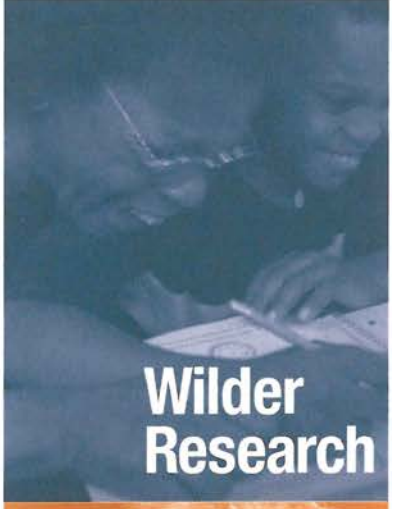

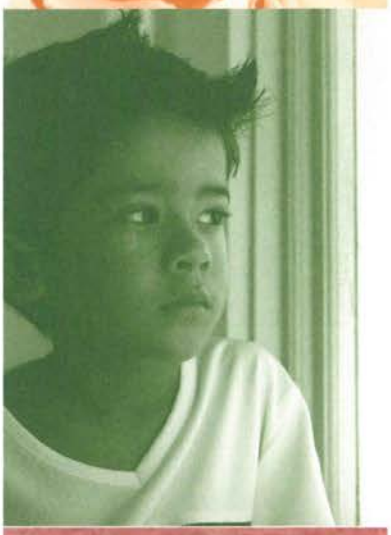

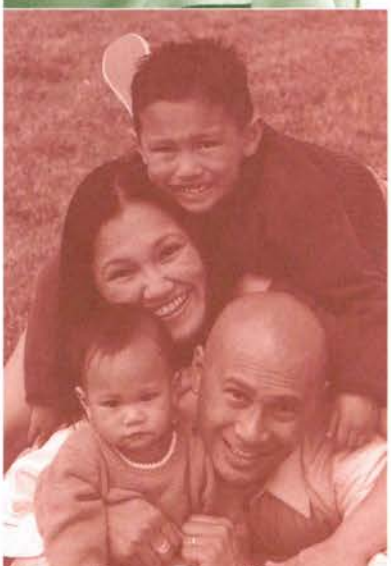

Social return on investment: Community Health Workers in cancer outreach

A toolkit developed for the American Cancer Society – Midwest division

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Social return on investment: Community Health Workers in cancer outreach

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Summary

Background

The main goal of Community Health Workers (CHWs) is to influence the behavior of diverse and underserved populations toward health outcomes through prevention and navigation of the health system. CHWs generate significant positive impacts in the communities where they work (Nemcek, 2003). In particular, CHWs contribute to increased likelihood of earlier cancer screenings, including self-examinations and clinical tests such as mammography, Pap smears, and colorectal screening (Viswanathan, M., Kraschnewski, J., Nishikawa, B., Morgan, L., Thieda, P., Honeycutt, A. Lohr, K., Jonas, D., 1999).

Many of these changed health behaviors have economic consequences for patients, families, caregivers, and taxpayers. These economic impacts accrue in terms of savings in health care costs due to a more efficient use of the health system, or increased labor productivity of healthier patients. The main goal of this economic analysis is to place the economic outcomes generated by CHWs in a cost benefit framework for defensibly measuring the Return on Investment (ROI) of this type of intervention. We consider the costs and benefits from the perspective of participants, taxpayers, CHWs and providers. The ROI estimates reflect the net benefits for the whole society. The ROI framework provides an objective methodology to identify and quantify the economic value of CHWs that work as agents of change in the area of cancer outreach.

Return on investment in community health workers in cancer outreach

We argue that the work of CHWs in cancer outreach may reduce mortality rates. Low mortality rates imply more years of productive life. Consequently, the individual will earn more income, pay more taxes, and see his/her labor productivity increased. In addition, CHWs provide education and guidance that allow individuals to use the health care system more efficiently. An example of improved efficiency is an increase in primary and preventive services usage and a reduction of urgent care visits. In Figure 1, we show the benefits and costs associated with the work of CHWs, and the resulting return on investment for society.

1. Lifetime benefits: Community health workers generate lifetime benefits in the order of $12,348 per person served by a CHW, or $851,410 for every CHW that serves at least 69 individuals per year. These benefits include the value of additional years of life saved because of early screenings, additional taxes paid during those additional years, and savings from reduction in urgent care use.

2. Costs: A conservative estimate of the additional per person costs of cancer outreach is $5,359. This amount includes the direct costs of the work of CHWs, such as salaries and overhead costs, and the costs of additional screening tests motivated by the intervention of CHWs.

3. Net benefits: The net benefits per person served by CHWs reach $6,990 or $481,920 per CHW. We estimate that for every dollar invested in cancer outreach using CHWs, the society receives 2.3 dollars in return.

1. Estimated return on investment in community health workers in cancer outreach

	Dollars per person served	Dollars per CHW
Present Value of Benefits	$12,348	$851,410
Present Value Cost of CHWs (10-year investment)	$5,359	$369,490
Net benefit	**$6,990**	**$481,920**
Return on Investment	**2.3**	

Methods

These estimates are based on effect sizes and parameters from the existing literature on effects of CHWs on health outcomes such as increased cancer screening and reduced urgent care usage. We used actual data on incidence and mortality rates of cancer in the U.S. from the Census Bureau and the U.S. National Center for Health Statistics, National Vital Statistics Reports (NVSR). We adjust these effect sizes and parameters by age and risk profiles of the population. Whenever possible or necessary, we use survey data and expert opinions on the value of these parameters. All dollar estimates are net present values at a discount rate of 4 percent to account for future uncertainties and time preferences.

Conclusions

Cancer outreach and education is critical for reducing the damages this disease inflicts in society. Investing in community health workers produces changes in health behaviors with substantial economic value for individuals and the society.

The benefits generated by community health workers offset the investment made in them. Investing $41,184 per year in community health workers for a period of ten years generates net economic benefits of $481,920.

According to the Health Resources and Services Administration (HRSA) there are nearly 20,000 community health workers in the Midwest region, and from our survey of these CHWs, we estimate that 62 percent of them are working in cancer outreach. These CHWs will generate more than 5.8 billion dollars in net benefits for the society in the next 20 years.

Introduction

Purposes of this study

This study demonstrates the economic value of investing in cancer outreach via community health workers. Much of this value takes the form of savings. For example, individuals reached by community health workers are more likely to have more cancer screenings and tests than persons not served by CHWs. This raises the chance of early detection of cancer and thus improves the chances of survival from the disease. Every year of life that is not lost due to cancer implies savings for the individual in terms of income not lost, and the subjective value of additional years of life. The increased income during these years of life not lost also implies more tax revenues for taxpayers. The improved usage of the health care system generates savings for participants and in some cases for taxpayers.

The main goal of this economic analysis is to place the economic outcomes generated by CHWs in a cost benefit framework for defensibly measuring the Return on Investment (ROI) in this type of interventions. We consider the costs and benefits from the perspective of participants, taxpayers, and programs. The ROI estimates reflect the net benefits for the whole society.

On the cost side, we indentify the economic resources that the society allocates to the work of CHWs including: salary and benefits, materials, infrastructure, and other inputs. In addition, we estimate the cost of increasing the number of medical tests and cancer screenings (e.g. mammography, colorectal exams, etc,). We use conservative assumptions about the most likely value of these benefits and costs based on previous studies and data collected from our surveys. The resulting ROI estimates are prospective; that is, they reflect the economic returns that CHWs would generate if the intended outcomes associated with their work are achieved.

Many of the benefits of the work of CHWs do not materialize immediately. In fact, the biggest returns will occur in the future with every year of life not lost generates a stream of benefits in the future. Furthermore, the positive consequences of increasing the chances of survival of a person may be in fact incalculable, and thus we think that any ROI in CHW's work is conservative.

This study builds on models and methods used in the analysis of the impact of CHWs and cancer outcomes. It translates the best research on the returns associated with CHWs and cancer prevention into usable estimates of the actual returns for investing in CHWs in the field of cancer outreach.

Assumptions in the analyses

- The analyses in this study estimate benefits and cost savings for individuals, taxpayers, and the society.
- Estimates of saved costs are based on actual rates for the various conditions or population characteristics such as: incidence rates of cancer and mortality rates in the U.S. Cost data based on survey data and key informant interviews collected by Wilder Research for the American Cancer Society.
- The study focus is on individuals (both genders) ages 20 to 60 that are likely to be served by CHWs (The Community Health Worker Study Work Force Study from HRSA, has estimated that the client targeted most frequently were females and adults ages 18 to 48). We assume a specific number of years of life remaining for each age category based on life expectancy rates from the Census Bureau.
- CHWs usually target persons classified as 'at risk', thus the cancer incidence rate of these persons is higher than in the general population. Thus, we need to apply an assumed percent scale-up parameter to adjust the incidence rate of cancer in the targeted population.
- Estimated benefits of years of life not lost are based on the "willingness to pay" method. This approach captures the monetary value that a person is willing to pay for an additional year of life (Yabroff, Bradley, Mariotto, Brown, & Feuer, 2008; Cutler, Gruber, Hartman, Landrum, & Newhouse, 2008; and Lichtenberg, 2008).
- It is assumed that CHWs have an average productivity of 69 persons served in a year. This is an ad-hoc value based on (Whitley, Everhart, & Wright, 2006)
- Costs include the investment in CHWs for 10 years and cost of additional tests for 20 years. Benefits refer to life time benefits for remaining years of life based on life expectancy in the U.S. for the population analyzed (20 to 60 years old).
- See the methods section for detail sources of parameters and methodology.

Estimated benefits

This section estimates the lifetime benefits for one person served by a CHW. The benefit estimates fall into three categories:

Increased income and value of life – Savings from reduced years of life lost.

Benefits for taxpayers – Increased tax revenues from increased income during years of life not lost.

Increased efficiency – Savings from the reduction in emergency room or urgent care utilization due to health education and help of CHWs.

Estimated benefits from reduced years of life lost

The work of CHWs in cancer outreach reduces mortality rates by increasing the number of screenings and tests of the population served. Lower mortality rates imply more years of productive life. Consequently, the individual will earn more income, pay more taxes, and see his/her labor productivity increased. However, not every person that receives services from CHWs will suffer cancer and thus will not experience a reduction in number of years of life lost because of cancer. Consequently, not every person served by CHWs has the same probability of generating benefits. We estimate the net expected value of a year of life not lost due to the intervention of CHWs is $289. This estimate is based on the impact of CHWs on screenings, and the effects of additional screening on mortality rates. Incidence rates of cancer in the U.S. are also taken into account in this calculation (See the Technical Appendix for a detailed description of the methodology).

The total benefits accrued by a person would be the net present value of the annual benefits accumulated during the remaining years of life that are not lost. This is, the annual benefit valued at $289 and discounted at a rate of 4 percent. Depending on the age of the person at the time of being served by CHW, the potential number of remaining years of life will vary; i.e. a younger person will have more years of life remaining than an elderly person. For instance, an individual that receives services from CHWs when she is 20 years old could expect to live 59 more years; based on life expectancy rates in the U.S. In Figure 2 we show the present value of a year of life not lost due to the intervention of CHWs for individuals 20 to 60 years old and the average value for the group. For this group of selected ages, the average lifetime benefit is $5,578.

2. Value of years of life not lost due to CHWs

Age	Average number of years of life remaining based on life expectancy	Value of remaining years of life increased due to CHWs
20	59	$6,507
25	54	$6,353
30	49	$6,164
35	45	$5,985
40	40	$5,717
45	35	$5,391
50	31	$5,080
55	27	$4,717
60	23	$4,291
		Average: $5,578

Assuming a productivity of CHW of 69 individuals served during a year, the average life time benefits per CHW could reach $384,599.

Estimated cost savings to taxpayers

Increased tax receipts

Every year of life not lost may potentially be used to work and earn income. This implies tax receipts paid that would have been lost if the person was not alive and productive. Given the estimated impact of CHWs on mortality rates (See the section on methods for details), an assumed income bracket for the most common population served by CHWs of approximately $32,000 per year, and the marginal tax rate for that level of income (4.7%), we estimate that a person served by CHWs is likely to pay $2.23 in additional taxes every year. The average net present value of this amount for the expected number of years remaining for participants between age 20 and 60 is nearly $43 dollars.

3. Lifetime additional taxes paid per additional person served by CHWs

Age	Average number of years of life remaining based on life expectancy	Value of increased tax revenues for remaining years of life due to CHWs
20	59	$50
25	54	$49
30	49	$48
35	45	$46
40	40	$44
45	35	$42
50	31	$39
55	27	$36
60	23	$33
		Average: $43

Other benefits for taxpayers

When individuals receive health education and help navigating the health system, they may change the way they use health care resources. A more efficient use of the health system may lead individual to increase their usage of primary care and reduce use of more expensive services such as urgent care. In some of these cases, the state may save some money if individuals are covered by public health insurance or if the state is the provider and the individuals are unable to pay their medical bills. On the other hand, health education may lead to more use of health care services in general and thus generate more costs to the state. However, it has been shown that the alternative of this increase in use and costs is even more expensive in the long run (Whitley, Everhart, & Wright, 2006). In addition, taxpayers can avoid some costs generated by family disintegration when a member dies from cancer, including public assistance and child welfare.

These savings should be included in the ROI in CHWs. However, without specific data on insurance coverage type and health care usage of individuals receiving help from CHWs, and public assistance data from official sources, we cannot reasonably disaggregate these benefits and estimate the savings to taxpayers. Instead, we estimate the benefits for the whole society that result from improved efficiency in the use of the health care system.

Estimated cost savings from increased efficiency in health system

CHWs can affect the level of urgent care used by individuals, and guide them to utilize primary and preventive care instead. Impact studies in the field have found that the savings from reduced urgent care offset the increases in costs from more primary care visits. The net savings from reduced urgent care visits per person served range from $162 to $995 per year, with an average net savings of $495 (See Figure 4).

The present value of this potential annual savings is $6,728 per person served and $463,843 per CHW.

4. Estimated savings from reduced urgent care visits motivated by community health workers

Study	Net savings per person served
Whitley (2006)	$162
Krieger, et al (2005)	$342
Fedder (2003)	$480 - $995
Average	**$495**

Note: Per person estimates are calculated from monthly savings and participation data from each of these studies.

Summary of benefits generated by community health workers

Each community health worker has the potential to generate $862,440 in benefits per year and every person served by CHWs generates $12,509 per year in net present valued benefits. Fifty four percent of these benefits coming from increased efficiency in the use of health care services, and 46 percent of benefits accrued in the form of value of years of life not lost. The estimated benefits received by taxpayers are small in this framework. However, many of the savings that the state accumulates from the work of CHWs are included in the savings from the reduced use of urgent care.

5. Estimated total lifetime value of community health workers working on cancer outreach

Benefit category	Per participant	Per CHW
Present value of remaining years of life increased due to CHWs	$5,778	$384,599
Present value of additional taxes paid during remaining years of life increased due to CHWs	$43	$2,968
Present value of savings from reduced urgent care use	$6,728	$463,843
Total Benefits	**$12,349**	**$851,410**

Estimated costs

The investment in CHWs consists of costs directly associated with the provision of services. These include: wages and salaries, overhead costs, other direct costs such as materials, transportation, marketing tools, etc. In addition, increased testing and screening motivated by CHWs add to the costs. Figure 6 contains a summary of these costs. The detailed cost estimations are presented in the technical appendix.

The estimated direct cost of CHWs is approximately $41,184 per year. This amount includes salaries and other administrative and operational costs associated with the work of CHWs. We use wage and employment data from a survey of CHWs conducted for this study by Wilder Research in 2012. Other authors have found similar costs per CHWs (Whitley, Everhart, & Wright, 2006).

The cost of additional tests is based on an assumed test cost of $300. This amount is assumed using information from average cost of tests in the U.S. and input from experts in the field. This cost includes several types of tests like Papanicolaou (Pap smears), mammograms, stool tests, and other common screening tests for cancer. The costs of tests vary depending on the type of test and other market conditions, thus the variation of the cost around this average may be significant. However, the cost of tests represents nearly 7 percent of the costs in the ROI and has a relatively low importance in the ROI. Thus we think that the use of the average does not bias the ROI results significantly.

It is assumed that CHWs will cause an increase in the number of tests and screening of about 13 percent. This is equivalent to approximately 9 additional tests per year motivated by each CHW.

The present value of costs is obtained by discounting the annual direct cost of CHW (10 years of investment) plus the annual cost of additional tests for 20 years at a discount rate of 4 percent.

6. Estimated total lifetime value of community health workers working on cancer outreach

Cost category	Per participant	Per CHW
Direct costs	$597	$41,184
Costs of additional tests and screenings	$42	$2,608
Total annual costs of CHWs	**$639**	**$43,792**
Present value of costs	**$5,539**	**$369,490**

Return on Investment

Each community health worker generates $851,410 in lifetime benefits from years of life not lost, increased efficiency using the health care system and increased tax revenues. Generating these benefits requires an investment of $369,490 in a period of 20 years. For every dollar invested in CHWs, the society receives $2.3 in benefits; a return of more than 200 percent.

The benefits of CHWs are mostly accrued by private individuals who can enjoy years of life that would have been lost if CHWs would have not educated and helped them. Perhaps the most important benefit of CHWs derived from reduced mortality is the nurture and enhancement of the human capital of the society. This is the value of the contributions of each productive person that is not lost due to cancer. Yet, the value of human capital and life itself is difficult to capture, and thus we can only assume that the estimations in this framework are just a fraction of the real benefits experienced by individuals and the society.

7. Estimated return on investment in community health workers in cancer outreach

	Dollars per person served	Dollars per CHW
Present Value of Benefits		
Present value of remaining years of life increased due to CHWs	$5,578	$384,599
Present value of additional taxes paid during remaining years of life increased due to CHWs	$43	$2,968
Present value of savings from reduced urgent care use	$6,728	$463,843
Total benefits	**$12,349**	**$851,410**
Present value cost of CHWs (10-year investment)	**$5,359**	**$369,490**
Net benefit	**$6,989**	**$481,920**
Return on Investment	**2.3**	

Study methods

Value of years of life not lost

One of the impacts of CHWs is the increase in cancer screenings and tests. The economic benefit of this impact comes from the reduction in mortality rates of potential cancer patients whose cancers where detected at an earlier stage. The key parameter is the monetary value of every year of life that is not lost due to cancer that can be attributed to the work of CHWs.

It has been estimated that every additional year of life that is not lost due to cancer may have a value of $195,906 (dollars value in 2012). This figure is obtained using the "willingness to pay" methodology, estimated in previous studies (Cutler, et al, 2008 and Lichtenberg, 2008) and is the amount that an individual is willing to pay to enjoy an additional year of life. The willingness to pay may include assessments of subjective aspects of life such as enjoying time with family. In addition, it may include assessments about personal productivity, such as the chance of work and earn income.

However, not every person that receives services from CHWs will suffer cancer and thus will not experience a reduction in number of years of life lost because of disease. Furthermore, depending on the age of the person at the time of being served by CHW, the potential number of remaining years of life will vary, i.e. a younger person will have more years of life remaining than an elderly person. Consequently, not every person served by CHWs will generate benefits, and if they do, benefits will vary across individuals depending on age, incidence rates, and mortality rates.

We estimating the Net Expected Value of a Year of Life not Lost due to the intervention of CHWs (NEVYL), which accounts for all these factors. This value is given by:

$$\mathrm{NEVYL} = \mathrm{EVYL}^{chw} - \mathrm{EVYL}^{o}$$

Where, EVYL^{chw} is the expected value of a year of life when served by a CHW, and EVYL^{o} is the expected value of a year of life of a person not served by a CHW. We obtain these values from the following expressions:

$$\mathrm{EVYL}^{chw} = \mathrm{WTP}_{\mathrm{alive}} \cdot \Pr(\mathrm{alive}|\mathrm{chw}) + \mathrm{WTP}_{\mathrm{dead}} \cdot \Pr(\mathrm{dead}|\mathrm{chw}))$$

where, $\mathrm{WTP}_{\mathrm{alive}}$ is the value of a year of life not lost due to cancer assessed using the Willingness to Pay method. Note that $\mathrm{WTP}_{\mathrm{dead}}$ is zero, since it is expected that nobody would pay for being dead. The term, Pr(alive|chw), is the probability of being alive if served by a CHW, and Pr(dead|o) is the probability of death if served by a CHW.

Similarly, we have the value of a year of life not lost due to cancer if not served by a CHW given by,

$$\mathrm{EVYL}^{o} = \mathrm{WTP}_{\mathrm{alive}} \cdot \Pr(\mathrm{alive}|\mathrm{o}) + \mathrm{WTP}_{\mathrm{dead}} \cdot \Pr(\mathrm{dead}|\mathrm{o}))$$

In this expression, Pr(alive|o) is the probability of being alive in the general population. Combining these two expressions and simplifying we have that,

$$\mathrm{NEVYL} = \mathrm{WTP} \cdot [\Pr(\mathrm{alive}|\mathrm{chw}) - \Pr(\mathrm{alive}|\mathrm{o})] \cdot I$$

Note that the NEVYL refers to the population that is served by CHWS. In the above equation, the parameter *I* is the assumed incidence rate of cancer of the at-risk population served by CHWs. This rate is assumed since CHWs target populations that may be considered at risk of having cancer, thus using the actual incidence rate of the population may bias the result dowards. The probabilities of being alive are estimated using the following:

$$\Pr(\mathrm{alive}|\mathrm{chw}) = 1 - \mathrm{MRC}_{\mathrm{s}} - \mathrm{MRP}$$

And

$$\Pr(\mathrm{alive}|\mathrm{o}) = 1 - \mathrm{MRC}_{\mathrm{o}} - \mathrm{MRP}$$

Where, $\mathrm{MRC}_{\mathrm{s}}$ is the reduced mortality rate of cancer due to increased screenings, $\mathrm{MRC}_{\mathrm{o}}$, is the mortality rate of cancer in the population, and MRP is the general mortality rate in the population. We also have that,

$$\mathrm{MRC}_{\mathrm{s}} = \mathrm{MRC}_{o} \cdot (1 + \mathrm{S}) \cdot \mathrm{C}$$

Where, S is the average impact of increased screenings in mortality rates. This reduced mortality rate is affected by the impact of CHWs on the number of screenings, denoted by C. Using the above expressions and with some algebraic work we have that:

$$[\Pr(\mathrm{alive}|\mathrm{chw}) - \Pr(\mathrm{alive}|\mathrm{o})] = \mathrm{MRC}_{o} - \mathrm{MRC}_{s}$$

The assumed incidence rate of cancer of the at-risk popultion served by CHWs (*I*), is given by,

$$I = I^{p} \cdot (1 + scale)$$

Where, I^{p} is the incidence of cancer in the population and *scale*, is an assumed parameter to scale up the incidence rate due to the fact that CHWs target at-risk populations.

Table 9 contains the main parameters and calculations for this outcome.

8. Methods Table 1: Summary of parameters used in estimation of benefits from years of life not lost

Parameter	Source	Values
Value of 1 year of PYLL		$195,906
Assumed scale up parameter to capture CHWs work on target/at risk populations	Authors	0.01
Average Impact of CHWs on SCREENINGS (Percent)	Average of selected studies	0.1261
US Incidence (Prob) (2004-2008)	U.S. Census	0.0046
Probability of survival no CHWs	Estimated	0.6530
Mortality	Estimated/U.S. Census	0.3470
Assumed incidence rate of at risk pop	Estimated	0.0046
Average Impact of screening on mortality	Average of selected studies	-0.2537
Reduced Mortality due to screening	Estimated	0.2589
[Pr(alive)_chw] - [Pr(alive)_0] =	Estimated	0.3143
Net EVYL =	Estimated	$289

9. Methods Table 2: Sources of parameters used in estimation of benefits from years of life not lost

Impact of CHWs on screenings

Type of test	Source	Estimated net percent change in number of screenings
Pap smears	(Taylor, Hislop, & Jackson, 1992)	24%
	(Mock, McPhee, & Nguyen, 2007)	10.6% – 0.16.8%
Mammography	(Paskett E, 2006)	15,2%
	(Erwin, 1999)	9.1%
	(Sauaia, Min, & Lack, 2007)	2%
	(Earp, Eng, & O'Malley, 2002)	6%
	(Dignan, Burhansstipanov, & Hariton, 2005)	15.6%
	(Sung, Blumenthal, & Coates, 1997)	9.8%
Clinical breast examination	(Sung, Blumenthal, & Coates, 1997)	4.9%
	(Wilson, Fraser-White, & Feldman, 2008)	2%
Colorectal cancer screening	(Jandorf, Gutierrez, & Lopez, 2005)	17% - 18.5%

Impact of screenings on mortality

	Source	Estimated reduction in mortality rate
Average estimated form studies summarized by Hanley, et al (2010).	(Hanley, 2011)	16%-35%

Tax revenues

10. Methods Table 3: parameters and calculation of tax revenues

Parameter	Values
Income range (First income decile)	$32,167
Effective tax rate	0.047
Value of 1 year of additional taxes	$1,512
[Pr(alive)_chw] - [Pr(alive)_0] =	0.314342
Net Expected Value of Additional Tax revenues per person served by CHW	$2.23

Costs

11. Methods Table 4: Cost estimation

Parameter	Values	
Cost of CHWs		
Average salary	$12/hour	$24,960
Benefits	30% of annual wage	$7,488
Overheard and administrative costs	35% of annual wage	$8,736
Total direct costs per CHW (ANNUAL):		$41,184
Total direct costs per participants		$597.35
Cost of additional tests:		
Average increased in screenings		13%
Average cost of tests		$300
Additional number of tests/year		8.7
Total cost of tests per CHW		2,608.53
Cost of additional tests per participant		37.84
Total annual cost per participant		**$635.19**

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