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Evaluation of a Pilot Intervention to Relink Formerly Incarcerated PLWHAs to HIV/AIDS Care

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ABSTRACT

HIV is a manageable chronic disease. However, it requires knowing one's status, retention in care, and medication adherence for viral suppression. Disadvantaged groups of persons living with HIV/AIDS (PLWHAs) who experience incarceration and major depressive disorders, homelessness, substance use and lack of social support are overwhelmed by these burdens and do not fully engage in HIV care, without help. Four Northeast Florida entities engaged in action research to influence health equity for formerly detained PLWHAs. The City of Jacksonville, Ryan White Part-A Program, Florida Department of Health-Duval, Lutheran Social Services, and Jacksonville Sherriff's Office convened a coalition, called CAPRICE. Activities focused on intensive medical case management, linkage to core HIV services, job placement, and up to 90-days of transition housing to support the transition from jail to community. The coalition created system level relationships, with structure and processes. Next steps should focus on how to support the infrastructure for disadvantaged groups over the long-term. Estimated sustainable cost compared reasonably with published research. The local HIV Health Services Planning Council and CAPRICE members have the task of garnering financial support for this work, which aims to plug one of the leaks in the local HIV Continuum of Care.

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BACKGROUND

America's chronic disease burden is pervasive. At the turn of the century, slightly more than one-fifth of the non-institutionalized population had two or more diseased states, of duration lasting 12 months or longer that required long-term medical care (Anderson & Horvath, 2004). Therefore, it is not surprising that chronic diseases also affect institutionalized populations, including those in local jails and state and federal prisons. What follows is a snapshot of a small slice of the larger chronic disease burden. That slice is HIV infection, which requires medication adherence if it "...is to become a truly chronic disease" (Deeks et al., 2013, p. 2).

More than 1.2 million PLWHAs live in the United States (U.S.). Of this group, annually, one-sixth live in correctional facilities on a recurring basis (Meyer et al., 2014). The recently incarcerated population has

an increased burden of comorbid mental health and substance abuse disorders, a higher incidence of homelessness and unemployment, and less health care coverage. Incarceration also associates with high-risk sexual and substance use behaviors. Moreover, affected groups are more likely to be poor and non-white (Westergaard et al., 2013; Mayer, Mayer, Althoff, & Altice, 2013; Binswanger et al., 2009). These disadvantages collectively decrease rates of continuous engagement in care leading to higher HIV-related morbidity and higher community viral loads (Williams et al., 2013).

The Transitional Care Coordination model, (TCCM), provides a framework for addressing the needs of formerly incarcerated PLWHAs. TCCM focuses on "...improving continuity of health care by transitioning clients from jails to community health care" in ways that are comprehensive, client-

centered, and personally empowering. The TCCM has linkage and retention in outpatient, ambulatory medical care in its focus.

PURPOSE

PLWHAs with incarceration histories have a plethora of unmet needs. These needs range from survival to social to health services, and such needs, if not addressed promptly, can overwhelm a person's innate resources such that adherence to life-saving, antiretroviral treatments is not a high priority (Nunn et al., 2010). Hence, Rapp et al., (2013) called for creativity in the design of HIV care reengagement interventions. In response to that call, public health, public safety, and health services delivery systems in Northeast Florida created a coalition to address the needs of PLWHAs.

Four Northeast Florida entities sought to address PLWHAs unmet needs by a coalition called CAPRICE. It stands for Consortia Advocacy Program for Relinking Incarcerated PLWHAs to Care Early. Coalition members included the Ryan White Parts A & B programs, Lutheran Social Services, and the Jacksonville Sheriff's Office. In fall 2015, the Jacksonville Transitional Grant Area (JTGA), HIV Health Services Planning Council approved an agenda for the pilot, CAPRICE, program and in spring 2016, formal implementation of the pilot began after completion of the planning phase. In theory, the coalition is sustainable because each entity has an enduring agenda and the trio shares consensus on the theme of access to life-saving HIV care for people living with HIV/AIDS, (PLWHAs) and health protection of the uninfected community. Using in-kind resources and limited, carryover funds from the fiscal year 2015, the coalition implemented CAPRICE to plug one of the leaks in the local HIV treatment cascade, a.k.a., HIV Continuum of Care. The treatment cascade refers to the sequence of steps from HIV diagnosis, linkage to HIV care, On-ART, retention-in-care, and HIV RNA viral suppression (Kay et al., 2016).

Sustainability of CAPRICE to address unmet needs of PLWHAs with incarceration histories is important for the transition from jail to community. However, "Sustaining interventions in the absence of regulatory and financial incentives confound even those healthcare organizations and systems with the best of intentions" (Parrish et al., 2009, p. 283). It is almost a decade since 2009, and healthcare systems are making strides toward understanding the determinants of intervention sustainability. For example, to be sustainable, interventions require community readiness, collaborative support, and financial support, among others (Tibbits et al., 2010). What is clear is sustainability is not automatic, but it is calculable.

The aim of this study is threefold: (1) identify a best-fitted model, (BFM), for the observed data generated by CAPRICE; (2) If a BFM emerges, estimate the economic cost of continuation of CAPRICE; and (3) Use the BFM to calculate return on investment. Locally, CAPRICE is one of the plugs that HIV health services researchers and practitioners have identified for closing gaps in the Jacksonville Transitional Grant Area HIV Continuum of Care, (HCC). Our working hypothesis is HCC gaps will shrink when individuals complete multiple steps. These steps begin with self-awareness of HIV status. Next is ongoing engagement in HIV medical care. Then start antiretroviral therapy, (ART), followed by ART adherence, which is essential to maximally reduce community viral load (Pence, O'Donnell, & Gaynes, 2012). Thus, model selection for cost estimation is imperative if the local HIV Health Services Planning Council must effectively evaluate the sustainability of CAPRICE in Duval County, Florida. A brief description of the pilot intervention follows. CAPRICE is an intensive Medical Case Management intervention. It links formerly detained PLWHAs to support services, including mental health, substance abuse treatment services, and up to 90-days of transitional housing. It also coordinates job training or placement, as indicated, and transitions former detainees to either a new community Case Manager or a former Community Case Manager, in instances of pre-incarceration involvement in HIV care. The intervention begins pre-release, triggered by voluntary consent of detainees and a phone call by jail staff to the CAPRICE Case Manager. Then, dedicated CAPRICE personnel begin screening and rapport development and follow the detainee through his or her court date and the discharge planning process. Intervention activities continue post-release through 90 days by which time the client transitions either to self-motivated involvement in HIV care or standard Ryan White Case Management. The pilot program cost estimation analysis focused on two variables: the cost of FTEs for each interventionist and number of duplicative person contacts per year because each client meets different service staff. Methods researchers have noted that "...Many health economics and health services research problems [are replacing the linear regression model with nonlinear regression models], as these models are often more appropriate for... skewed distributions such as healthcare costs" (Terza et al., 2008, p. 532). That observation guided our model-testing environment, which compared six bivariate regression models to one set of paired data points for the two, previously mentioned variables. The programmatic questions of interests include:

- Which model, if any, best defines the dependent variable as a function of the predictor variable?
- If a suitable model emerges, what is the cost of sustaining the intervention beyond the pilot phase?
- What was the reach of the pilot program?
- What is the expected return on the CAPRICE investment as measured by linkage to HIV care, defined as the first medical appointment after detention and retention in HIV care, defined as at least two HIV medical appointments kept in the measurement year at least 90 days apart?

METHODS

The literature on re-engaging PLWHAs in ambulatory medical care by Rapp et al., 2013 provided the impetus for our work. The term, *our work*, is a euphemism for action research—solving practical problems through a process of “problem identification, choosing an option from among alternatives, taking action, evaluating the action, and identifying general findings” (Susman & Evered, 1978, p. 588). Hence, the City of Jacksonville Social Services Division, (COJ), Florida Department of Health (FDOH)—Duval, Lutheran Social Services, (LSS), and Jacksonville Sheriff Office (JSO) convened as a coalition. In five meetings, coalition members reviewed documentation, brainstormed ideas from legacy Jail Link experiences in Duval County, and planned coalition activities. These meetings were one hour in duration, and average attendance was eight participants.

Structure and organization of the planning meetings were integral to the evolution of the coalition. COJ Ryan White Administrative Agency program manager had responsibility for agenda setting with input from participants, room reservations, meeting set up, convening stakeholders via meeting reminders, conducting the meeting, making task assignments when needed, summarizing consensus actions and decisions, articulating next steps, and preparing meeting Minutes. LSS had responsibility for assembling a work plan with a budget based on input received from participants. FDOH—Duval had responsibility for procurement of Memorandum of Agreements between participating agencies, staffing on weekends and part-time during weekdays. JSO had responsibility for coordinating external agencies access to the jail, lead agency staff orientation to lock-down processes once inside the custodial facility, access to client information for Jacksonville Transitional Grant Area, (JTGA) centralized electronic medical record, (CAREWare), and bidirectional communication with the lead agency.

Focusing the planning meetings was also integral to evolving the coalition. The specific foci of discussions were the local jurisdiction HIV Treatment Cascade gaps, average monthly incarceration rates among PLWHAs past 12-months, recidivism—repeat offenders, variability and uncertainty of release date from the penal system, jail access eligibility requirements, multiple agency staffing coordination, task sequencing, and data management and security. Dividing the coalition into three workgroups provided momentum for completing assigned tasks that culminated in a flexible implementation work-plan. For efficiency of care coordination, stakeholder accountability, and process documentation, LSS served as lead agency for implementation activities. In contrast, COJ served as evaluation and conceptual coordinators, and FDOH—Duval served as process reviewer and back-up support role to the lead agency. In the first quarter of implementation, the coalition met monthly to review processes, reach consensus on contingency plans when implementation integrity faltered, and document lessons learned. After the first quarter when processes stabilized, coalition meetings occurred quarterly until the end of the pilot implementation year.

RESULTS

Which model, if any, best defines the dependent variable as a function of the predictor variable? We used STATA, version 14 for data analysis and followed a regression framework. A formative assumption was there is “...a single best model” in the universe that generated the observed data. Unclear about which model generated the data, evaluation of competing models compared six, examining the relative support for each model in the observed data (Johnson & Omland, 2004). Table 1 presents a comparison of six univariate regression models. Each model regressed annual project salary, (for the 10 professionals associated with CAPRICE, hereafter referred to as *program cost*), on person contacts each profession had during the pilot year, (hereafter referred to as *annual person contacts*). The null hypothesis, (H_0), stated that the population Beta coefficient is zero, ($H_0: \beta = 0$). Using the F statistic, three of the six models were statistically significant ($p < .05$). A discussion of the models that refuted H_0 follows.

Logarithmic regression model, $[y = a + b \cdot \ln(x)]$. The computed F statistic, ($F(1, 8) = 5.65$), was greater than the critical F value, ($F = 5.32$) on the $p = 0.5$ table. The computed r^2 was 41.39%. The root mean square error, (RMSE), was 12,979. The coefficient of variation, (CV), was 239,391.56. The sample beta coefficient was statistically significant at $p < .05$, ($b = 11,147.500$, $t = 2.380$, $p = 0.045$). The Akaike Information Criterion, (AIC), was 219.57.

Power regression model, $[y = a \cdot x^{(b)}]$. The computed F statistic, (F (1, 8) = 13.40), was greater than the critical F value, (F = 5.32) on the $p = 0.5$ table. The computed r^2 was 62.62%. The root mean square error, (RMSE), was 0.481. The coefficient of variation, (CV), was 8.88. The sample beta coefficient was significant at $p < .01$, ($b = 0.637$, $t = 3.660$, $p = 0.006$). The Akaike Information Criterion, (AIC), was 15.53.

Exponential regression model, $[y = a \cdot e^{(bx)}]$. The computed F statistic, (F (1, 8) = 9.72), was greater than the critical F value, (F = 5.32) on the $p = 0.5$ table. The computed r^2 was 54.84%. The root mean square error, (RMSE), was 0.529. The coefficient of variation, (CV), was 9.76. The sample beta coefficient was significant at $p < .01$, ($b = 0.003$, $t = 3.120$, $p = 0.014$). The Akaike Information Criterion, (AIC), was 17.42.

Taken together, the largest F-Statistic—the ratio of the model mean squares to residual mean squares—is indicative of the smallest prediction error, (residuals). Evidence from the model CV, which made the RMSE unitless, and the AIC supported the F statistic. Juxtaposing these three measures with the model r -square, the power regression model emerged as the best-fitted model that accounted for the observed data.

If a suitable model emerges, what is the cost of sustaining the intervention beyond the pilot phase?

CAPRICE's sustainable economic cost based on the power regression follows the function $y = a \cdot x^b$. Let letter a equal the intercept term exponentiated, (exp). Let y equal program cost and let x equal number of person contacts that each professional had during the pilot implementation year. Therefore, $y = \exp(6.40596) \cdot (3060^{0.6368833})$. By simplifying the right side of the function, it yields $(605.442745) \cdot (165.957837)$. The cross-product of the two terms equals \$100,477.97. Program cost based on a best fitting model provides opportunities for extrapolating the future cost of y by substituting values of x into the equation (Elton & Gruber, 1972).

What was the reach of the pilot program? Figure 1 presents evidence of the reach of CAPRICE. In the calendar-year 2015, Duval County, Jacksonville, Florida Pre-Trial Detention Facility, (PTDF), housed 319 PLWHAs. Of this group, 137, (42.9%), voluntarily consented and completed the CAPRICE screening. However, by their court date, held within 15 days of detention, 18 were prison bound. Of the remaining 119, nine were set free after their court appearance, and all nine self-transitioned to the community without any further contact with CAPRICE staff. Thus, 110, (80.3%), of the original 137 consenting PLWHAs maintained contact with CAPRICE staff, and they enrolled 100, (73.0%), in the intervention protocol and eight, (5.8%), were excluded due to mental health disorders. Staff linked

these eight participants to more intensive psychiatric services for paranoid schizophrenia, dissociative identity disorder, major depressive recurrent disorder, mixed anxiety-depressive disorder, and schizoaffective disorder. Two PLWHAs decline enrollment. Figure 2 presents service utilization among enrollees. One in two received medical case management, slightly more than 1 in 3 received employment services and received job placement, almost 1 in 4 received mental health services, and almost 1 in 5 received the maximum 90-days transitional housing services.

What is the expected return on the CAPRICE investment as measured by linkage to HIV care, defined as the first medical appointment after detention and retention in HIV care, defined as at least two HIV medical appointments kept, post-detention, in the measurement year at least 90 days apart? Table 2 presents linkage and retention in HIV ambulatory medical care among CAPRICE's participants. Staff scheduled 46 HIV medical appointments, one for each participant. The majority, ($n = 38$, 82.6%), attended the first appointment and fewer, ($n = 30$, 65.2%), attended the second appointment; however, differences in proportions were not significant at $\alpha = .05$, ($Z = 0.425$, $p = .667$). Aggregated data findings can be misleading; therefore, disaggregated analyses explored subgroup differences. The results mirrored the findings from the aggregated data analysis. At least three of four participants attended the first appointment and about two-thirds attended the second appointment across all groups.

DISCUSSION

We fulfilled three objectives—model fitting, cost estimation, and return on investment determination. The results provide evidence of the best fitting model of the observed data. A multiplicative, power regression model had the best performance above five competing models, among which, two other viable models were rivals. Summarizing the three rival models, their proportion of shared variance, (r^2), from the regression of program cost on annual person contacts, emerged as a "...useful... measure of the success of predicting..." (Nagelkerke, 1991, p. 691) program cost. Model building research posits that r^2 compares the bivariate model with the null model that has only the intercept term; thus, r^2 is a robust measure of association between program costs and annual person contacts (Edwards et al., 2008). One cautionary note – the simple association between a criterion variable and a predictor variable is not enough to confirm the adequacy of a prediction model; so, other model statistics are useful for model selection decision-making. Thus, attention turns to the model statistics derived from an assessment of residuals.

Table 1. Comparison of regression models for program costs as a function of number of person contacts per year

Regression Models	Linear	Polynomial	Logarithmic	Square Root	Power	Exponential
F-Statistic	F(1, 8)=4.28	F(2, 7)=2.54	F(1, 8)=5.65	F(1, 8)=5.09	F(1, 8)=13.40	F(1, 8)=9.72
Probability > F	0.0723	0.1482	-	-	-	-
F-Table Critical Value*	5.32	4.73	5.32	5.32	5.32	5.32
r ²	34.86%	42.05%	41.39%	38.87%	62.62%	54.84%
Adjusted r ²	26.72%	25.49%	34.06%	31.23%	57.95%	49.20%
Root Mean Square Error	13683.000	13797.000	12979.000	13254.340	0.481	0.529
Coefficient of Variation	252366.760	254466.580	239391.560	244465.420	8.879	9.759
b (sample beta)	46.920	149.480	11147.500	1547.410	0.637	0.003
t-Statistic	2.070	1.330	2.380	2.260	3.660	3.120
p-Value (for beta)	.072	.225	.045	.054	.006	.014
95% CI, Lower Limit	-5.370	-116.310	331.370	-34.570	0.236	0.001
95% CI, Upper Limit	99.200	415.260	21963.630	3129.400	1.038	0.005
Akaike Information Criterion	220.625	221.456	219.570	219.989	15.526	17.416

*F-table (p = .05): http://www.socr.ucla.edu/Applets.dir/F_Table.html#FTable0.05

Residuals—differences between observed and predicted results—are useful for model selection. Hence, RMSE measured each model's error variance. RMSE is an indicator of model performance because a model with a smaller RMSE is a better representation of the observed data than a model with a larger RMSE (Chai & Draxler, 2014; Pandey & Nguyen, 1999). Because RMSE is not unitless, cross comparisons would be problematic. However, dividing the RMSE by the mean of the predicted dependent variable yields another measure called the coefficient of variation, (CV). Some researchers think of it as a variability measure, while others regard it as a precision measure (Busing, Groenen, Rotterdam, & Heiser, 2005; Bendel, Higgins, Teberg, & Pyke, 1989). Either way, CV is a unitless measure of model fit, where smaller values are indicative of better model fit above larger values. The story of model fitting is neither an exact nor a perfect science. Thus, another tool in the model selection decision-making process is the Akaike Information Criterion, (AIC). AIC is a quantitative "...estimate of the... information lost [when] using a model to approximate the process that generated the observed data, (Johnson & Omland, 2004, p. 102); consequently, smaller AIC values are indicative of a better fitting model. All of these units of information converged to support the selection of the power regression model as the model of best fit for the observed data. Linkage to HIV primary medical care was encouraging, but not

perfect, even with intensive medical case management. Participants kept four of every five scheduled linkage, (first), appointments compared to two of every three-scheduled retention, (second or more), appointments. The linkage rate of 82.6% in the pilot year established a reasonable baseline for benchmarking. Research using a randomized trial study design expected "...the success rate in the [case management] group [to] be between 75% and 80%" (Gardner et al., 2005, p. 425). CAPRICE did slightly better than the upper limit of the gold standard research study.

This study has limitations. The design of action research produces context dependent findings. Therefore, knowledge may not be broadly generalizable to contexts that are different from the settings where this intervention evolved. However, this limitation rests on a positivist model of science, which assumes that researchers are independent of the research they conduct. Members of the CAPRICE team and the study authors who work in the Jacksonville, Florida community did not satisfy that epistemological assumption.

Conclusions

Predicting public health and health services interventions sustainable cost and quantifying the return on those interventions is paramount in times of political and economic uncertainty. In Duval County, roughly half of the incarcerated PLWHAs are

Table 2. Demographics of CAPRICE enrollees linked to and retained in ambulatory HIV medical care in 2016

Groups by Appointment Keeping			One OAMC Visit		Two + OAMC Visits		X ² value	p-value
	n	%						
All			38	82.61%	30	65.22%		
Gender	46							
Female	12	26%	9	75%	8	67%	0.0795	.778
Male	34	74%	29	85%	22	65%		
Race	46							
Black	36	78%	30	83%	23	64%	0.0507	.821
White	10	22%	8	80%	7	70%		
Age-Groups	46							
13-24 Years	6	13%	6	100%	4	67%	More than 20% of the cells had observed values less than 5, which violated one of the	
25-34 Years	16	35%	13	81%	10	63%		
35-44 Years	8	17%	7	88%	6	75%		
45-54 Years	12	26%	10	83%	8	67%		
55-64 Years	4	9%	2	50%	2	50%		
Age-Groups (Collapsed)	46							
13-34 Years	22	48%	19	86%	14	64%	0.0746	.785
35-64 Years	24	52%	19	79%	16	67%		

Note. OAMC is outpatient ambulatory medical care. One OAMC is linkage to ambulatory HIV medical care. Two + OAMC is retention in ambulatory HIV

actively engaged in care at the time of arrest. Considering the additional hardships brought on by incarceration, in the absence of robust relinkage interventions during and after incarceration, it is unlikely that this percentage would improve after release. The burdens of incarceration layered onto existing HIV-related disparities constitute an additional risk factor for maintaining treatment cascade gaps. Therefore, periods of incarceration, and recidivism, in the absence of external social support and social capital development, have the effect of depleting resources and diminishing personal capacities for prioritizing personal health and wellness above survival, at least from Maslow's hierarchy of needs perspective (McLeod, 2018). For this reason, determining the sustainable cost of intervention mediated relinkage to HIV care is necessary if the work of reconnecting disadvantaged, formerly incarcerated PLWHAs to HIV outpatient primary medical care will continue.

Cost estimates for public health and health services must be evidence and methods based. The application of statistical methods to program cost data estimation provided an empirical window into intervention sustainability. To estimate the sustainable cost of mediated relinkage to HIV medical care, we used regression modeling for estimation of model parameters. Based on the assumption that the best-fitted model generated the observed data and accounted for the relationship defined by a set of data points, we have created an empirical basis for extrapolating the cost of funding the program beyond the pilot year. Pairs of data points represented program cost, (for project salary), and annual person contacts, (for each service received by face-to-face contact with staff). Regression determined the values of model parameters that generated the observed data. Fitted models minimized "the squared sum of the [residuals, i.e., differences] between observed and predicted" scores (Pandey & Nguyen, 1999, p. 94). The result, if graphed, would show a line of best fit that estimates the relationship between the dependent and predictor variables; which, visually represents a regression function that implies one value of x gives one and only one value of y.

Figure 1. Reach of the CAPRICE pilot program to relink detainees to HIV primary medical care relinkage

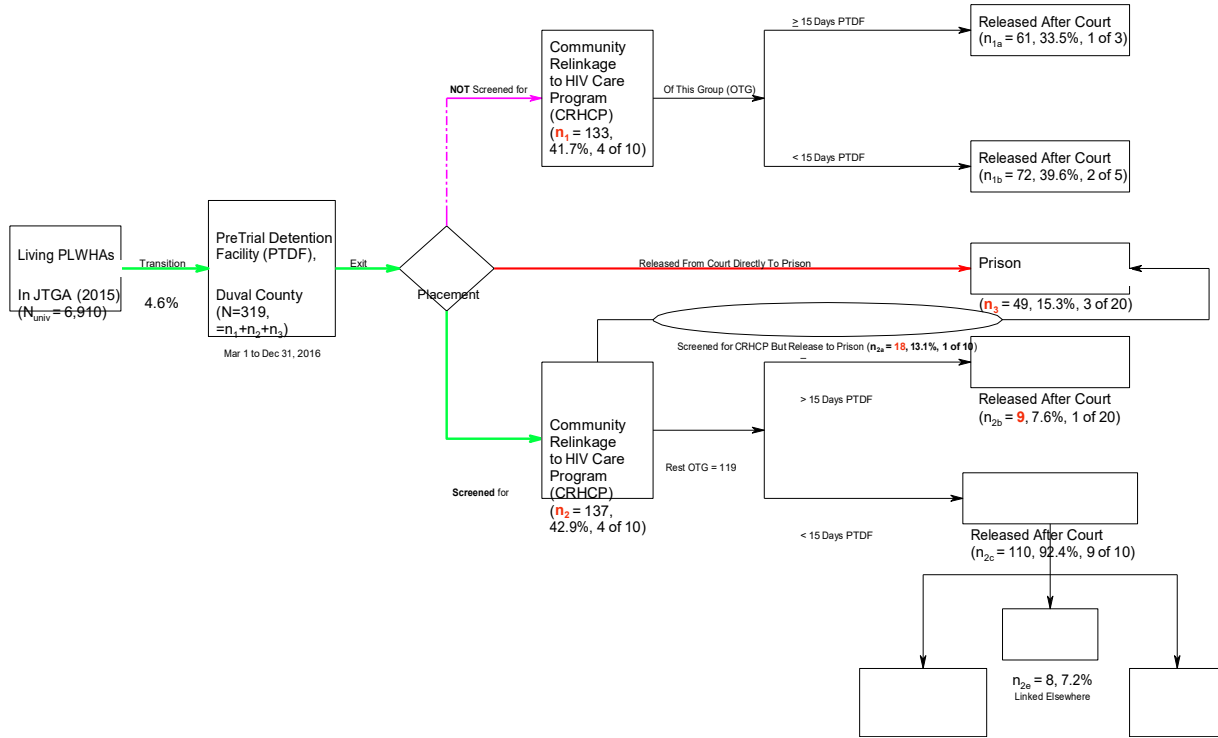


Figure 2. Services Provided to 108 Formerly Detained PLWHAs in Jacksonville, Florida Screened for Re-Enrollment in HIV Primary Medical Care During March to December 2016

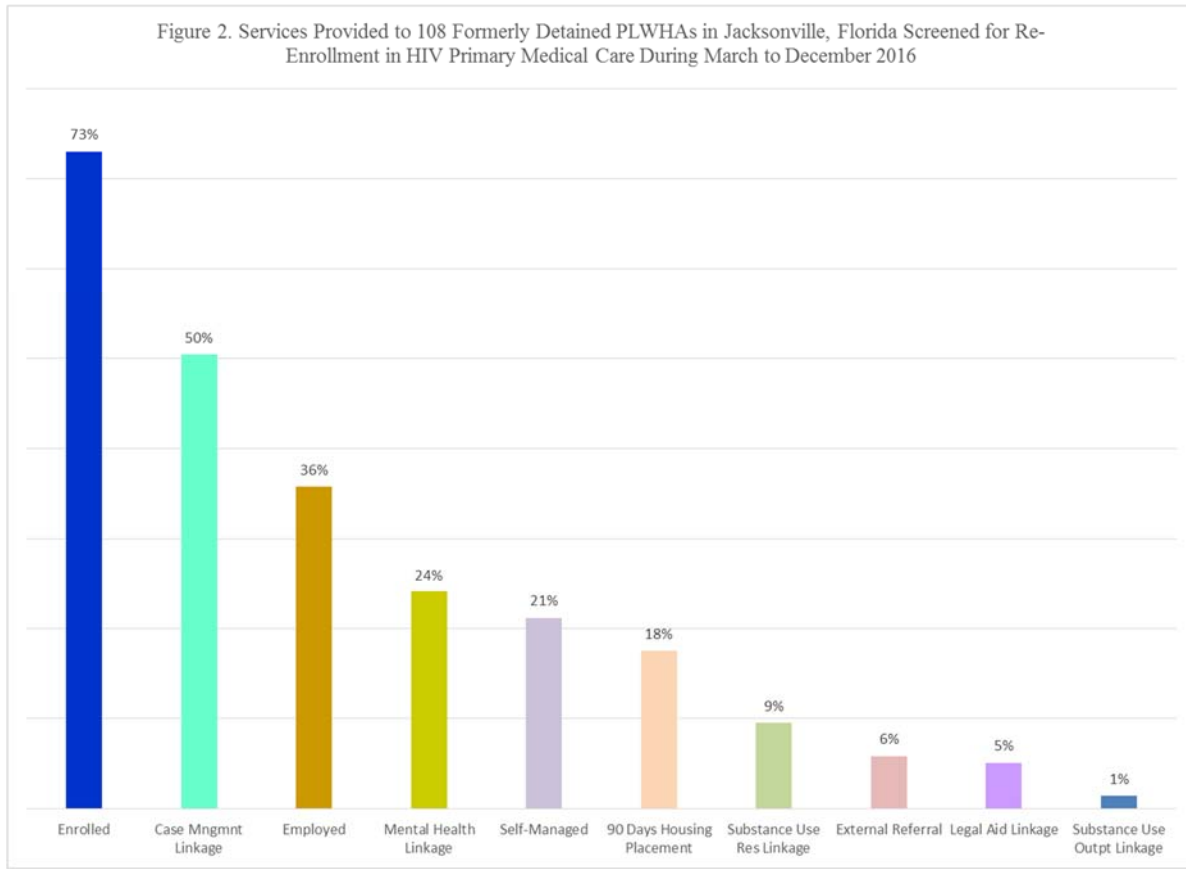


Figure 3. Trends and projections in United States inflation rate by years and consumer price index

Retrieved from <http://www.tradingeconomics.com/united-states/inflation-cpi>

IMPLICATIONS FOR PUBLIC HEALTH

Why are the results of this study important? The statistical methods used in this study identified a way to predict the likely costs of plugging leaks in the Jacksonville, Transitional Grant Area treatment cascade, which lose about 5% of PLWHAs to incarceration annually. A focus on using science to predict the cost of sustaining an intervention opens the door for transparency, critique, and improvement of future cost estimation. In the short-term, it gives the Jacksonville Transitional Grant Area HIV Health Services Planning Council a scientific, data-driven solution for making decisions about prioritizing limited resources to address the needs of vulnerable PLWHAs. Given year one of the project represented the pilot implementation, lessons learned in the domains of care coordination and quality management can refine implementation steps for greater efficiency regarding serving more clients at the current level of staffing.

This study contributes to science by raising awareness of the value of research methods for addressing contemporary, community health, and social problems. The prevailing culture of patient-centered outcomes research goes beyond merely linking program cost to activities and processes. Stakeholders, including policy makers and funders, want to know what the cost of producing quantifiable results is. This study answers that question by making connections between the numbers of formerly

incarcerated PLWHAs recruited and linked to HIV primary medical care and the cost of doing so.

Health disparities, including HIV-related health disparities, have roots in the social determinants of health (SDH). SDH conceptualizes linkages across political, economic, and social factors that culminate in excess morbidities among disadvantaged individuals and groups. The magnitude of this documented problem has led the World Health Organization to form a Commission on the Social Determinants of Health, (CSDH), which highlights the sustained actions of civil society to promote greater health equity (Blas et al., 2008). Patterning our work along the lines of the CSDH, four Northeast Florida entities coalesced to take action. The specific aim of their "...action [is] to ensure [that] all groups [of PLWHAs] living within... [Northeast Florida have] access to the resources that promote and protect health" (Dicent-Taillepierre et al., 2016, p. S43). Those resources include, but are not limited to, four principles:

- Shared public health goals,
- Mutual consensus on public health actions and HIV health services strategies to address shared goals,
- Shared in-kind costs to develop an intervention package that is client centered for PLWHA released from detention or incarceration, and

- Repeat community meetings to share lessons learned and address temporal challenges and opportunities to support CAPRICE implementation integrity.

CAPRICE longevity depends on its financial viability. That is, the intervention must be able to pay for the cost of the core services team, to secure the dedication of the team over the long-term, if sustainability is the desired result. When fully implemented, CAPRICE engages and relinks PLWHAs with care holidays to core medical services. However, its Outreach activities with disadvantaged groups like detained PLWHAs are costly and labor intensive (Gardner, McLees, Steiner, del Rio, & Burman, 2011). Therefore, HIV and community health planning bodies must wrestle with what costs is reasonable for the program to prioritize scarce funding.

Research shows that newly diagnosed PLWHAs enrolled in short-duration—five or fewer contacts over 90-days—case management cost US\$ 1,171.00 per client (Gardner et al., 2005). Other researchers posit that to increase the National HIV/AIDS Strategy goal of early linkage, (within three months of HIV diagnosis), from 65% to 85%; jurisdictions may spend up to [US\$] 8,900.00 and remain cost-effectiveness (Gopalappa, Farnham, Hutchinson, & Sansom, 2012). Using these estimates as benchmarks, our best-fitting Power Regression model predicted project salary for relinkage to HIV primary medical care at US\$ 100,477.97. For this sum of money over the nine months duration, CAPRICE relinked 38 of 100 formerly detained PLWHAs to HIV medical care, of which 65%, (30/46) remained in HIV primary care.

CAPRICE had a modest return on its predicted investment. The cost to relink each formerly detained PLWHAs in HIV ambulatory medical care was US\$ 2,644.16, (US\$ 100,477.97 ÷ 38). This value is within the range of published estimates. In 2005, the Gardner study reported US\$ 1,171.00 for 90-days Brief Case Management. Adjusted for inflation, Brief Case Management in 2016 would cost US\$ 1,454.75 using the average rate of 2% for the year 2010, the mid-year of the range from 2005 to 2016, as Figure 3 shows (Lincoln.ne.gov, n.d.). Validation using the online CPI inflation calculator (2016) yielded US\$ 1,437.83, a difference of US\$ 16.92. In contrast, CAPRICE 90-days intensive Medical Case Management cost US\$ 2,644.16, an additional US\$ 1,189.41, (above the 2005 cost adjusted for inflation). Therefore, when the local HIV Health Services Planning Council makes priority and allocation decisions under conditions of uncertainty, the findings presented here provide insights into costs contemplation and allocation decisions. Decision-making that relies on data, rather than intuition, not

only helps the governing body with managing intervention expectations and setting thresholds but also creates a collegial climate for rationality. Decisions about priorities and spending can be emotionally charged; therefore, any tools to help stakeholders weigh options and engage in what-if analyses from an evidentiary perspective has value as local efforts aim to plug a persistent leak in the local HIV Continuum of Care.

What else do these findings mean for public health and health services research? Sectoral integration by community-based agencies that targets improvement in health equity outcomes for disadvantaged groups is a strategy for bundling resources beyond the capacity of single agencies to accumulate. Because the supply of resources for protecting the public's health is limited and heavily drawn upon, it is necessary to form integration partnerships to manage scarce financial and human resources for system optimization. In the context of system optimization, a benefit-to-cost-ratio is useful for informing decisions about programs that pursue health equity. Future research should examine whether intervention cost varies by client acuity or health literacy indices because CAPRICE staff anecdotally reported that the level of need is congruent with the intensity of services provided.

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