also avoid the cost of updating the Brodhead call center phone systems. Phone systems for 9-1-1 call centers are expensive because they have several functions other than receiving calls, including: identifying the caller's location, calling back

[45] Phone interview with Christine Westrich, Milwaukee County Director of Emergency Management, November 29, 2018.
[46] Amenta and Henken, "Modeling a Consolidated Dispatch Center for Milwaukee County's South Shore."

abandoned or accidental calls, determining whether a caller is a real person, and maintaining a phonebook and memory.[47] These systems must be updated every 10 to 15 years.[48] Under current policy, each call center requires a specialized phone system. However, under three-part consolidation, Brodhead would no longer require its own phone system. Therefore, the cost to update the Brodhead phone system would be avoided.

After consulting with the Director of the Milwaukee County Office of Emergency Management, we identified the specific equipment costs avoided and applied these to our analysis. Under the minimum staffing alternative, we estimate total avoided equipment costs of $517,000 over a 10-year period, based on the sum of the avoided costs for updating two consoles and Brodhead's phone system. Under the maximum staffing alternative, we estimate total avoided equipment costs of $267,000 over a 10-year period, based on the sum of the avoided costs for updating one console and Brodhead's phone system. See Appendix 11 for details.

Value of Released Space

Under three-part consolidation with minimum staffing, dispatchers and their workstations would move out of only the Brodhead Police Department, releasing space for other Brodhead Police Department use. Under three-part consolidation with maximum staffing, dispatchers and their workstations would move out of the Green County Sheriff's Department and the Brodhead Police Department, releasing space for other agency use. Using opportunity cost methodology, we estimate that the value of released space is $1,200 under the minimum staffing alternative and $2,800 under the maximum staffing alternative. See Appendix 8 for details.

[47] Phone interview with Christine Westrich, Milwaukee County Director of Emergency Management, November 29, 2018.
[48] Ibid.

Positive Non-Monetized Benefits

Reduced Dispatch Processing Time for Monroe Callers

Eliminating transfers between 9-1-1 call centers would improve response times for dispatching police in Monroe.[49] This is important because, in some tragic cases, delays caused by transfer time are fatal.[50] In the event of an active shooter, for example, a 9-1-1 call from Monroe would currently go to the Green County call center, which would dispatch EMS but transfer the call to Monroe to dispatch police services. Due to the transfer time, EMS would arrive on-site before the police and be unable to enter the site, despite perhaps a dire need for services.[51]

This non-monetized benefit is demonstrated by the school shooting that occurred earlier this year in Parkland, Florida. In that case, 9-1-1 callers reported gunfire through a two-step system: first reaching operators in Coral Springs, then being transferred to a regional call center.[52] Bob Gualtieri, Pinellas County Sheriff and chairman of the Marjory Stoneman Douglas High School Public Safety Commission studied the incident and stated the following:

> What happened in Parkland was that every single cellular 911 call made from Marjory Stoneman Douglas High School, every kid in that school, everybody in Parkland that was calling 911 to report information, was that it was going to the Coral Springs communications center….Coral Springs is not the primary police provider in Parkland. Broward County Sheriff's Office is. So you had people who were conveying firsthand information to the entity that wasn't the first responder for law enforcement. So what was happening was that Coral Springs would have been required to transfer the callers from the Coral Springs communications center to the regional communications center so the regional communications center could then convey it to the deputies. Was that a factor in this? Yeah, absolutely it's a factor.[53]

[49] L.R. Kimball, "Consolidation Guide Prepared for Office of Statewide Emergency Telecommunications State of Connecticut," 2012.
[50] Jonathan D. Mayer, "Emergency Medical Service: Delays, Response Time and Survival," *Medical Care* 17, no. 8 (1979): 818–27.
[51] Client meeting, October 5, 2018.
[52] David Fleshler and Stephen Hobbs, "911 System May Have Caused Fatal Delays in Parkland Shooting," *South Florida Sun Sentinel*, June 11, 2018, https://www.sun-sentinel.com/local/broward/parkland/florida-school-shooting/fl-florida-school-shooting-911-problems-20180711-story.html.
[53] Ibid.

Transfer time added 30 seconds of delay in response time in the Parkland incident.[54] Our clients estimated that call transfers add 60 to 120 seconds to response time.[55] Because it might, in some cases, save lives and reduce injuries, any reduction in dispatch processing time is a meaningful and significant benefit.

Consistency of Service

Consolidation improves consistency of service in dispatch operations. A single training program ensures that all staff receives training to the same standards.[56] Likewise, a single wage schedule ensures that similarly qualified dispatchers are hired and rewarded for their work equally.

Negative Non-Monetized Benefits

Local Knowledge of Brodhead

Dispatchers' local knowledge of Brodhead is an important benefit of the current policy for two reasons. First, Brodhead is a smaller jurisdiction set apart from Monroe on the border of Green County and Rock County, so dispatchers working in the Green County and Monroe call centers are not as familiar with Brodhead. Second, Brodhead has expanded since the time that the shared computer-aided dispatch system was purchased 11 years ago, and the maps are out of date.[57] Brodhead dispatchers utilize their personal knowledge of local streets, landmarks, and callers in their work.[58] Updating the maps used by the computer-aided dispatch systems would largely mitigate the loss of local knowledge.[59] However, if local knowledge of Brodhead is not

[54] Ibid.
[55] Client meeting, October 5, 2018.
[56] L.R. Kimball, "Consolidation Guide Prepared for Office of Statewide Emergency Telecommunications State of Connecticut."
[57] Client meeting, November 9, 2018.
[58] Client meetings, October 5, 2018, and November 9, 2018.
[59] Client meeting November 9, 2018.

institutionalized via retraining and record-keeping, its loss might increase dispatch time and the likelihood of sending officers to the wrong address. Brodhead callers might also be less likely to call or be less forthcoming with dispatchers who are not their neighbors.

Brodhead Elderly Emergency Monitoring System

Under three-part consolidation with minimum staffing, Brodhead would lose the BEEMS program because the current and incoming Sheriffs have both advised Brodhead that the program would not be feasible under comparable staffing levels to the current policy. However, the BEEMS program could remain under three-part consolidation with maximum staffing.

Losing BEEMS would have two consequences: BEEMS members would lose an important service, and Brodhead might no longer be able to employ CSOs.

First, Brodhead residents who previously benefited from the service would be less connected to their community, might be more likely to have accidents in their homes, and would be less likely to reach dispatch in an emergency. Specifically, BEEMS members attempting to reach dispatch might not be successful without use of their pendants or wristbands; emergency assistance personnel might not be able to access members' homes without the key in a lockbox outside; and members would no longer benefit from monthly visits from CSOs. Current BEEMS users who want to retain similar benefits would face increased costs through other service providers; some users who cannot afford these increased costs would forego services entirely.

Second, Brodhead might no longer be able to employ CSOs. Because CSO wages are partly funded through a grant program that supports BEEMS, losing BEEMS might mean that the Brodhead Police Department could no longer afford to pay CSOs and use them for other purposes such as security at public events.[60] As a result, police officers would have to take on

[60] Client meeting, November 9, 2018.

work currently completed by CSOs at a much higher pay rate, leading to forgone benefits from cost savings of paying CSOs compared to police officers. A calculation of these forgone benefits is outside the scope of this project.

Results

We use a Monte Carlo simulation to quantitatively account for uncertainty under each consolidation alternative. A Monte Carlo simulation is a statistical model that calculates net benefits in scenarios with uncertainty surrounding parameter values by drawing from specified distributions of each parameter within the greater analysis.[61] The simulation produces both the mean present value of net benefits for each alternative over the next 10 years (discounted at 3.5 percent), and the probability that net benefits would be positive—conveying the riskiness of the project. See Appendices 12 and 13 for details.

According to our Monte Carlo simulation, two-part consolidation with minimum staffing produces a mean of $1.7 million in net benefits, with 100 percent of the trials yielding positive net benefits. The two-part consolidation alternative with maximum staffing yields a mean benefit of $674,000, with 98 percent of the trials yielding positive net benefits. The simulation results suggest that recurring costs drive the positive results of both two-part consolidation alternatives. Both two-part consolidation alternatives contain negative recurring costs which significantly increase benefits and ultimately lead to positive net benefits. See Appendix 12 for details.

We consider three-part consolidation among the Green County, Monroe, and Brodhead call centers with either minimum or maximum staffing. According to the Monte Carlo simulation, the three-part consolidation alternative with minimum staffing yields a mean of roughly $3.2 million in net benefits, with 100 percent of the trials yielding positive net benefits.

[61] Anthony E. Boardman et al., *Cost-Benefit Analysis: Concepts and Practice* (Cambridge University Press, 2018).

The three-part consolidation alternative with maximum staffing yields a mean loss of $73,000, with 45 percent of the trials producing positive net benefits. The difference between the minimum and maximum staffing alternatives for three-part consolidation is attributable to recurring costs. For the three-part consolidation alternative with minimum staffing, recurring costs are negative and therefore turn the net benefits positive.

Recommendation

We recommend three-part consolidation with minimum staffing. This alternative has a mean net present value of $3.2 million and produces positive net benefits in 100 percent of trials. Further, this alternative realizes the non-monetized benefits of reduced dispatch time in Monroe and improved consistency of service. However, three-part consolidation with maximum staffing is also a viable alternative, producing positive net benefits 45 percent of the time. If our clients determine that the value of further reducing dispatch time in Monroe and retaining BEEMS outweighs the difference in increased recurring costs, then three-part consolidation with maximum staffing would be preferable.

If three-part consolidation is not feasible, we recommend two-part consolidation with minimum staffing. This alternative has the mean net present value of $1.7 million and produces positive net benefits in 100 percent of trials. Further, this alternative realizes the non-monetized benefits of reduced dispatch time in Monroe, improved consistency of service, retention of local knowledge, and retention of BEEMS. However, two-part consolidation with maximum staffing is also a viable alternative, producing a mean net present value of $675,000 with positive net benefits in 98 percent of trials. If our clients determine that the value of further reducing dispatch time in Monroe and improving the consistency of service outweigh the difference in increased

recurring costs, then the two-part consolidation alternative with maximum staffing would be preferable.

For all consolidation alternatives, we recommend maintaining the call center consoles and workstations in the Monroe Police Department so that dispatchers can use that space as a backup in the event of a significant equipment or building failure.[62]

Regardless of whether the call centers consolidate, we have identified the following recommendations to make operations more efficient: (1) updating the GIS data obtained through Spillman which is now 11 years old; and (2) standardizing the dispatch workflow with respect to when information should be entered and requiring that dispatchers use headsets.

Limitations

Several factors limit this analysis: unavailable or incomplete data, unknown issues that might arise during implementation, unknown terms of a cost-sharing agreement, and unknown future costs of 9-1-1 equipment.

First, some of our calculations are limited by the data available. For example, costs and upgrade timelines for each facility were unavailable, so we derived the costs associated with phone system upgrades from a similar consolidation project in Milwaukee County (scaling down the Milwaukee County consolidation costs to fit the volume of Brodhead's calls). Also, our compensation calculations do not explicitly include Social Security or retirement account contributions because it was unclear whether personnel budgets for two of the three agencies included these contributions. Other limitations due to unavailable or incomplete data are noted in the report as they apply.

[62] Cannon, "Consolidation of Law Enforcement Dispatch Operations in Harris County Texas."

Second, our analysis is limited because of issues that might arise during implementation. For example, the pay increases required to standardize rates for all employees would depend on the makeup of the staff after implementation. If the number of FTEs is reduced through laying off lower-wage employees, average wages would increase; if the number of FTEs is reduced through attrition of higher-wage employees, the average wage would decrease. In addition, we did not account for costs associated with radio system upgrades, which take place every 10 to 15 years. Green County had a study completed in 2018 to assess the upgrade options available and is currently waiting to take action on the matter.[63] Finally, although we are unaware of the specific accreditation requirements for the BEEMS program, we make the reasonable assumption that Brodhead would still satisfy the requirements under consolidation. These limitations are beyond the scope of this analysis and would require planning prior to implementation.

Third, our analysis is limited in that costs and benefits are pooled, rather than broken down by agency. Thus, a cost-sharing agreement would be needed to ensure equitable contributions to consolidated dispatch operations.

Fourth, we could not account for changes in 9-1-1 services, including NextGen 9-1-1. This limits the accuracy of our calculation of future upgrade costs.

[63] Day & Thompson 2018 (Green County Radio System Report)

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Appendix 1: Definitions

Table 3: Definitions

Terms	Definitions
BEEMS	Brodhead Elderly Emergency Monitoring Systems. This program serves aging and disabled residents of Brodhead at a subsidized rate.
Common-pool resource	A public good that it is both rivalrous and non-excludable.
CSO	Community Service Officer. Used to describe a part-time employee of the Brodhead Police Department who provides low-risk community service as opposed to law enforcement.
Dispatch console	A system that interfaces to a radio system, allowing the dispatcher to communicate directly with police officers, fire fighters, EMS, and other relevant personnel.
Economies of scale	The cost advantages obtained due to the scale of operation, with cost per unit of output decreasing with increasing scale.
Fringe benefits	Supplemental benefits to an employee's wage, predominately health insurance.
FTE	Full-Time Equivalent. Used to describe a full-time employee or part-time employees whose hours worked add up to the equivalent of a full-time worker.
Monte Carlo simulation	A probability simulation used to account for the uncertainty inherent in particular point estimates.
Non-excludable	A public good that is provided to anyone who requires it.
Opportunity cost	The value of an input in its next best alternative use.
Rivalrous	A public good that is consumed independently.
Social discount rate	The discount rate used in computing the value of funds spent on social projects. For this analysis we use the recommended rate of 3.5 percent.

Source: Authors.

Appendix 2: Jurisdictional Areas

Located in south-central Wisconsin, Green County is comprised of 24 municipalities, including 16 towns, 6 villages, and 2 cities, with the City of Monroe holding the county seat. Four of the municipalities have a population greater than 2,000 people: the City of Monroe, City of Brodhead, Village of New Glarus, and the Town of Exeter.[64] Green County spans 584 square miles of land and is home to roughly 36,851 residents and one post-secondary education institution, Blackhawk Technical College.[65] Green County is rural—although it is bordered by two metropolitan counties, with Dane County to the north and Rock County to the east. Green County's contiguous geography to the more urban areas of Rock and Dane County has spurred the in-migration rate for the County. From 2000-2010, the county experienced a 9.5 percent increase in the population, compared to Wisconsin's overall growth rate of 6 percent.[66] As shown in Table 4, the County population is expected to grow 14.3 percent by 2020.[67] As also shown in Table 4, the County population is aging: 14.9 percent of Green County's population was 65 and older, relative to 13.7 percent for the state.[68] Presently, more than 18 percent of the population in Green County is age 65 and older.[69] In 2010, the county's median resident age was 41 years (older than the state average of 39 years).[70]

Monroe is in the south-central part of Green County, spanning just shy of five square miles. As shown in Table 4, Monroe is home to approximately 10,604 residents and stands as the largest of the 26 municipalities in the county, with a population three times that of the next

[64] Mike Day and John Thompson, "Green County, Wisconsin Public Safety Radio System Study" (Stillwater, 2018), http://www.co.green.wi.gov/.
[65] United States Census Bureau, "Census.Gov," accessed December 2, 2018, https://www.census.gov/.
[66] Ibid.
[67] Ibid.
[68] Ibid.
[69] Ibid.
[70] Ibid.

largest municipality.[71] Contrary to the county trends, Monroe's population has remained relatively constant and is projected to see little to no growth over the next decades.[72] As also shown in Table 4, Monroe has an aging population, consistent with that of the rest of the county: approximately 20 percent of the population is 65 years or older. In 2010, Monroe's median resident age was 41.[73]

Brodhead is located on the eastern border of Green County, adjacent to Rock County. Despite covering only two square miles of land and a declining population, the city is the second largest municipality in the county after Monroe. As shown in in Table 4, Brodhead has 3,253 residents.[74] Like the rest of the county, Brodhead is home to an aging population. In 2010, Brodhead's median resident age was 42.[75]

Table 4: Jurisdictional Area Populations (Historic and Projected)

Area	2010 Population	2017 Population	2020 Population (projected)	2030 Population (projected)	2040 Population (projected)	Population aged 65 and older (percent)
Green County	36,842	36,851	39,270	41,551	41,804	18.0
City of Monroe	10,827	10,604	11,140	11,450	11,100	20.1
City of Brodhead	3,293	3,325	3,420	3,555	3,485	17.6*

Source: US Census Bureau, where (*) indicates data was taken from 2010; Wisconsin Department of Administration Population and Household Projections.

[71] United States Census Bureau, "Census.Gov."
[72] Ibid.
[73] Ibid.
[74] Ibid.
[75] Ibid.

Appendix 3: Jurisdictional Map

As shown in Figure 1, Green County is located on the Wisconsin-Illinois border adjacent to Lafayette, Dane, and Rock Counties; the City of Brodhead is on the eastern border of the County, in the southeast quadrant; and the City of Monroe is in the southwest quadrant. The County's boundaries do not perfectly correspond to the geographical responsibilities of the Green County call center. The call center serves most of Green County, as well as parts of Lafayette County. A map of the exact boundaries of Green County dispatch service was not provided.

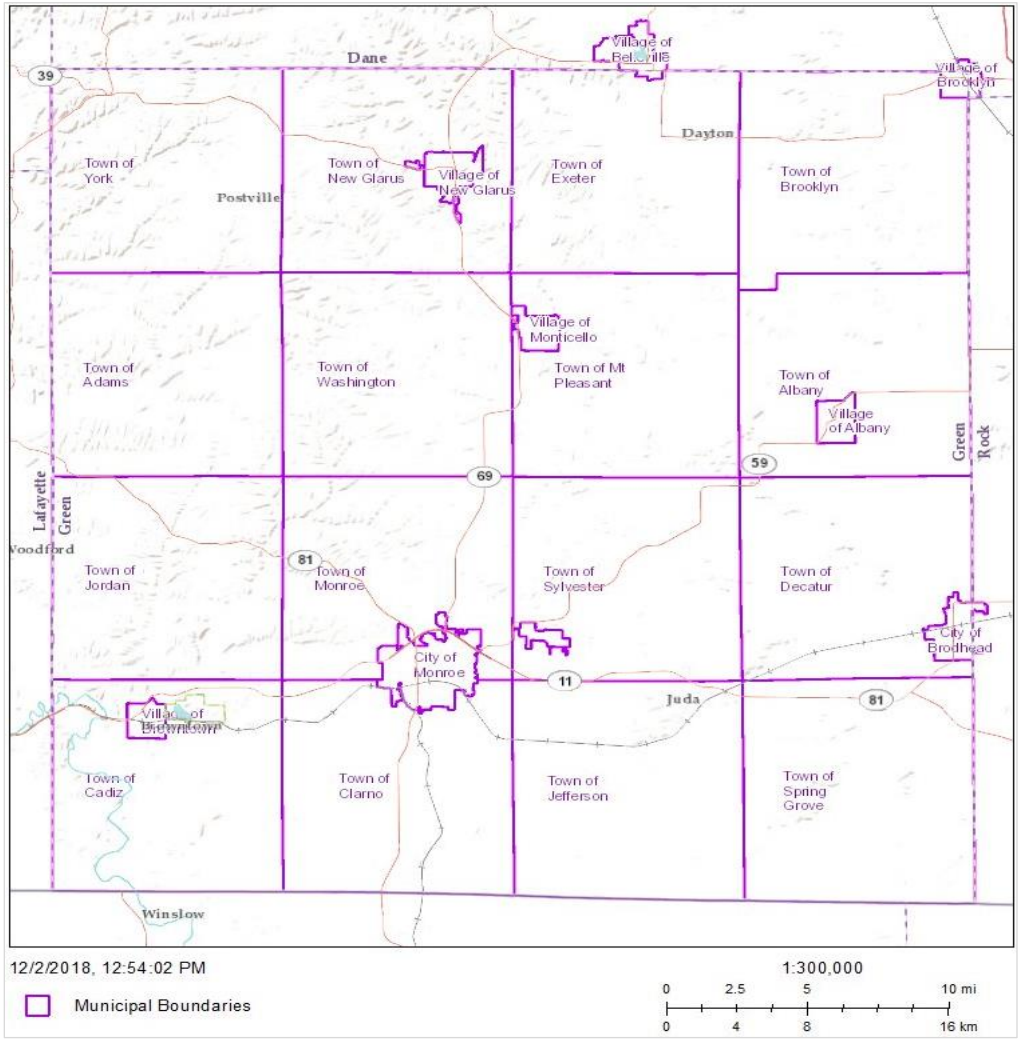

Figure 1. Jurisdictional map of Green County, the City of Monroe, and the City of Brodhead.
Source: http://landrecords.greencountywi.org/GreenCountyGISDataViewer/.

Appendix 4: Call Volume under Current Operations

As shown in Figure 2, call volume for each of the centers marginally increased over the past five years. The Green County call center took 15,701 calls in 2013 and 17,527 in 2017; the Monroe call center took 9,169 calls in 2013 and 9,925 calls in 2017. Brodhead call volume increased significantly over two years, then more slowly: the Brodhead call center took 4,333 calls in 2013; 6,422 calls in 2015; and 7,317 calls in 2017. This suggests a consistent call volume for all three call centers. Figure 2 illustrates these increases from 2013 to 2017.

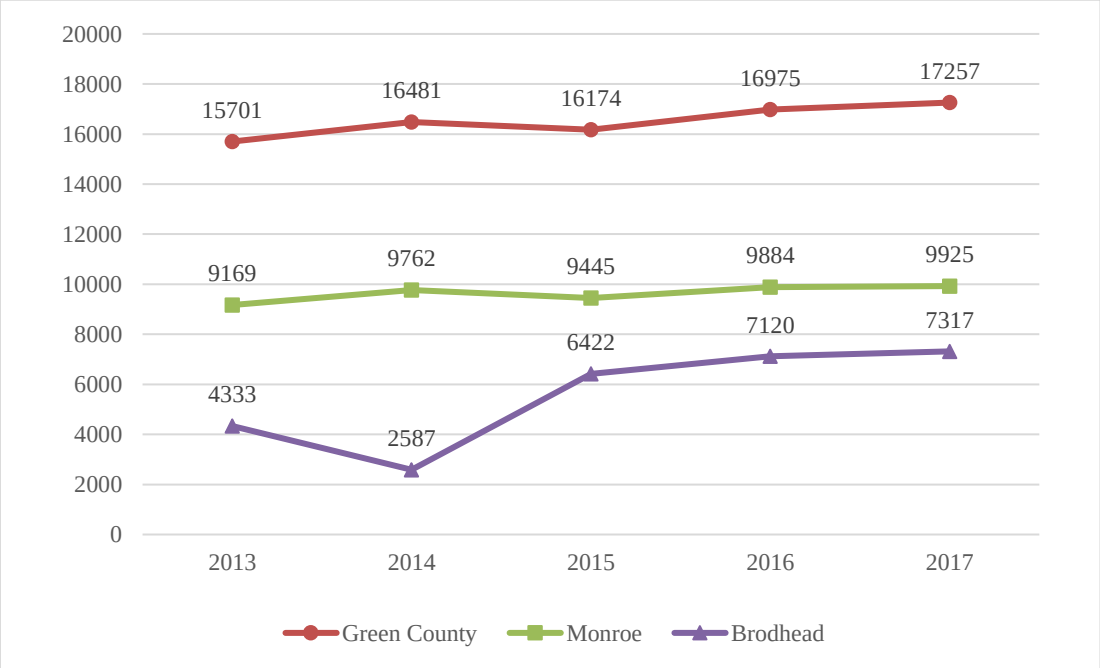

Figure 2. Call volume by agency, 2013-2017.
Source: Report titled "How Calls Are Received, Totals by Area," provided by Sheriff Rohloff.

Due to the uncertainty in forecasting future demand for emergency dispatch in Green County and the Cities of Monroe and Brodhead, we chose not to utilize a projected call volume in our analysis. Instead, we utilize the 2017 call volume in our analysis, which yields more conservative cost estimates. Additional information on the use of call volumes in this analysis is found in Appendix 9.

As shown in Figure 3, Green County call center call volume varies by both time of day and day of the week. On an average day in 2017, call volume was lowest in the early morning and highest at 4:00 p.m. and 12:00 a.m. On the average week in 2017, call volume was lowest on Thursday and Sunday and highest on Friday and Saturday.

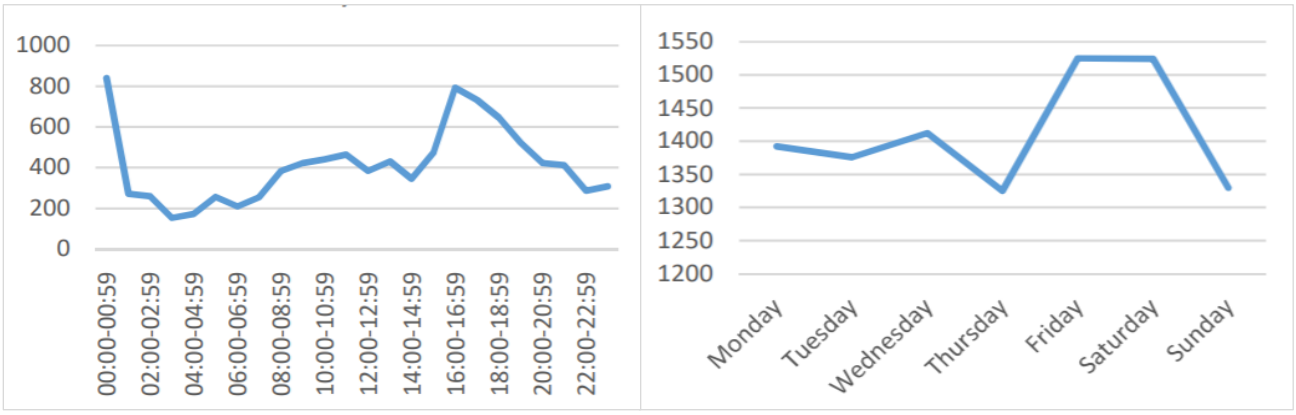

Figure 3. Green County average call volume by time of day (left) and day of week (right). *Source: Report titled "Green County Sheriff's Office 2017 Annual Report," provided by Green County Sheriff Rohloff.*

As shown in Figure 4, Brodhead call center call volume also varies by both time of day and day of the week. On an average day in 2017, call volume was lowest in the early morning and highest at 10:00 a.m., 4:00 p.m. and 10 p.m. During the average week in 2015-2017, call volume was highest on weekdays and lowest on the weekend.

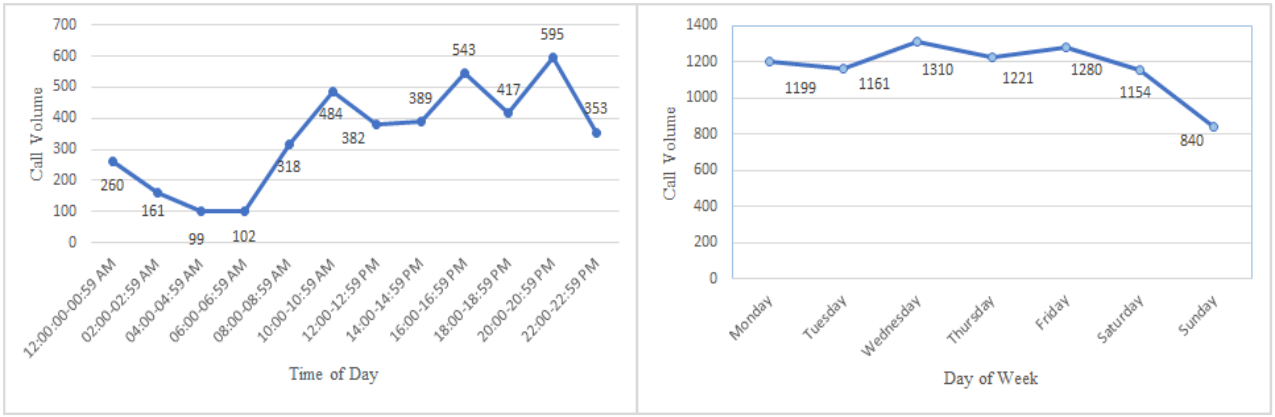

Figure 4. Brodhead average call volume by time of day (left) and day of week (right). *Source: Underlying data provided by Chief Hughes.*

Appendix 5: Compensation under Current Policy

As shown in Table 5, the three call centers currently provide different rates of compensation and benefits to their dispatchers. Green County employs six full-time dispatchers. The 2018 budget includes $456,017 for wages, $4,878 for overtime costs, and $196,087 for fringe benefits.[76] Monroe employs six full-time dispatchers. Wages range from $20.13 to $24.17 per hour, and total wages will be $270,236.64 in 2018.[77] Brodhead employs three full-time dispatchers, one full-time supervisor, and three-part time dispatchers. In 2018, wages for full-time employees ranges from $15.30 to $18.73 per hour for dispatchers and up to $20.94 for a supervisor. Pay for part-time employees is 85 percent of full-time starting wages at one year of service, 90 percent of full-time wage starting wages at two years of service, and 100 percent of full-time starting wages at three years of service. Overtime pay was approved at $4,442.56 for 2019. For 2018, total expected wages are $172,355.77 (excluding overtime), total fringe benefits are $86,260.60, and total compensation is $263,058.93.[78]

Table 5: Call Center Compensation

Call center	Staff	Wages ($)	Overtime ($)	Fringe benefits ($)	Total compensation ($)
Green County	6 FTE	456,017	4,878	196,087	656,982
City of Monroe	6 FTE	270,237	Unavailable	Unavailable	Unavailable
City of Brodhead	4 FTE, 3 part-time	176,798	4,443	86,261	263,059

Source: Underlying data provided by Sheriff Rohloff, Chief Kelley, and Chief Hughes.

[76] "Green County Budget 2018: Communications Account" (Monroe, 2017).
[77] Email from Chief Kelley, December 3, 2018.
[78] "Police Department Budget Trends" (Brodhead, 2018).

Appendix 6: One-Time Moving Costs

To determine a point estimate for moving costs, we called local moving companies to obtain a quote. Accounting for the call centers' approximate square footage, the number and proximity of locations, number of workstations, and presence of heavy equipment, a company that provides full moving services (O'Mara Moving and Storage) estimated that moving a single office space would cost $833.33 and moving two office spaces would cost $1666.67. Under the three-part consolidation alternative with minimum staffing, equipment and files from the Brodhead call center would move to a new space, so we use $833.33 as the point estimate for moving costs. Under the three-part consolidation alternative with maximum staffing, equipment and files from both the Brodhead and Green County call centers would move to a new space, so we use $1666.67 as the point estimate for moving costs.

Appendix 7: One-Time Retraining Costs

During the implementation phase of consolidation, dispatchers from each agency would require comprehensive retraining to ensure consistency of service. While dispatchers participate in trainings on standard practices and operating procedures, they are unable to engage in their traditional work hours. These foregone work hours stand as the opportunity cost of retraining efforts. We estimate that 40 hours of retraining would be required for each employee to adjust to a new space and workflow.[79] This is a conservative estimate, based on the number of hours expected to train a new dispatcher. The costs of retraining are the product of the number of FTEs (the number of dispatchers plus one administrative assistant), the new average dispatcher salary, and the number of retraining hours. Because the administrative assistant in Monroe could need to dispatch calls during periods of backup, one additional FTE is included in each of the calculations.

(Number of FTEs) x (New average hourly wage) x (40 hours)

We estimate a new average hourly wage of $21.81 per hour, based on the new average salary calculated in Appendix 10 and divided by 2,080 hours (the number of hours worked per year by FTEs). Below are the point estimate calculations for each consolidation alternative. Each consolidation alternative requires varying numbers of FTEs, as calculated in Appendix 9.

Two-Part Consolidation

For minimum staffing, we estimate $9,600 in retraining costs:

(11) x ($21.81/hour) x (40 hours) = $9,596.40

For maximum staffing, we estimate $11,300 in retraining costs:

(13) x ($21.81/hour) x (40 hours) = $11,341.20

[79] GeoComm, "Southeastern Regional Planning and Economic Development District Final Report and Implementation Plan" (St. Cloud, 2011).

Three-Part Consolidation

For minimum staffing, we estimate $11,300 in retraining costs:

(13) x ($21.81/hour) x (40 hours) = $11,341.20

For maximum staffing, we estimate $14,800 in retraining costs:

(17) x ($21.81/hour) x (40 hours) = $14,830.80

Appendix 8: Value of Space

Cost Calculation for a New Space

Three-part consolidation with maximum staffing would require the acquisition of a new call center space. We calculated the cost of a new space by estimating the value of square footage of new office space and the necessary number of square feet for a three-part consolidated call center with maximum staffing.

To estimate the value of square footage of new office space in Green County, we called local real estate agencies, including Century 21, and researched the current real estate market using online listing sites, including Zillow.com. We found that the average cost of one square foot of office space in Green County ranges between $16 and $21. We used these values as the endpoints for a uniform distribution to capture this range of possible prices.

To estimate the necessary number of square feet for three-part consolidation with maximum staffing, we use a series of ratio methods. First, we found the ratio of square feet to workstations in each of the three current call centers. The ratios of current workspaces per workstation are approximately 128 square feet per workstation, 210 square feet per workstation, and 121.33 square feet per workstation for the Brodhead, Monroe, and Green County call centers. For a hypothetical consolidated center, we used the average of these three ratios to obtain an ideal space of approximately 160 square feet per workstation.

Second, we found the number of square feet needed to hold this ratio constant using the calculated number of required workstations for each alternative from Appendix 9. For three-part consolidation with maximum staffing, four workstations are needed. Applying the same methodology used to find the original square feet to workstation ratios, we estimate that the consolidated space with four workstations would need 650 square feet of space.

Third, we applied this 650 square foot office space to the $16 to $21 per square foot range for real estate in Green County. This distribution yields a monthly mean cost of $12,027.62 and a standard deviation of $941.94. A consolidated center in Green County with four workspaces should expect to pay, on average, about $12,000 in monthly rental fees, based on the current real estate market.

Benefits Calculation for Released Space

Three-part consolidation would result in released space, benefitting the agencies that gain use of square footage previously occupied by a call center. To calculate the value of benefits from use of released space, we estimate the value of square footage of released space and multiply that by the number of square feet of released space under each alternative.

Released space cannot be bought and sold because it is firmly fixed within a government building, however, it can be valued at its opportunity cost. So, to estimate the value of square footage of released space, we estimate the opportunity cost, i.e. the value of its next best alternative use, of the space currently occupied by call centers. Released space can be used for storage or new office space. Because the value of released space is less than the value of new space, yet greater than zero, we discount the value of released space between zero and 50 percent the value of the new space.

For both three-part consolidation alternatives, the Brodhead Police Department would gain roughly 256 square feet of released space.[80] At the released space value between zero and 50 percent of the retail market range of $16 to $21 per square foot, the released space in the Brodhead police department would provide a monthly mean benefit of $1,190.47 with a standard

[80] Email from Chief Hughes, November 27, 2018.

deviation of $690.27. Accordingly, under both three-part consolidation alternatives, the monthly value of released space at the Brodhead Police Station would be approximately $1,200.

The three-part consolidation with maximum staffing alternative would result in released space at the Green County call center of 364 square feet.[81] At the released space value between zero and 50 percent of the retail market range of $16 to $21 per square foot, the released space in the Green County call center would provide a monthly mean benefit of $1,692.69 with a standard deviation of $981.48. As a result, under three-part consolidation with maximum staffing, in addition to the benefit of released space at Brodhead, the Green County space would also have a monthly benefit of approximately $1,700.

[81] Email from Jim Moldenhauer, November 28, 2018.

Appendix 9: Staff and Space Needs

Consolidation of the 9-1-1 call centers would require a strategic reallocation of resources. Appendix 5 details the current staffing and compensation of each existing center, while Table 1 provides each center's square footage. This appendix provides calculations for the staffing and square footage required under each consolidation alternative.

For ease of calculation, we used the call volume numbers given to us in our original client meeting instead of the data provided in Appendix 4: 17,500 calls for Green County, 10,000 calls for Monroe, and 7,500 for Brodhead. Under two-part consolidation the consolidated center would receive approximately 27,500 annual calls, and under three-part consolidation, a consolidated center would receive approximately 35,000 annual calls.

Calculation of Number of Needed Dispatcher FTEs

To calculate the number of dispatcher FTEs needed for each alternative, we derived the ratio of calls to dispatcher FTEs using estimates provided by Green County Lead Dispatcher, Jim Moldenhauer. Supplemental literature that employed queuing formulas to obtain staffing estimates corroborated our call to dispatcher ratio.[82] Green County's 9-1-1 call center is operating with only 6 FTEs but have been quoted by an outside consultant that they should be operating with at least 8 FTEs. In a minimum staffing alternative, the ratio of calls to dispatcher FTEs is approximately 17,500 to 6, or 2,917 calls per dispatcher per year. In a maximum staffing alternative, the ratio of calls to dispatcher FTEs is 17,500 to 8, or 2,188 calls per dispatcher per year. We did not use the 1,429 ratio from Brodhead or the 1,667 ratio from Monroe call centers because our team assumed the Green County quoted numbers would best reflect the workload of

[82] *PSAP Staffing Guidelines Report*. Report no. NENA-REF-001-2003. National Emergency Number Association. L.R. Kimball.

a consolidated center. Additionally, the number of needed receptionist positions is discussed in Appendix 10. Below is the equation used for calculating the new number of dispatcher FTEs. Using information from Table 6 below, we report the results from each calculation in Table 7 at the end of this appendix.

$$\frac{\#\ of\ Calls}{\#\ of\ FTES} = Ratio\ of\ Calls{:}FTEs = \frac{New\ \#\ of\ Calls}{New\ \#\ of\ FTEs}$$

Table 6: Current Policy Annual Calls:FTEs Ratio per Center

	Annual calls	Number of FTEs	Ratio of annual calls:FTEs
Green County (current policy)	17,500	6	2,917
City of Monroe (current policy)	10,000	6	1,667
Brodhead (current policy)	7,500	5.25	1,429
Green County (optimal staffing)	17,500	8	2,188

Source: Authors.

In the two-part consolidation alternative with minimum staffing, the number of dispatcher FTEs is the product of the minimum staffing ratio (2,917 calls per dispatcher per year) and the new total number of calls in the two-part consolidated centers (27,500 annual calls). This consolidation alternative would require 10 dispatcher FTEs to sufficiently intake the number of expected calls per year.

$$\frac{17{,}500}{6} = 2{,}917\ Calls{:}FTEs = \frac{27{,}500}{9.427}$$

In the two-part consolidation alternative with maximum staffing, the number of dispatcher FTEs is the product of the maximum staffing ratio (2,188 calls per dispatcher per year) and the new total number of calls in the two-part consolidated centers (27,500 annual calls). This consolidation alternative would require 12 dispatcher FTEs to sufficiently intake the

number of expected calls per year. Due to workstation constraints, we decided this alternative would remain at 12 FTEs instead of rounding to 13 FTEs.

$$\frac{17{,}500}{8} = 2{,}188\ Calls{:}FTEs = \frac{27{,}500}{12.568}$$

In the three-part consolidation alternative with minimum staffing, the number of dispatcher FTEs is the product of the minimum staffing ratio (2,917 calls per dispatcher per year) and the new total number of calls in the three-part consolidated centers (35,000 annual calls). This consolidation alternative would require 12 dispatcher FTEs to sufficiently intake the number of expected calls per year.

$$\frac{17{,}500}{6} = 2{,}917\ Calls{:}FTEs = \frac{35{,}000}{11.99}$$

In the three-part consolidation alternative with maximum staffing, the number of dispatcher FTEs is the product of the maximum staffing ratio (2,188 calls per dispatcher per year) and the new total number of calls in the three-part consolidated centers (35,000 annual calls). This consolidation alternative would require 16 FTEs to sufficiently intake the number of expected calls per year.

$$\frac{17{,}500}{8} = 2{,}188\ Calls{:}FTEs = \frac{35{,}000}{15.99}$$

Calculation of Number of Needed Workstations

We calculated the number of needed workstations required under each alternative by comparing the number of desk hours available per week to the minimum number of hours needed for all FTEs to achieve full-time status. These calculations are limited in that they do not account for time of day and day of the week. Our calculations supply the minimum number of available desk hours needed in order to employ each alternative's staffing number of FTEs. The distribution of employees is left to the discretion of the consolidated spaces.

Under each consolidation alternative, the number of desk hours per week, *X*, is the product of the number of necessary workspaces and the total number of hours in one week (168 hours). The minimum number of hours worked per week, *Y*, is the product of the number of FTEs and 40 hours. The 40 hours per week ensures that each FTE has the ability to remain at full-time status. The necessary number of workspaces is the smallest possible number of workstations that yields a value of *X* that is greater than or equal to the value of *Y*. This number of workspaces would ensure that there are enough total available hours possible in each center so that each dispatcher FTE can maintain full-time status. We use the following equations to calculate values for *X* and *Y* under each consolidation alternative.

$$X = (\#\ \textbf{workstations}) \times (168\ \text{hours}) = (\#\ \text{desk hours available})$$

$$Y = (\#\ \text{of FTEs}) \times (40\ \text{hours}) = (\text{minimum}\ \#\ \text{hours worked})$$

$$X \geq Y$$

In the two-part consolidation with minimum staffing alternative, the Green County and Monroe call centers would consolidate into the current Green County space. Additionally, this alternative would maintain the Monroe call center as a backup space and retain 10 FTEs (as calculated above). This would require a minimum of 3 workspaces to achieve full-time status for the 10 dispatcher FTEs. The Green County space already has 3 workstations, so each of the existing workspaces would remain operational.

$$X = (\textbf{3 workstations}) \times (168\ \text{hours}) = (504\ \text{desk hours available})$$

$$Y = (10\ \text{FTEs}) \times (40\ \text{hours}) = (\text{minimum}\ 400\ \text{hours worked})$$

$$(504\ \text{desk hours available}) = X > Y = (\text{minimum}\ 400\ \text{hours worked})$$

In the two-part consolidation with maximum staffing alternative, the Green County and Monroe call centers would also consolidate into the current Green County space and maintain the

Monroe call center as a backup space. However, this consolidation alternative requires 12 FTEs (as calculated above). This alternative would require 3 workspaces to achieve full-time status for the 12 dispatcher FTEs. The Green County space already has 3 workstations, so each of the existing workspaces would remain operational.

Note that according to the calculation above for the needed number of FTEs in two-part consolidation with maximum staffing, the true rounded number would come to 13 FTEs. This would cause the calculation below to require four workstations instead of three. This change would not allow for this alternative to occupy the current Green County call center and would force this alternative to find new space. We decided the small difference in 12 and 13 FTEs was less costly than relocation.

*X = (**3 workstations**) x (168 hours) = (504 desk hours available)*

Y = (12 FTEs) x (40 hours) = (minimum 480 hours worked)

(504 desk hours available) = X > Y = (minimum 480 hours worked)

In the three-part consolidation with minimum staffing alternative, the Green County, Monroe, and Brodhead call centers would consolidate into the current Green County space and retain 12 FTEs (as calculated above). The current Monroe call center would be maintained as a backup space while the current Brodhead call center would close. This alternative would require three workspaces in the consolidated center to achieve full-time status for the 12 dispatcher FTEs. Again, the three existing Green County workspaces would remain operational.

*X = (**3 workstations**) x (168 hours) = (504 desk hours available)*

Y = (12 FTEs) x (40 hours) = (minimum 480 hours worked)

(504 desk hours available) = X > Y = (minimum 480 hours worked)

In the three-part consolidation with maximum staffing alternative, the Green County, Monroe, and Brodhead call centers would consolidate into a new call center space and retain 16 dispatcher FTEs (as calculated above). The current Monroe call center would be maintained as a backup space while the current Brodhead and Green County call centers would close. This alternative would require 4 workspaces to achieve full-time status for the 16 dispatcher FTEs. Because the Green County space only has room for 3 operational workspaces, the new consolidated call center would need to find another location. The calculation of this needed space is found in Appendix 8.

*X = (**4 workstations**) x (168 hours) = (672 desk hours available)*

Y = (16 FTEs) x (40 hours) = (minimum 640 hours worked)

(672 desk hours available) = X > Y = (minimum 640 hours worked)

Table 7: Staffing Requirements by Alternative

	Two-part, minimum	**Two-part, maximum**	**Three-part, minimum**	**Three-part, maximum**
Calls at consolidated center	27,500	27,500	35,000	35,000
Approximate ratio of annual calls:FTEs	2,917	2,188	2,917	2,188
Dispatcher FTEs	10	12	12	16
Minimum number of workstations	3	3	3	4

Source: Authors.

Appendix 10: Recurring Compensation Costs

As shown in Table 8, higher staffing costs increase recurring costs which, in turn, reduces net benefits. The components of compensation cost calculations are further described below.

Table 8: Compensation Costs as Drivers of Net Benefits

	Two-part, minimum	Two-part, maximum	Three-part, minimum	Three-part, maximum
Dispatchers total compensation ($)	5,181,000	6,218,000	6,218,000	8,291,000
Receptionists total compensation ($)	392,000	392,000	785,000	785,000
Change in cost from reduced supervisor ($)	n/a	n/a	(485,000)	(485,000)
Total compensation costs ($)	5,574,000	6,611,000	6,519,000	8,592,000
Change in total recurring costs, compared to current policy ($)	(1,722,000)	(686,000)	(2,739,000)	534,000
Mean present value of net benefits ($)	1,713,000	674,000	3,212,000	(73,000)

Source: Authors.

Cost Calculation for Dispatcher Salaries

Under current policy, dispatchers earn wages based on disparate salary schedules. We assume that under consolidation dispatchers would be placed on the same wage schedule. Therefore, before finding the average salary of a dispatcher, we adjusted dispatchers to the Green County salary schedule. Monroe and Green County's dispatchers appear to earn comparable wage rates, but Brodhead's dispatcher wage schedule is considerably lower than that of Green

County. To address this issue, we applied the three full-time Brodhead dispatchers' years of service to the Green County salary schedule and identified the increased hourly wages that the three dispatchers would earn upon consolidation. The wage increases ranged from 22 percent to 38 percent. We averaged the adjusted salaries of dispatchers in Monroe and Green County to find an average hourly wage of a dispatcher under two-part consolidation. We averaged the adjusted salaries of dispatchers for all three agencies to find the average hourly wage of a dispatcher under three-part consolidation. The difference between the two average wages was four cents, so we used the larger of the two to produce a more conservative estimate. We estimated the dispatcher FTEs' average annual salary by multiplying the average hourly wage of $21.81 by 2,080 hours to get $45,364.80. We used this salary as a point estimate in the Monte Carlo simulation.

Due to a variety of factors, the actual average salary of a dispatcher upon implementation is uncertain. For example, under the maximum staffing alternatives, new staff would need to be hired. Those staff would likely be hired at the lower (less than average) end of the pay scale. Under the minimum staffing alternatives, FTEs would be reduced. If FTEs are reduced through attrition or retirement, then the average salary would likely be lower than the current policy because employees with the most years of experience generally earn higher wages than newer employees. If FTEs are reduced through layoffs, then the average wage would likely increase because of the common practice to layoff the newest, and therefore lowest paid, employees first. This would increase the new average wage. Therefore, when estimating total compensation costs in the Monte Carlo calculations, we use random value draws from a normal distribution, with a mean equal to the new average salary of a dispatcher ($45,364.80) and a $2,268.24 (5 percent) standard deviation.

Cost Calculation for Administrative Assistant Salaries

To estimate the cost of hiring an administrative assistant, we used the salary range posted for a vacant "Administrative Assistant—Police Department" position in Monroe: $33,904.00 per year to $34,944.00 per year.[83]

Cost Calculation for Dispatch Supervisor Salary

As discussed above, Brodhead's wage schedule is lower than Green County's wage schedule. Therefore, to produce a more conservative financial estimate by assuming continuation of the more expensive position, we estimate the cost savings from eliminating a supervisor position using the hourly wage of Brodhead's Dispatch Supervisor position. We took this hourly wage ($20.94) and multiplied it by 2,080 hours and by 1.3393 to account for the cost of fringe benefits in Brodhead (see fringe calculations below). This calculation provided us with a point estimate for the total compensation cost of a dispatch supervisor of $58,333.48.

Cost Calculation for Fringe Benefits

To estimate the expected cost of fringe benefits under each alternative and in future years, we first calculated fringe costs in each jurisdiction as a percent of the whole personnel budget. Monroe's budget data did not break down dispatch personnel costs to fringe benefits. However, the Green County and Brodhead budgets delineate payroll and fringe costs. Fringe costs are equivalent to 40.56 percent of Green County dispatchers' total wages and 33.93 percent of Brodhead dispatchers' total wages. To account for this difference, or uncertainty, in estimating fringe cost, our analysis draws a random value from a uniform distribution of 1.3393 to 1.4056. We used a uniform distribution because there is no mean around which values converge, and because it seems equally likely that any value within the range would be realized. To determine

[83] "Job Descriptions," 2018, http://cityofmonroe.org/government/employment/job_descriptions.php.

the total expected compensation costs for both positions, including fringe benefits, we multiplied the random draw by the new average salary calculations for dispatchers and administrative assistants.

Table 9: Fringe Benefits Calculations

	Green County (2017 anticipated)	Brodhead (2017 actual)
Payroll (salaries and wages, $)	441,489	176,052.67
Overtime ($)	4,783	N/A
Fringe benefits ($)	181,010	59,732.90
Total wages (payroll +overtime, $)	446,272	176,052.67
Fringe benefits as a percent of total wages	40.56	33.93

Sources: Green County Budget, provided by Sheriff Rohloff; Brodhead Budget, provided by Chief Hughes.

Appendix 11: Avoided Equipment Costs

Avoided Cost Calculation for Consoles

To calculate the avoided cost due to reducing the number of console updates, we used randomly drawn values from a uniform distribution between $200,000 and $300,000, assuming the avoided cost would be incurred in year 10 and discounted by 3.5 percent.

Avoided Cost Calculation for Phone Systems

The cost to update a phone system is determined by the volume of calls received by the center.[84] To calculate the expected cost of updating Brodhead's phone system, we used the recent costs Milwaukee County incurred by updating its phone system to find an estimated cost-per-call ratio. Milwaukee County spent $485,000 to update its phone system and handles about 197,000 calls.[85] Therefore, we expect that updating a phone system would cost approximately $2.46 per call. Given Brodhead's call volume of 7,317 in 2017, an expected cost to update the city's 9-1-1 call center phone system is $17,999.82. However, this estimate is limited by the uncertainty of the price of updating the phone system due to different vendor pricing or a change in call volume. Therefore, when calculating the avoided cost of updating Brodhead's phone system in the Monte Carlo simulation, we draw random values from a normal distribution with a mean of $17,999.82 and a standard deviation of $899.99 (+/-5 percent).

[84] Ibid.
[85] Ibid.

Appendix 12: Monte Carlo Simulation Point Estimates

Table 10 provides each point estimate used in the Monte Carlo simulation for this analysis. The basis of each point estimate used in the Monte Carlo simulation is separately provided in Appendices 6-12. As Table 10 also shows, we used a 3.5 percent social discount rate when calculating present values.

Table 10: Point Estimates Used in Monte Carlo Simulation

Description of point estimate	**Point estimate value**	**Appendix**
Moving costs in three-part, minimum	$833.33	6
Moving costs in three-part, maximum	$1,666.67	6
Retraining costs in two-part, minimum	$9,605.93 ($477.85)*****	7
Retraining costs in two-part, maximum	$11,352.46 ($564.73)*****	7
Retraining costs in three-part, minimum	$11,352.46 ($564.73)*****	7
Retraining costs in three-part, maximum	$14,845.52 ($738.49)*****	7
Size of current space – Brodhead	256 sq. ft.	9
Size of current space – Monroe	420 sq. ft.	9
Size of current space – Green County	364 sq. ft.	9
Value of new space	$16-21 / sq. ft.[#]	8
Value of freed space in call centers	0-50 percent of new space value[#]	8
Total FTEs in two-part, minimum	11 (10 dispatcher FTEs + 1 administrative assistant)	9, 10
Total FTEs in two-part, maximum	13 (12 dispatcher FTEs + 1 administrative assistant)	9, 10
Total FTEs in three-part, minimum	14 (12 dispatcher FTEs + 2 administrative assistants)	9, 10
Total FTEs in three-part, maximum	18 (16 dispatcher FTEs + 2 administrative assistants)	9, 10

Current policy compensation – Brodhead	$235,785.57	10
Current policy compensation – Monroe	$250,305.00	10
Current policy compensation – Green County	$627,282.00	10
New average dispatcher salary in consolidation	$45,364.80 ($2,258.92)*****	10
Fringe benefits as a percent of total compensation	33.93-40.56 #	10
Administrative Assistant salary	$33,904.00-34,944.00 #	10
Supervisor compensation, including fringe benefits – Brodhead	$58,333.48	10
Cost of dispatch console	$200,000-300,000 #	11
Cost of phone system	$17,999.82 (899.99)*****	11
Social discount rate (percent)	3.5	1, 12

Point estimate uses a uniform distribution type.
*****Standard deviation indicated in parentheses.

Appendix 13: Monte Carlo Simulation Results

The Monte Carlo simulation yielded positive mean net benefits for two-part consolidation at both staffing levels, and for three-part consolidation with minimum staffing. As shown in Figures 5 and 6, two-part consolidation with minimum and maximum staffing yield positive net benefits in 100 percent and 98.06 percent of trials, respectively. As shown in Figures 7 and 8, three-part consolidation with minimum and maximum staffing yield positive net benefits in 100 percent and 44.7 percent of trials, respectively. In each Figure 5-8, the red vertical line represents the mean value in each distribution period; and the green line marks the zero value where present value of net benefits turn from negative to positive.

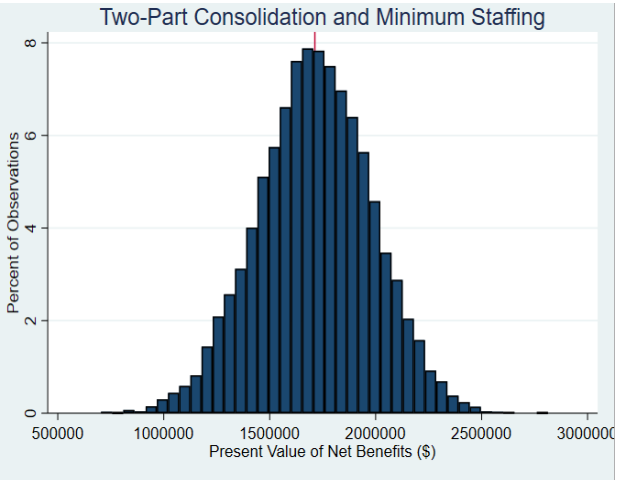

Figure 5. Histogram of Monte Carlo simulation results for two-part consolidation with minimum staffing.
Source: Authors.

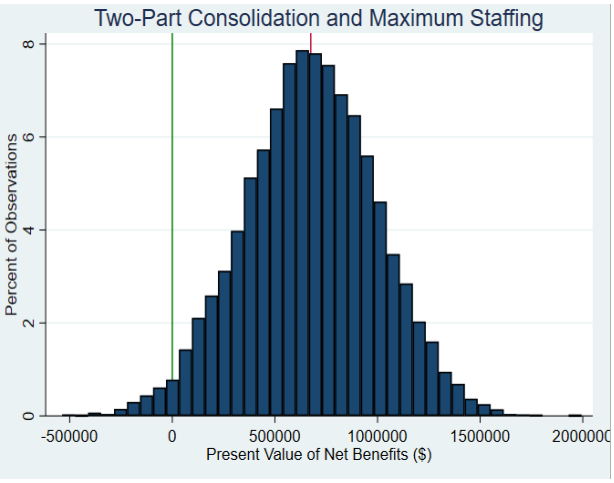

Figure 6. Histogram of Monte Carlo simulation results for two-part consolidation with maximum staffing.
Source: Authors.

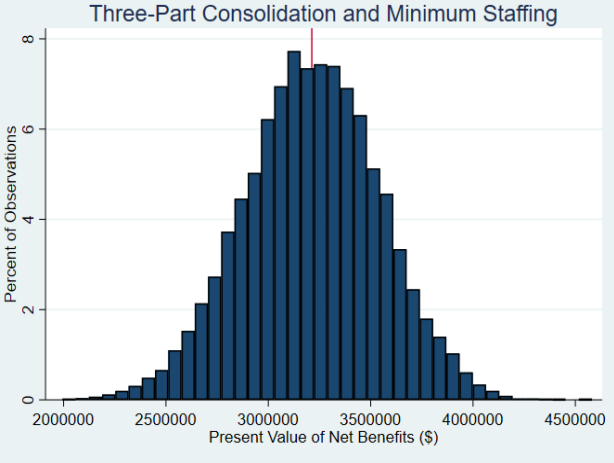

Figure 7. Histogram of Monte Carlo simulation results for three-part consolidation with minimum staffing.
Source: Authors.

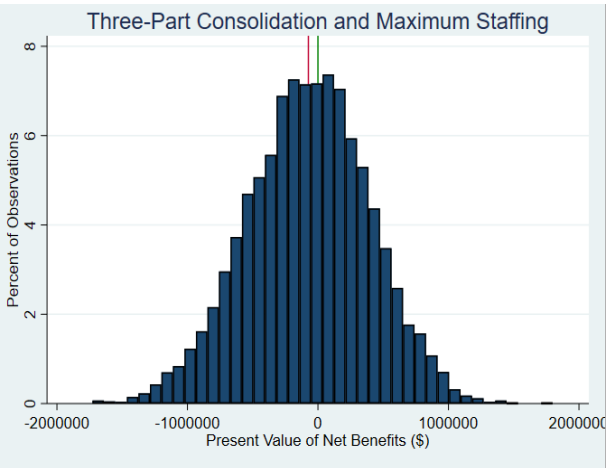

Figure 8. Histogram of Monte Carlo simulation results for three-part consolidation with minimum staffing.
Source: Authors.

As shown in Table 11, two-part consolidation alternative with minimum staffing yielded a mean present value of net benefits of $1,713,000 and the three-part consolidation alternative with minimum staffing consolidation yielded a mean present value net benefits of $3,212,000. Two-part consolidation with maximum staffing yielded a mean present value of net benefits of $674,000, while the three-part consolidation yielded a mean loss of $73,000 in present value of net benefits. Tables 12 and 13 provide additional descriptive statistics and sensitivity analysis of the consolidation alternatives.

Table 11: Present Value of Net Benefits by Alternative

	Two-part, minimum	Two-part, maximum	Three-part, minimum	Three-part, maximum
One-time costs ($)	9,600	11,300	12,100	16,500
Recurring costs ($)	(1,722,000)	(686,000)	(2,739,000)	534,000
Avoided costs / benefits ($)	N/A	N/A	485,000	477,000
Mean present value of net benefits ($)	1,713,000	674,000	3,212,000	(73,000)

Source: Authors.

Table 12: Descriptive Statistics of Present Value of Net Benefits by Alternative

	Two-part, minimum	Two-part, maximum	Three-part, minimum	Three-part, maximum
Standard deviation of present value of net benefits ($)	269,000	323,000	334,000	470,000
Maximum value ($)	2,813,000	1,994,000	4,581,000	1,798,000
Minimum value ($)	703,000	(536,000)	1,993,000	(1,728,000)
Positive observations (%)	100.00	98.06	100.00	44.70

Source: Authors.

Table 13: Sensitivity Analysis of Present Value of Net Benefits by Alternative

	10th Percentile ($)	25th Percentile ($)	50th Percentile ($)	75th Percentile ($)	90th Percentile ($)	Percent of positive trials
Two-part, minimum	1,400,000	1,500,000	1,700,000	1,900,000	2,100,000	100.00
Two-part, maximum	253,000	459,000	675,000	896,000	1,100,000	98.06
Three-part, minimum	2,800,000	3,000,000	3,200,000	3,400,000	3,600,000	100.00
Three-part, maximum	(684,000)	(389,000)	(63,000)	249,000	520,000	44.70

Source: Authors.

Appendix 14: STATA Code

```
cd "C:\Users\User\Documents\Fall 2018\CBA\Stata"
clear all
capture log close
log using 911CBA.log, replace
set more off
eststo clear

set obs 10000

set seed 123456789

**********************************Point Estimates*****************************

//recurring costs
   //cost of space - monthly
scalar c_s2pt=0    //new space cost for 2pt consolidation is 0
scalar c_s3min=0 //new space cost for 3pt minimum consolidation is 0
scalar Bsqft=256 //Brodhead sqft
scalar Gsqft=364 //Green County sqft
scalar Newsqft=650 //New consolidated space sqft in 3part Max model
gen c_space=16+(21-16)*runiform() //cost of space will be between $16 and $21/sqft
gen c_s3max=Newsqft*c_space //new space three-part max
   //above: Brohead opportunity cost + GCSO opportunity cost - cost of newly acquired space

   //staff compensation
scalar ftes2min=10
scalar ftes2max=12
scalar ftes3min=12
scalar ftes3max=16

gen receptionsalary=33904+(34944-33904)*runiform() //receptionist salary, per FTE
gen receptioncomp=receptionsalary*(1.3393+(1.4056-1.3393)*runiform()) //receptionist salary
and fringe, per FTE
scalar reception2ptftes=1 //2pt consolidation requires 1 receptionist for Monroe
scalar reception3ptftes=2 //3pt consolidation requires a receptionist for Monroe and Brodhead

scalar mcompsq=250305 //Monroe total compensation in status quo
scalar gcompsq=627282 //Green County total compenstation in status quo
scalar bcompsq=235785.57 //Brodhead total compensation in status quo
gen sqtotalcomp2=mcompsq+gcompsq //MPD and GCSO status quo
gen sqtotalcomp3=sqtotalcomp2+bcompsq //MPD, GCSO, and BPD status quo
gen supervisor=20.94*2080*1.3393 //Supervisor salary + fringe for Brodhead

gen newavgsalary=(45364.8)+(45364.8*.05)*rnormal() //average dispatch hourly wage is $21.82
```

```
gen newtotalcomp=newavgsalary*(1.3393+(1.4056-1.3393)*runiform()) /*includes fringe
benefits
   cost, fringe is 33.93% of Brodhead's total compensation and 40.56% of GCSO's*/

gen c_comp2min=(ftes2min*newtotalcomp + receptioncomp*reception2ptftes)-sqtotalcomp2
gen c_comp2max=(ftes2max*newtotalcomp + receptioncomp*reception2ptftes)-sqtotalcomp2
gen c_comp3min=(ftes3min*newtotalcomp + receptioncomp*reception3ptftes - supervisor)-
sqtotalcomp3
gen c_comp3max=(ftes3max*newtotalcomp + receptioncomp*reception3ptftes - supervisor)-
sqtotalcomp3

//one-time costs
   //moving costs = quoted $2500 for all three centers
scalar move = 2500/3
scalar moving2pt = 0 //no moving costs needed
gen moving3min=move*1 //Move Brodhead center to Green County
gen moving3max=move*2 //Move Brodhead and Green County centers to new space

   //training costs = # of FTEs * hourly pay rate * 40 hours of training
gen training2min=((ftes2min+1)*newavgsalary/2080)*40
gen training2max=((ftes2max+1)*newavgsalary/2080)*40
gen training3min=((ftes3min+1)*newavgsalary/2080)*40
gen training3max=((ftes3max+1)*newavgsalary/2080)*40

//avoided costs
   //console costs
gen c_console=200000+(300000-200000)*runiform() //cost per console is between $200k-$300k

   //phone system
gen c_phonesB=17999.82+899.99*rnormal() //Brodhead only using 7,317 calls per year

   //opportunity cost of space
gen opcost=0+(.50-0)*runiform() //value of newly available space is between 0% - 50% retail
value
gen avoidedop3min=(Bsqft*c_space*opcost)
gen avoidedop3max=((Bsqft*c_space*opcost)+(Gsqft*c_space*opcost))

   //total avoided equipment costs
scalar avoided2min_10=0 //does not eliminate consoles, nor phone system
scalar avoided2max_10=0 //does not eliminate consoles, nor phone system
gen avoided3min_10=c_console*2 + c_phonesB //eliminates 2 consoles and Brodhead phone
system
gen avoided3max_10=c_console*1 + c_phonesB //eliminates 1 console and Brodhead phone
system

//benefits
```

```
scalar bens=0

//social discount rate
gen rate=.035

**************************Calculate One-Time Costs*****************************

//2min - One-Time Costs
gen pv_onetime2min = moving2pt + training2min

//2max - One-Time Costs
gen pv_onetime2max = moving2pt + training2max

//3min - One-Time Costs
gen pv_onetime3min = moving3min + training3min

//3max - One-Time Costs
gen pv_onetime3max = moving3max + training3max

//One-Time Costs
sum pv_onetime2min
sum pv_onetime2max
sum pv_onetime3min
sum pv_onetime3max

**************************Calculate Recurring Costs*****************************

//2min - Recurring Costs, no discounting
gen recurring2min_1 = c_s2pt*12 + c_comp2min
gen recurring2min_2 = c_s2pt*12 + c_comp2min
gen recurring2min_3 = c_s2pt*12 + c_comp2min
gen recurring2min_4 = c_s2pt*12 + c_comp2min
gen recurring2min_5 = c_s2pt*12 + c_comp2min
gen recurring2min_6 = c_s2pt*12 + c_comp2min
gen recurring2min_7 = c_s2pt*12 + c_comp2min
gen recurring2min_8 = c_s2pt*12 + c_comp2min
gen recurring2min_9 = c_s2pt*12 + c_comp2min
gen recurring2min_10 = c_s2pt*12 + c_comp2min

//2max - Recurring Costs, no discounting
gen recurring2max_1 = c_s2pt*12 + c_comp2max
gen recurring2max_2 = c_s2pt*12 + c_comp2max
gen recurring2max_3 = c_s2pt*12 + c_comp2max
gen recurring2max_4 = c_s2pt*12 + c_comp2max
gen recurring2max_5 = c_s2pt*12 + c_comp2max
gen recurring2max_6 = c_s2pt*12 + c_comp2max
```

```
gen recurring2max_7 = c_s2pt*12 + c_comp2max
gen recurring2max_8 = c_s2pt*12 + c_comp2max
gen recurring2max_9 = c_s2pt*12 + c_comp2max
gen recurring2max_10 = c_s2pt*12 + c_comp2max

//3min - Recurring Costs, no discounting
gen recurring3min_1 = c_s3min*12 + c_comp3min
gen recurring3min_2 = c_s3min*12 + c_comp3min
gen recurring3min_3 = c_s3min*12 + c_comp3min
gen recurring3min_4 = c_s3min*12 + c_comp3min
gen recurring3min_5 = c_s3min*12 + c_comp3min
gen recurring3min_6 = c_s3min*12 + c_comp3min
gen recurring3min_7 = c_s3min*12 + c_comp3min
gen recurring3min_8 = c_s3min*12 + c_comp3min
gen recurring3min_9 = c_s3min*12 + c_comp3min
gen recurring3min_10 = c_s3min*12 + c_comp3min

//3max - Recurring Costs, no discounting
gen recurring3max_1 =  c_s3max*12 + c_comp3max
gen recurring3max_2 =  c_s3max*12 + c_comp3max
gen recurring3max_3 =  c_s3max*12 + c_comp3max
gen recurring3max_4 =  c_s3max*12 + c_comp3max
gen recurring3max_5 =  c_s3max*12 + c_comp3max
gen recurring3max_6 =  c_s3max*12 + c_comp3max
gen recurring3max_7 =  c_s3max*12 + c_comp3max
gen recurring3max_8 =  c_s3max*12 + c_comp3max
gen recurring3max_9 =  c_s3max*12 + c_comp3max
gen recurring3max_10 =  c_s3max*12 + c_comp3max

//2min - Recurring Costs, Discounted to present value, Years 1-10
gen pv_recurring2min_1 = recurring2min_1/(1+rate)^1
gen pv_recurring2min_2 = recurring2min_2/(1+rate)^2
gen pv_recurring2min_3 = recurring2min_3/(1+rate)^3
gen pv_recurring2min_4 = recurring2min_4/(1+rate)^4
gen pv_recurring2min_5 = recurring2min_5/(1+rate)^5
gen pv_recurring2min_6 = recurring2min_6/(1+rate)^6
gen pv_recurring2min_7 = recurring2min_7/(1+rate)^7
gen pv_recurring2min_8 = recurring2min_8/(1+rate)^8
gen pv_recurring2min_9 = recurring2min_9/(1+rate)^9
gen pv_recurring2min_10 = recurring2min_10/(1+rate)^10

//2max - Recurring Costs, Discounted to present value, Years 1-10
gen pv_recurring2max_1 = recurring2max_1/(1+rate)^1
gen pv_recurring2max_2 = recurring2max_2/(1+rate)^2
gen pv_recurring2max_3 = recurring2max_3/(1+rate)^3
gen pv_recurring2max_4 = recurring2max_4/(1+rate)^4
```

```
gen pv_recurring2max_5 = recurring2max_5/(1+rate)^5
gen pv_recurring2max_6 = recurring2max_6/(1+rate)^6
gen pv_recurring2max_7 = recurring2max_7/(1+rate)^7
gen pv_recurring2max_8 = recurring2max_8/(1+rate)^8
gen pv_recurring2max_9 = recurring2max_9/(1+rate)^9
gen pv_recurring2max_10 = recurring2max_10/(1+rate)^10

//3min - Recurring Costs, Discounted to present value, Years 1-10
gen pv_recurring3min_1 = recurring3min_1/(1+rate)^1
gen pv_recurring3min_2 = recurring3min_2/(1+rate)^2
gen pv_recurring3min_3 = recurring3min_3/(1+rate)^3
gen pv_recurring3min_4 = recurring3min_4/(1+rate)^4
gen pv_recurring3min_5 = recurring3min_5/(1+rate)^5
gen pv_recurring3min_6 = recurring3min_6/(1+rate)^6
gen pv_recurring3min_7 = recurring3min_7/(1+rate)^7
gen pv_recurring3min_8 = recurring3min_8/(1+rate)^8
gen pv_recurring3min_9 = recurring3min_9/(1+rate)^9
gen pv_recurring3min_10 = recurring3min_10/(1+rate)^10

//3max - Recurring Costs, Discounted to present value, Years 1-10
gen pv_recurring3max_1 = recurring3max_1/(1+rate)^1
gen pv_recurring3max_2 = recurring3max_2/(1+rate)^2
gen pv_recurring3max_3 = recurring3max_3/(1+rate)^3
gen pv_recurring3max_4 = recurring3max_4/(1+rate)^4
gen pv_recurring3max_5 = recurring3max_5/(1+rate)^5
gen pv_recurring3max_6 = recurring3max_6/(1+rate)^6
gen pv_recurring3max_7 = recurring3max_7/(1+rate)^7
gen pv_recurring3max_8 = recurring3max_8/(1+rate)^8
gen pv_recurring3max_9 = recurring3max_9/(1+rate)^9
gen pv_recurring3max_10 = recurring3max_10/(1+rate)^10

//PVNB 2min - Total
egen pv_recurring2min = rowtotal(pv_recurring2min_1-pv_recurring2min_10)

//PVNB 2max - Total
egen pv_recurring2max = rowtotal(pv_recurring2max_1-pv_recurring2max_10)

//PVNB 3min - Total
egen pv_recurring3min = rowtotal(pv_recurring3min_1-pv_recurring3min_10)

//PVNB 3max - Total
egen pv_recurring3max = rowtotal(pv_recurring3max_1-pv_recurring3max_10)

//Recurring Costs
sum pv_recurring2min
sum pv_recurring2max
```

```
sum pv_recurring3min
sum pv_recurring3max

**************************Calculate Avoided Costs*******************************

//2min - Avoided Costs for New Space (opportunity cost) = 0
//2max - Avoided Costs for New Space (opportunity cost) = 0

//3min - Avoided Costs for New Space (opportunity cost)
gen opcost3min_1 = avoidedop3min*12
gen opcost3min_2 = avoidedop3min*12
gen opcost3min_3 = avoidedop3min*12
gen opcost3min_4 = avoidedop3min*12
gen opcost3min_5 = avoidedop3min*12
gen opcost3min_6 = avoidedop3min*12
gen opcost3min_7 = avoidedop3min*12
gen opcost3min_8 = avoidedop3min*12
gen opcost3min_9 = avoidedop3min*12
gen opcost3min_10 = avoidedop3min*12

//3min - Avoided Costs for New Space (opportunity cost)
gen opcost3max_1 = avoidedop3max*12
gen opcost3max_2 = avoidedop3max*12
gen opcost3max_3 = avoidedop3max*12
gen opcost3max_4 = avoidedop3max*12
gen opcost3max_5 = avoidedop3max*12
gen opcost3max_6 = avoidedop3max*12
gen opcost3max_7 = avoidedop3max*12
gen opcost3max_8 = avoidedop3max*12
gen opcost3max_9 = avoidedop3max*12
gen opcost3max_10 = avoidedop3max*12

//3min - Opportunity Costs, Discounted to present value, Years 1-10
gen pv_opcost3min_1 = opcost3min_1/(1+rate)^1
gen pv_opcost3min_2 = opcost3min_2/(1+rate)^2
gen pv_opcost3min_3 = opcost3min_3/(1+rate)^3
gen pv_opcost3min_4 = opcost3min_4/(1+rate)^4
gen pv_opcost3min_5 = opcost3min_5/(1+rate)^5
gen pv_opcost3min_6 = opcost3min_6/(1+rate)^6
gen pv_opcost3min_7 = opcost3min_7/(1+rate)^7
gen pv_opcost3min_8 = opcost3min_8/(1+rate)^8
gen pv_opcost3min_9 = opcost3min_9/(1+rate)^9
gen pv_opcost3min_10 = opcost3min_10/(1+rate)^10

//3max - Opportunity Costs, Discounted to present value, Years 1-10
gen pv_opcost3max_1 = opcost3max_1/(1+rate)^1
```

```
gen pv_opcost3max_2 = opcost3max_2/(1+rate)^2
gen pv_opcost3max_3 = opcost3max_3/(1+rate)^3
gen pv_opcost3max_4 = opcost3max_4/(1+rate)^4
gen pv_opcost3max_5 = opcost3max_5/(1+rate)^5
gen pv_opcost3max_6 = opcost3max_6/(1+rate)^6
gen pv_opcost3max_7 = opcost3max_7/(1+rate)^7
gen pv_opcost3max_8 = opcost3max_8/(1+rate)^8
gen pv_opcost3max_9 = opcost3max_9/(1+rate)^9
gen pv_opcost3max_10 = opcost3max_10/(1+rate)^10

//PVNB 3min - Total
egen pv_opcost3min = rowtotal(pv_opcost3min_1-pv_opcost3min_10)

//PVNB 3max - Total
egen pv_opcost3max = rowtotal(pv_opcost3max_1-pv_opcost3max_10)

//2min - Avoided Costs, Discounted to present value, Year 10
gen pv_avoided2min = (avoided2min_10/(1+rate)^10)

//2max - Avoided Costs, Discounted to present value, Year 10
gen pv_avoided2max = (avoided2max_10/(1+rate)^10)

//3min - Avoided Costs, Discounted to present value, Year 10
gen pv_avoided3min = (avoided3min_10/(1+rate)^10) + pv_opcost3min

//3max - Avoided Costs, Discounted to present value, Year 10
gen pv_avoided3max = (avoided3max_10/(1+rate)^10) + pv_opcost3max

//Avoided Costs
sum pv_avoided2min
sum pv_avoided2max
sum pv_avoided3min
sum pv_avoided3max

**********Calculate Net Present Benefits/Costs**********

gen costs2min = pv_onetime2min + pv_recurring2min - pv_avoided2min
gen costs2max = pv_onetime2max + pv_recurring2max - pv_avoided2max
gen costs3min = pv_onetime3min + pv_recurring3min - pv_avoided3min
gen costs3max = pv_onetime3max + pv_recurring3max - pv_avoided3max

gen pvnb2min = bens - costs2min
gen pvnb2max = bens - costs2max
gen pvnb3min = bens - costs3min
gen pvnb3max = bens - costs3max
```

```
sum pvnb2min
sum pvnb2max
sum pvnb3min
sum pvnb3max

**********************************Histograms*********************************

label variable pvnb2min "Present Value of Net Benefits ($)"
label variable pvnb2max "Present Value of Net Benefits ($)"
label variable pvnb3min "Present Value of Net Benefits ($)"
label variable pvnb3max "Present Value of Net Benefits ($)"

hist pvnb2min, percent ytitle(Percent of Observations) name(twomin, replace) /*
   */title(Two-Part Consolidation and Minimum Staffing) fcolor(navy) lcolor(black)/*
   */ xline(0) xline(1713067)
hist pvnb2max, percent ytitle(Percent of Observations) name(twomax, replace) /*
   */title(Two-Part Consolidation and Maximum Staffing) fcolor(navy) lcolor(black)/*
   */ xline(0) xline(674746.9)
hist pvnb3min, percent ytitle(Percent of Observations) name(threemin, replace) /*
   */title(Three-Part Consolidation and Minimum Staffing) fcolor(navy) lcolor(black)/*
   */ xline(0) xline(3212643)
hist pvnb3max, percent ytitle(Percent of Observations) name(threemax, replace) /*
   */title(Three-Part Consolidation and Maximum Staffing) fcolor(navy) lcolor(black)/*
   */ xline(0) xline(-73293.19)

**************************Percent Positive and Negative PVNBs********************

//2min
count if pvnb2min==0
count if pvnb2min<0
count if pvnb2min>=0
sum pvnb2min
codebook pvnb2min

//2max
count if pvnb2max==0
count if pvnb2max<0
count if pvnb2max>=0
sum pvnb2max
codebook pvnb2max

//3min
count if pvnb3min==0
count if pvnb3min<0
count if pvnb3min>=0
sum pvnb3min
```

```
codebook pvnb3min

//3max
count if pvnb3max==0
count if pvnb3max<0
count if pvnb3max>=0
sum pvnb3max
codebook pvnb3max
```

About UniverCity Year

UniverCity Year is a three-phase partnership between UW-Madison and one community in Wisconsin. The concept is simple. The community partner identifies projects that would benefit from UW-Madison expertise. Faculty from across the university incorporate these projects into their courses, and UniverCity Year staff provide administrative support to ensure the collaboration's success. The results are powerful. Partners receive big ideas and feasible recommendations that spark momentum towards a more sustainable, livable, and resilient future. Join us as we create better places together.

GREEN COUNTY WISCONSIN

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