SciMedCentral

Clinical Research in HIV/ AIDS

Research Article

An Estimate of the Benefits of not Having HIV/AIDS in A Prison Setting

Robert J Brent* and Tina Maschi

Department of Economics, Fordham University, USA

***Corresponding author**

Robert J Brent, Department of Economics, Fordham University, Bronx, NY 10458, USA, Email: brent@fordham.edu

Submitted: 09 April 2015

Accepted: 06 May 2015

Published: 08 May 2015

Abstract

Background: A growing body of evidence suggests that high rates of incarcerated people and high levels of HIV coexist and that people with HIV/AIDS in prisons have histories of cumulative trauma and stress. Almost inevitably, a prison population is an aging population. The purpose of this study was to provide a general method for valuing the benefits of not having HIV using the preferences of prisoners so that these can be compared to the costs in order that a Cost-Benefit analysis of HIV interventions can take place.

Methods: The proposed method involves representing the utility function of an incarcerated person as being determined negatively by the presence of having HIV, and positively by having an income, and then finding the marginal rate of substitution between having HIV and giving up some income. A regression equation is used to estimate the utility function where the Centers for Disease Control and Prevention's (CDC's) health-related quality of life is used to measure utility. Apart from HIV and income the regression equation has life stressors and age as controls. We use a sample of 516 incarcerated adults from a self-reported survey, consisting mainly of persons aged 50 and older housed in a Northeastern prison system, to apply our methods.

Results: Our regression analysis showed that four life stressors and age were significant and important as controls for HIV/AIDS status and income in determining an incarcerated person's quality of life. Our best estimate of the benefit of not having HIV in a prison setting was around $350,000.

Conclusion: The value of not having HIV in a prison setting is large. This value could make many existing interventions to prevent HIV/AIDS be shown to be to be socially worthwhile as they would pass a Cost-Benefit test. Our finding of the importance of life stressors for a prison population with HIV would suggest that interventions that involve the prevention of traumatic experiences in early childhood could also be socially worthwhile as they would both help to prevent HIV/AIDS and lessen the impact on quality of life if HIV were to occur. Targeting older prisoners with HIV should also be a priority as their quality of life is significantly lower than for younger prisoners.

OVERVIEW

In the world today there are two interconnected epidemics that have particular current health policy implications: one of imprisonment and one of HIV [1]. Thus the prevalence of HIV in countries worldwide is several times higher in prisons than in the community at large, ranging from 2 to 50 times larger [2]. In the US, in 2007, it was 2.4 times larger [3]. Often it is drug dependence that supplies the link between the two epidemics, as it is those who take illegal drugs that are arrested, and intravenous drug use through the sharing of needles that is a major way that HIV is transmitted. Also when drug use is involved, incarcerated people serve shorter sentences and recidivism to prison is common. So HIV-positive people move frequently between prison and their home communities. This means that irrespective of whether the HIV was initiated outside or inside the prison, many people with HIV end up in prisons.

Given that so many people in prisons have HIV there is the need to consider interventions that can impact the disease by either preventing transmissions before or after imprisonment or treating incarcerated people once they have HIV. There are many interventions to address HIV in prisons that have been shown to be effective, and these include: needle and syringe programs, condoms for the prevention of sexual transmission, drug dependence treatments such as opioid substitution, anti-retroviral drugs, HIV education and counseling and testing programs [1]. All of these interventions involve considerable

costs. To determine whether any of these HIV interventions are socially worthwhile, which involves carrying out a Cost-Benefit Analysis (CBA), it is necessary to compare these costs with the possible benefits [4,5]. Since it is preventing or treating HIV in prisons that is being evaluated, it is important that the benefits be derived from the preferences of the incarcerated people themselves in the prison setting. To our knowledge there are no estimates of the benefits of intervening for HIV that utilize the preferences of incarcerated people. In this paper we present a method for evaluating the benefits of intervening for HIV based on prisoner preferences that relies on a measure of the health quality of life and then we apply the method to a sample of around 500 in a New Jersey prison.

The prison setting that we are analyzing consists of a population that has two main characteristics (other than race). Firstly, there are a large number of older adults. Of the 2.3 million incarcerated people in the United States, approximately 200,000 (16%) are adults aged 50 and older [6]. Secondly, within this incarcerated elder population, there is a growing body of evidence that documents their lifetime cumulative life stressors, including histories of living in poverty prior to prison, and being diagnosed with chronic and serious illnesses [7-12]. For example, in a sample of 677 adultsin a Northeastern prison system, it was found that, on average, adults aged 50 and older reported three lifetime experiences of traumatic and stressful life events [9,13]. The traumatic experiences included being a child victim or witness to family or community violence, physical and emotional neglect, having an incarcerated family member, and being diagnosed with a serious physical or mental illness, such as HIV/AIDS. These findings are consistent with the Adverse Childhood Experiences Study (ACES) findings in which an accumulation of life course adversities showed a higher level of physical and mental illness among diverse age groups [14].

This paper is organized as follows: First, it describes a general method for estimating the benefits of any HIV intervention that will prevent or treat HIV in a prison setting. Next we summarize the data that will be used to apply the general method that we have presented. Then we carry out the estimation and present the results. Lastly, the main findings and conclusions are reviewed.

THE METHOD FOR ESTIMATING THE BENEFITS

The starting point is the basic concept that underlies much of Economic theory that of an individual's utility function U, which is a function of all the goods and services that s/he may consume, whether through purchases on the market (such as food and clothing) or through interactions with others external to markets, such as air quality, noise of airplanes, or even infectious diseases. The role of the utility function is to transform the units of the goods and services into units of satisfaction, called utils, which can be positive or negative depending on what is contributing to the utils. In this paper we want to focus on HIV H, which is a communicable disease that can be expected to have a negative impact on utility. The individuals we will be analyzing are incarcerated people who contracted the disease either outside in the community or during the current (or previous) prison sentence. We set H apart from all of the other ingredients in the utility function by recognizing that income Y can be used as a simple way to represent all the other utility determinants than H. The higher is income, the higher will be utility. To allow for individual heterogeneity, we can include in the utility function a set of variables to denote individual characteristics. In general, race (being African American) would be a defining characteristic in the US prison population. However, because in our sample race was not statistically significant, we suppress race as a characteristic in our modeling. Given the ageing of the prison population, the main characteristic we will be focusing on (apart from H) is age A. As a final addition, we specify a set of life stressors L that record the past histories (traumas) of the individuals that help determine future prison and HIV behavior and also eventually current utility. These life stressors impact utility both indirectly, through their causing H to be high and Y to be low, and having a direct effect by lowering utility. The utility function can then be represented as:

$$U = U(H, Y, A, L) \quad (1)$$

For estimation, we will take a linear approximation of (1) and use:

$$U = \alpha_H H + \alpha_Y Y + \alpha_X A + \alpha_L L \quad (2)$$

where: $\alpha_H < 0$, $\alpha_Y > 0$, $\alpha_A < 0$ and $\alpha_L < 0$.

Note that in this formulation, the alphas are fixed coefficients and we have suppressed the constant term and the random error (which is assumed to be random and normally distributed). For the purpose of the method we are proposing for estimating benefits, the role of A and the L variables in equation (2) is to act as controls to ensure that other factors are held constant and do not impact the coefficients α_H and α_Y that, as we now explain, we are most interested in. The alphas show the effect on the dependent variable of a unit change in the independent variables. Hence we have:

$$\alpha_H = \Delta U/\Delta H; \quad \text{and} \quad \alpha_Y = \Delta U/\Delta Y \quad (3)$$

Valuing HIV involves taking changes in HIV and converting them into monetary terms, which are the units in which income is expressed. This means that the HIV valuation comes from $\Delta Y/\Delta H$. It is the marginal rate of substitution between Y and H. Using the definitions in equation (3) we obtain:

$$\Delta Y / \Delta H = (\Delta U / \Delta H) / (\Delta U / \Delta Y) = \alpha_H / \alpha_Y \quad (4)$$

Thus the value of HIV is given as the ratio of the first two coefficients that are specified in equation (2).

To complete the description of the estimation framework we need a specification of the dependent variable U. For this purpose we will use as a proxy for U the incarcerated peoples' Health Related Quality of Life (HRQOL). In the branch of Health Care Evaluation field that is covered by Cost-Utility Analysis (CUA), the HRQOL is used to help measure the main effectiveness outcome [4]. That is, Quality Adjusted Life Years (QALYS) is the CUA outcome measure and this is given by the product of number of life years and the quality of each year. It is for estimating the quality of life that the HRQOL is used.

Ordinary Least Squares (OLS) will be used to carry out the estimation of all the coefficients. This method is appropriate when all the independent variables are exogenous, as in our case. Income and life-stressors are all variables that are time

specific and, in our data set, occur many years prior to the current incarceration in which the quality of life is being measured. So *Y* and the *L* variables cannot be determined by *Q*. Age is not a behavioral variable and the current quality of life is not any known transmission mechanism for *H*.

SAMPLE DATA

The sample data was collected as part of the 2010 John A. Hartford Foundation funded mixed methods study that examined cumulative trauma and physical and mental well-being using a sample of adults mostly aged 50 and older in a Northeastern state prison system [10]. The study used a cross-sectional, correlational design and a self-administered survey mailed to older inmates in fourteen state prisons supervised by the New Jersey Department of Corrections (NJ DOC) during September 2010 (the study start date). Of approximately 25,436 incarcerated people housed in the NJ DOC in January 2009, approximately 7% (n = 1750) were adults aged 50 and above. The study population and sampling frame consisted of approximately 1700 male and 50 female older adult incarcerated people in the NJ DOC as of September 2010. Information to create the sampling frame included the names, state numbers, prison location and demographic information (e.g., age, gender, race/ethnicity, educational status, sentence length).

A survey was sent out to the study population. The response rate was 42%, which is considered a high response rate for a population in secure care. This resulted in a sample of 677 adults, mostly aged 50 and older (the average age was 54 years). For the purposes of our paper, the sample was reduced to the total number (n = 516) that answered all questions examined in the current analysis. The CDC's Health-Related Quality of Life Survey [15], which is detailed below, was used to determine the number of participants who endorsed that they were diagnosed with HIV/AIDS. Approximately 5% (n=32) self-reported being diagnosed with HIV/AIDS.

The self-administered survey consisted of measures of the key study constructs. Measures were selected because they have been used with samples of older adults and/or incarcerated people and they require only a 6th to 8th grade reading level and were valid and reliable measures, including with older adults in secure care settings. Table 1 lists and defines all the variables that appear in the estimation equations and table 2 presents the data summary.

This study examines life stressors, quality of life, and social inequality variables, such as age, income, and HIV/AIDS status. Life stressors (objective occurrences) were measured using the 31-item Life Stressors Checklist-Revised (LSC-R) [16]. The LSC-R estimates the frequency of the objective occurrences of lifetime and current traumatic events (e.g., being a victim of and/or witness to violence), which is consistent with DSM IV-TR Criterion A for post-traumatic stress [17]. It also accounts for stressful life events, such as losing a loved one, being diagnosed with a serious illness, divorce, financial problems, and institutional stress and abuse. The LSC-R has good psychometric properties, including use with diverse age groups and criminal justice populations [16-20]. Only the four of the 31 life stressors that were found to be statistically significant in explaining quality of life in our sample are included in tables 1 and 2. All four of the life stressors were included as dichotomous items (Yes = 1; No = 0). These four items were: (L_1) Have you ever had a serious accident or health related injury (for example, a bad car wreck or an on-the-job accident); (L_2) Was a close family member ever sent to jail or prison; (L_3) Have you ever been physically neglected (for example, not fed, not properly clothed, or left to take care of yourself when you were too young or ill); (L_4) Have you ever had a very serious mental illness (for example, depression, felt like killing yourself, hospitalized because of nerve problems)?

Quality of Life was measured using the Center for Disease Control and Prevention Health-Related Quality of Life survey (CDC HDQOL-14) [15,21]. It is a 14 item self-report measure that consists of three modules: *Healthy Days, Healthy Days Symptoms, and Activity Limitations* that is a standard set of valid measures distributed by the CDC. This measure includes an integrated set of broad questions about recent perceived health (and mental health status) and activity limitation. Authors report good construct validity and reliability, including with low-income older adult populations. For the purposes of this analysis, the following items were used: Would you say that in general your health is: [Participants could respond] Excellent = 1; Very good = 2; Good = 3; Fair = 4; and Poor = 5. So the higher the score, the lower the quality of life measure.

Social inequality variables came from the *Social Inequality*

Table 1: Description of Variables.

Variable	Description
Quality of Life Q	Would you say that in general your health is: Excellent = 1; Very good = 2; Good = 3; Fair = 4; and Poor = 5.
HIV H	Was HIV/AIDS either a major or one health impairment? Yes = 1; No = 0.
Income Y	What was your total yearly income prior to incarceration?
Age A	What is your current age (in years)?
Life Stressor 1 L_1	Have you ever had a serious accident or health related injury (for example, a bad car wreck or an on-the-job accident)? Yes = 1; No = 0.
Life Stressor 2 L_2	Was a close family member ever sent to jail or prison? Yes = 1; No = 0.
Life Stressor 3 L_3	Have you ever been physically neglected (for example, not fed, not properly clothed, or left to take care of yourself when you were too young or ill)? Yes = 1; No = 0.
Life Stressor 4 L_4	Have you ever had a very serious mental illness (for example, depression, felt like killing yourself, hospitalized because of nerve problems)? Yes = 1; No = 0.

Table 2: Descriptive Statistics (Proportions or Levels).

Variable	Sample Size	Age First Happened	Mean	Standard Deviation	Minimum	Maximum
Quality of Life Q	652	*na*	2.9678	1.1253	1	5
HIV H	659	*na*	0.0486	0.2151	0	1
Income Y	516	*na*	43,079	65,814	0	850,000
Age A	644	*na*	56.4752	6.3123	31	82
Life Stressor 1 L_1	636	26	0.5220	0.4999	0	1
Life Stressor 2 L_2	645	22	0.4543	0.4983	0	1
Life Stressor 3 L_3	641	13	0.1872	0.3904	0	1
Life Stressor 4 L_4	631	34	0.2758	0.4472	0	1

Table 3: OLS Estimates – Dependent Variable is the Health Related Quality of Life(p-values)†.

Variable	Equation (1)	Equation (2)	Equation (3)
	(n = 508)	(n = 505)	(n = 466)
Income Y	−0.00250***	−0.00259***	−0.00213***
	(0.000)	(0.001)	(0.007)
HIV H	0.8423 ***	0.8791 ***	0.8013***
	(0.000)	(0.000)	(0.000)
Age A		0.0282 ***	0.0352 ***
		(0.000)	(0.000)
Life Stressor 1: L_1			0.2897 ***
			(0.004)
Life Stressor 2: L_2			0.1974**
			(0.053)
Life Stressor 3: L_3			0.5045 ***
			(0.000)
Life Stressor 4: L_4			0.2508**
			(0.025)
Constant	3.0321***	1.4324 ***	0.6061
	(0.000)	(0.001)	(0.173)
R^2	0.0466	0.0730	0.1538
Value of HIV Reduction	$336,913	$339,415	$376,214
p-value ‡	0.010	0.011	0.031

Significance Levels: * 10%; ** 5%; *** 1%.
† p-values based on robust standard errors.
‡ p-value is for the non-linear Chi-square test for the null that the ratio of the coefficients is equal to zero.

Questionnaire [22]. It included two items used in this analysis for participants' age, (what is your age in years?) and income (what was your yearly income prior to your current incarceration?). HIV/AIDS status was measured by the checklist item in our survey: if a participant endorsed that HIV/AIDS was either a major or one health impairment (yes = 1; no = 0).

THE RESULTS

Table 3 presents the OLS estimates of all the coefficients and the summary statistics. To allow for the possibility of heteroscedasticy, all the equations use robust standard errors to derive the significance levels. Equation (1) includes just the two variables H and Y that are necessary to estimate the benefits of not having HIV. Equation (2) adds age as an additional independent variable (the only individual characteristic that was significant) and equation (3) includes the full specification with age and all the life-stress variables as controls.

As the higher is our measure of Q, the *lower* is the recorded quality of life; all the expected signs presented below equation (2) have to be reversed. In all the equations income and HIV have the expected signs and are both statistically significant, always at least the 1% level of significance. The estimates of the benefits are given at the bottom of the table as the ratio of the coefficients for income and HIV. As shown in the last line of table 3, all the estimates of benefits come from ratios which are statistically significantly different from zero at the 5% level (using a non-

linear Chi-square test). The fit of equation (3) is the best and this equation explains about 15% of the variation in Q. We therefore regard the results in equation (3) to be the best estimates. The benefit estimate using this equation is around $376,000. The other equation estimates of benefits are of a similar order of magnitude.

The four life stressors L_1 to L_4 were all significant at least the 5% level in equation (3) and had the expected signs, i.e., they lowered the quality of life (caused our measure of Q to go up). L_3, whether or not the individual had ever been neglected, had the most impact on Q and its coefficient was around 60% of that of HIV. Age A was highly significant in the two equations in which it was included. As expected it caused the quality of life to go down (measured Q to go up).

SUMMARY AND CONCLUSIONS

Only a Cost-Benefit Analysis can determine whether any kind of HIV intervention is worthwhile [5]. Costs of HIV interventions are routinely carried out. What is needed to complete the evaluation of any intervention is to measure the benefits. Given that HIV prevalence in prisons is higher than in the community as a whole, it is important to try to estimate the benefits of not having HIV in a prison setting. In this paper we presented a benefit estimation method that relied on the preferences of the incarcerated people. The method involved estimating the utility function, proxied by the health related quality of life, and deriving the benefits as the marginal rate of substitution between HIV and income. Because income is measured in monetary units, dividing units of HIV by units of income enables H to also be expressed in monetary terms.

Our best estimate produced a value of around $350,000 as the benefits for an intervention that could be used to prevent HIV/AIDS. One then has a benchmark to compare with the costs to carry out a CBA of an intervention. For example, it was found that preventing 4 cases of HIV in prison using HIV counselling and testing cost $125,000, or $31,250 per case in a cohort of 10,000 inmates [23]. Because they estimated that the lifetime treatment cost for someone with HIV is $186,900, they could conclude that the intervention was “cost-saving” and “cost-effective”. If one were to apply our best estimate of $350,000 from this study to measure the benefits in their study, one could say more than this and add to their conclusion that that particular intervention was also “socially worthwhile”.

The other main HIV policy conclusion from our analysis in this paper follow from the fact that we found that the life stressors (L_1 to L_4) and age A variables to be significant and important as controls for HIV/AIDS status and income. This enabled the benefits of any HIV interventions to be estimated more efficiently. But, more generally, the life stressor findings suggest that the use of trauma-informed approaches in the community and prison may reduce the risk of HIV risk behaviors. In this sample, life stressors, largely related to life course abuse and neglect and health status, have a significant adverse impact on quality of life in later years. Therefore, comprehensive trauma-informed care approaches used as interventions across service settings, including prison, may significantly reduce the number of individuals who contract HIV/AIDs through sexual contact or drug use or become involved in the criminal justice system. Our finding that older age lowers prison quality of life can also be used to inform interventions that target this most vulnerable and growing prison sub-population. A holistic treatment that addresses health, economic and social factors along with trauma-informed approaches may go a long way towards reducing the significant cost burden on society caring for incarcerated and formerly incarcerated elders with HIV/AIDS in prison, and after their release [24]. Lowering these costs couldpossibly lead to these care interventions passing a cost-benefit test once the benefits have been estimated as in this paper.

DISCLOSURE

There are no financial interests, or conflicts of interest, for either of the authors connected to this study.

REFERENCES

1. Jürgens R. Effectiveness of interventions to address HIV in prisons. WHO, UNODC and UNAIDS, Geneva, 2007.
2. Jürgens R, Nowak M, Day M. HIV and incarceration: prisons and detention. J Int AIDS Soc. 2011; 14: 26.
3. CDC. HIV in correctional settings, fast facts. Division of HIV/AIDS prevention, 2012
4. Brent, RJ. Cost-benefit analysis and health care evaluations, second edition. UK, Cheltenham: Edward Elgar, 2014.
5. Brent RJ. Setting priorities for HIV/AIDS: A cost-benefit approach. UK, Cheltenham: Edward Elgar.
6. American Civil Liberties Union. Annual report. Available from: http://www.aclu.org/organization-news-and-highlights/aclu-2011-annual-report
7. Maschi T, Morgen K, Zgoba K, Courtney D, Ristow J. Age, cumulative trauma and stressful life events, and post-traumatic stress symptoms among older adults in prison: do subjective impressions matter? Gerontologist. 2011; 51: 675-686.
8. Maschi T, Viola D, Sun F. The high cost of the international aging prisoner crisis: well-being as the common denominator for action. Gerontologist. 2013; 53: 543-554.
9. Maschi T, Viola D, Morgen K, & Koskinen L. (2013a). Trauma, stress, grief, loss, and separation among older adults in prison: the protective role of coping resources on physical and mental wellbeing. Journal of Crime and Justice. doi:10.1080/0735648X.2013.808853 (SPECIAL ISSUE ON ELDER ABUSE).
10. Maschi T, Viola D, & Morgen, K. (2013b). Trauma and coping among older adults in prison: Linking empirical evidence to practice. Gerontologist. First published online July 19, 2013 doi:10.1093/geront/gnt069.
11. Maschi, T. & Aday, R. (2014). The social determinants of health and justice and the aging in prison crisis: A call to action. International Journal of Social Work, 1: 1, 1-15.
12. Zgoba K., Jennings W G, Maschi T, & Reingle J M. (2012). An exploration into the intersections of early and late sexual victimization and mental and physical health among an incarcerated sample of older male offenders. Best Practice In Mental Health, 8: 82-98.
13. Maschi T, Morgen K, Westcott K, Viola D, & Koskinen L. (2014a). Aging, incarceration, and employment prospects: Recommendations for practice and policy reform. Journal of Applied Rehabilitation Counseling, 45: 44-55. (SPECIAL ISSUE)

14. Center for Disease Control [CDC] (2014). Adverse Life Experiences Study. 2014.

15. Centers for Disease Control and Prevention (CDC). Measuring health days: Population assessment of health-related quality of life. Atlanta, GA: Centers for Disease Control and Prevention, United States Department of Human Services 2000.

16. Wolfe J, & Kimerling, Gender issues in the assessment of posttraumatic stress disorder. In J.P. Wilson & T.M. Keane (Eds.). Assessing psychological trauma and PTSD, New York: Guildford. 1997; 192-238.

17. American Psychiatric Association [APA]. Diagnostic and statistical manual of mental disorders (TR). Washington, DC: American Psychiatric Association 2000.

18. Kimerling R, Clum GA, Wolfe J. Relationships among trauma exposure, chronic posttraumatic stress disorder symptoms, and self-reported health in women: replication and extension. J Trauma Stress. 2000; 13: 115-128.

19. Wolfe J, & Kimerling R, Gender issues in the assessment of posttraumatic stress disorder. In J.P. Wilson & T.M. Keane (Eds.). Assessing psychological trauma and PTSD, pp. New York: Guildford. 1997; 192-238.

20. McHugo G, Caspi Y, Kammerer N, Mazelis R, Jackson E, Russell L, et al. The Assessment of Trauma History in Women with Co-occurring Substance Abuse and Mental Disorders and a History of Interpersonal Violence. Journal of Behavioral Health Services & Research, 2005; 32: 113-127.

21. Moriarty DG, Zack MM, Kobau R. The Centers for Disease Control and Prevention's Healthy Days Measures - population tracking of perceived physical and mental health over time. Health Qual Life Outcomes. 2003; 1: 37.

22. Maschi T. Social Inequality Questionnaire: New York: Be the Evidence Press 2010.

23. Varghese B, Peterman TA. Cost-effectiveness of HIV counseling and testing in US prisons. J Urban Health. 2001; 78: 304-312.

24. Maschi T, Marmo S, Han J. Palliative and end-of-life care in prisons: a content analysis of the literature. Int J Prison Health. 2014; 10: 172-197.

Cite this article

Brent RJ, Maschi T (2015) An Estimate of the Benefits of not Having HIV/AIDS in A Prison Setting. Clin Res HIV/AIDS 2(2): 1022.