# A Cost-Effectiveness Study of Two Projects: Irish Red Cross Community Based Health and First Aid Prisoner Peer Education in Irish Prisons

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## Executive Summary

The Prison Programme, a community initiative implemented across all thirteen Irish prisons, is based on the Community Based Health and First Aid approach designed by the International Federation of the Red Cross and Red Crescent Societies. The programme features a unique partnership between the Irish Red Cross, the Irish Prison Services, and the Education and Training Board. This collaboration is crucial in enabling the Red Cross volunteer inmates in their mission to improve health in prisons through education and mentorship. Since the inception of the programme in 2009, over 200 unique campaigns have been instituted across Irish prisons with high levels of success.

The peer-reviewed literature has been vastly in support of peer education schemes in the prison environment and has shown that peer education can positively influence behaviours, attitudes, and health outcomes. However, the literature on the cost-effectiveness of peer education in prisons is severely lacking and of poor quality. Some evidence from the United States of America has shown that for every dollar spent on community based peer education schemes, $1.13 USD to $7.14 USD were returned in savings (Welsh & Farrington, 2000). Another study performed by the National Health Service (England) showed that peer education reduced the number of infractions and grievance claims among prisoners, saving $5,694 and $217,481 USD respectively over an 18-month period (South et al., 2014).

With regards to the cost-effectiveness of hepatitis C virus (HCV) screening in prison environments, many studies concluded that screening could be cost-effective if certain conditions were met. The three main recommendations for achieving cost-effectiveness were to:

1. Increase HCV case finding by improving the prevalence of HCV screening
2. Treat HCV cases with directly acting anti-viral drugs to reduce treatment duration
3. Ensure the proper transition of care from the prison environment to the community

In 2017, Mountjoy Prison was involved in a mass viral screening campaign as part of an extensive research project funded by the European Union on hepatitis C care models. The screening campaign at Mountjoy Prison was successful in large part due to the persistence and dedication of the IRC volunteers and prison staff. The screening resulted in a 75% participation rate and uncovered 53 HCV cases out of 538 inmates. Although two of the three literature recommendations were met, data on continuity of care in the community is not yet available. Research results on cost-effectiveness are expected to be published in April 2019.

In 2012, Wheatfield Prison was involved in a weapons amnesty campaign to combat high levels of violent assaults. The IRC volunteers drove the campaign's success due to their ongoing tenacity in educating and promoting the amnesty among inmates. The results were a 95% reduction in weapons assaults, and a 40% reduction in overall assaults in the 6-month post amnesty period. There were also significant reductions in emergency and bed day admissions, and required escort hours. Overall, the economic analysis showed that the weapons amnesty campaign saved €34,111.47 in societal costs over the 6-month post amnesty period.

The data from the literature and evidence from the economic analysis are largely supportive of the Prison Programme and peer education in a prison environment. Peer education schemes can not only improve health outcomes, but create savings in both the short- and long-term.

## Introduction

This report was written by a Master of Public Health (MPH) student from Western University, Canada. The Schulich Interfaculty Program in Public Health at Western University has an ongoing partnership with the Irish Red Cross Prison Programme. Every year, a student is welcomed to work on a research project during their three-month practicum period from May to July. This report was written as an independent review by an MPH student, who in 2018, looked at two successful projects from the Prison Programme from an economic perspective.

The report contains an analysis of two projects out of two-hundred unique projects implemented by the Prison Programme from its onset in 2009. They are: the mass viral hepatitis C screening campaign at Mountjoy Prison, and the weapons amnesty campaign at Wheatfield Prison. Due to the short duration of the practicum, a complete economic evaluation of the Prison Programme could not be completed. Additionally, the limited time frame reduced the scope of the analysis to short-term outcomes only.

Some findings are limited as, at the time of the report, the mass viral hepatitis C screening campaign was ongoing and did not have final statistics. It is hoped that future cost-effectiveness studies will be continued by subsequent MPH students from Western University from 2019 onwards.

## Background: The Irish Prison Programme

The Community Based Health and First Aid (CBHFA) approach was designed by the International Federation of the Red Cross and Red Crescent Societies for the improvement of health through the empowerment of local communities. In June 2009, the CBHFA approach was introduced in a pilot project to Wheatfield Prison making Ireland the first country to implement the CBHFA approach in a prison setting (Irish Red Cross, 2017a). The CHBFA approach was introduced to a group of selected Irish Red Cross (IRC) volunteer inmates through extensive training modules that spanned several months. The seven modules included: history on the foundation of the International Red Cross and Red Crescent, an accredited first aid course, emergency response training, disease prevention, overdose prevention, and education on non-communicable diseases (Irish Red Cross, 2017a). The Prison Programme, now in all thirteen prisons across Ireland, encompasses the CBHFA method and enables IRC volunteers to promote health and wellness within the prison community.

The idea for the adoption of the CBHFA approach into the Prison Programme was based on the World Health Organization's **whole prison approach**. The report titled *Health in Prisons*, 2007 discusses how only through the achievement of health in prisons can population wide public health goals also be achieved (Blaauw et al., 2007). According to the whole prison approach, individuals in prison should not have a reduced right to healthcare services and it should be in the administrations' duty to provide an environment that is conducive to promoting physical and mental well-being (Blaauw et al., 2007). Additionally, the report highlights the importance of building strong relationships between the prison population and prison staff (Blaauw et al., 2007). The values of the whole prison approach uphold the seven fundamental principles of the Red Cross (humanity, impartiality, neutrality, independence, voluntary service, unity, universality), making the Prison Programme an ideal community health project.

Strong leadership and collaboration between the three main stakeholder groups, the Irish Red Cross, the Irish Prison Services, and the Education and Training Board, allow for the programme to flourish on a largely voluntary basis. Irish Red Cross "champions" employed by the Irish Prison Services and Education and Training Board volunteer to train and support IRC volunteers. The champions within the Irish Prison Services are integral to encouraging and enabling volunteer-led health promotion campaigns within the prison environment. This requires a high level of trust as IRC volunteers are given special status within the prison and can move relatively unabated through the various landings to speak with other inmates. Relationships between prison staff and the prisoners in general have been significantly improved since the onset of the Prison Programme (Abiodun, 2016).

The health promotion campaigns are developed to suit the priorities of each specific prison environment. Some examples of successful campaigns include: personal hygiene awareness, education on communicable and non-communicable diseases, overdose prevention campaigns, charity events, tuberculosis awareness, and mass viral screening campaigns for HIV and hepatitis C. Since the inception of the programme in 2009, over 200 unique projects have been implemented across the thirteen prisons in Ireland by IRC volunteers. This first half of the report will focus on the evidence from the literature on the cost-effectiveness of peer education and hepatitis C viral screening campaigns in prisons. The second half of the report is an economic evaluation of the weapons amnesty campaign that was executed at Wheatfield Prison in 2012.

## Effectiveness of Community Based Schemes in Prisons

A literature search was conducted on the cost-effectiveness of peer-led education in prison settings or among vulnerable populations. One recurring theme that emerged in multiple literature identified prior or current drug abuse behaviours as a major risk factor for communicable diseases, mental illness, violence, and recidivism (Assoumou et al., 2018; Coulton et al., 2017; Darke, Cresswell, McPherson, & Hamoodi, 2016; Ford et al., 2018; French, Fang, & Fretz, 2010; Nymanthi et al., 2016; Post, Arain, & Lloyd, 2013; Sutton, Edmunds, Sweeting, & Gill, 2008; Zhang, Roberts, & Callanan, 2006). Substance abuse was directly correlated with the number of convictions an individual had; 81% of inmates in American prisons with five or more convictions were involved in drug abuse behaviours (French et al., 2010). Peer education programmes in prisons targeting substance abuse positively impacted numerous health issues.

A retrospective study performed using data collected by the New Jersey Department of Corrections showed that there were significant cost savings associated with substance abuse education programmes (French et al., 2010). Over a one-year period, inmates who had received peer education on substance abuse avoided arrest, on average, for 296 days compared with 260 days for inmates who had not received the peer education intervention (French et al., 2010). When considering costs associated with recidivism including the cost of arrest, conviction, incarceration, and wage loss, a reduced recidivism rate due to peer education translated into savings ranging from $4,323 to $6,209 per inmate over the one year study period (French et al., 2010).

Another study performed by Zhang et al., (2006) looked at community based programmes for parolees in Californian correction facilities, aimed at tackling barriers to integration upon release. Some identified barriers to integration include substance abuse, illiteracy, unemployment, and homelessness (Zhang et al., 2006). The recidivism rates for parolees receiving the community based intervention were observed over a thirty-six-month period. The comparison consisted of data on the Californian parolee population without access to community based interventions. The results showed that over a thirty-six-month period, parolees in the intervention group remained out of prison for an average of 446.7 days (Zhang et al., 2006). In comparison, the control group remained out of prison for an average of 393.1 days (Zhang et al., 2006). Considering the estimated cost of incarceration in California was $43.00 USD per day, per inmate, the cost-benefit ratio was 1:1.47. This meant that for every $1.00 USD spent on community based programmes, $1.47 USD were accrued in savings.

A systematic review by Welsh and Farrington (2000) looked at seven studies that had performed a cost-benefit analysis on their respective community based prison programmes. These community based programmes focused on a range of interventions such as rehabilitation services, and substance abuse aid (Welsh & Farrington, 2000). Overall, the analysis showed that the cost-benefit ratios ranged from $1.13 USD to $7.14 USD, meaning that for every $1.00 USD spent on community based programmes, the public payer was receiving $1.13 to $7.14 USD back in savings (Welsh & Farrington, 2000). These savings were based off the benefits calculated from changes in education, employment, health, social services use, and substance abuse status. These costs did not include the social costs associated with the prevention of criminal activity, which would have greatly increased the value received back in savings. For

example, the cost associated with being a victim of rape in 1985 was $51,058 USD and included direct loss, pain, suffering, fear of injury, and risk of death (Welsh & Farrington, 2000). When converted to 2017 prices, the cost of rape would be $127,645 USD (see Appendix C for conversion).

Another systematic review by Devilly, Sorbello, Eccleston, and Ward (2005) looked at peer education with regards to perceptions and behaviours surrounding HIV and/or AIDS. Studies from their systematic review showed that peer education positively influenced condom use, decreased sexual activity with high risk partners, and reduced risky drug use behaviours (Devilly et al., 2005). The systematice review however contained only a limited analysis from a cost-perspective point of view. The authors Devilly et al., (2005) suggested that despite the initial up front costs of implementing peer education in prisons, the potential long-term savings would surpass the initial investment. They argued that peer education was financially viable since peer inmates worked 24 hours a day, 7 days a week without monetary compensation (Devilly et al., 2005). Additionally, the authors argued that benefits seen by improvments in personal development in those exposed to peer education such as self-worth, self-confidence, and self-efficacy, were difficult to quantify (Devilly et al., 2005). While the authors were correct about peer education schemes being financially viable, they did not consider that some voluntary time may have economic value due to the opportunity cost of labour.

In 2014, the National Health Service (NHS) England funded a systematic review which looked at the effectiveness and cost-effectiveness of peer interventions in prisons across several countries (South et al., 2014). Most of the articles in the review were from OECD countries, predominantly the United States of America (USA), the United Kingdom (UK), and Canada. Articles in the review focused on numerous health outcomes including general hygiene, substance abuse, self-harm, HIV and hepatitis infection rates, mental health, and tendencies toward violent behaviours. The overall findings showed that peer education programmes reduced recidivism and substance abuse behaviours (South et al., 2014).

When looking at cost-effectiveness, only one study out of 1,158 fit the inclusion and exclusion criteria of the NHS systematic review. This study, performed in the USA, looked at monetary costs associated with prison infractions. The intervention group had peer-mentor support through activities such as group therapy and role-playing. Most of the peer support focused on influencing drug behaviours and increasing social responsibility. The comparator was a group of individuals in the same prison environment who did not have access to any peer support programmes. The analysis found that those who had received the peer intervention were less likely to receive an infraction and less likely to file a grievance (South et al., 2014). The total savings in the intervention group over an 18-month period were $5,694 due to fewer infractions and $217,481 due to a reduction in grievance claims (South et al., 2014).

Further economic modelling conducted by the NHS England looked at HIV education interventions in prisons. Due to the high prevalence of HIV infections in prison populations, the researchers acknowledged that education in the prison environment was ideal. The Bernoulli model developed by the NHS used costs and QALYs to make comparisons between peer education, professional education, and no education (South et al., 2014). The results were that QALYs gained were highest in the peer education group at 3.34, followed by 1.26, and 0 for professional education and no education respectively (South et al., 2014). When translated to

lifetime costs, peer education saved £192,000, professional education saved £72,000, and no education was estimated to cost the NHS £485,000 over a lifetime (South et al., 2014).

## Discussion

Overall, the literature search revealed that relatively little research had been done on the cost-effectiveness of peer education programmes in prison settings. Cost-effectiveness studies were of low quality, incomplete economic evaluations, or uncritical of results. Many studies considered only upfront financial costs, and ignored opportunity costs associated with the implementation of peer education programmes. Additionally, most studies were conducted over a short time horizon thereby precluding the ability to measure lifetime costs and consequences of community based programmes.

One major drawback of the summarized studies was the failure of researchers to properly define the community based or peer education intervention. These interventions can take on many forms and vary vastly in resource use. Failure to outline the parameters of the intervention reduced the ability to apply the findings to another setting. Most of the defined interventions were not as intensive or well integrated as the Irish Prison Programme. In addition, most research was performed in American or British prison environments. The notable differences in prison operations and funding between American prisons and Irish prisons influenced the adaptability of the findings to the Irish setting. Articles from the UK better reflected the Irish prison environments due to the similarities in the funding models. However, as each individual prison is a unique environment with different problems and priorities, an effective intervention implemented in one prison may not be as effective when applied in another prison.

Despite lack of generalizability of the literature and lack of high-quality cost-effectiveness studies on community based and peer education interventions, the literature did show that overall, the evidence was overwhelmingly in support of community schemes in the prison environment. Modelling conducted by the NHS showed that peer education was cost-saving and produced substantial lifetime savings especially when compared with the alternative of no education schemes. Similar results were seen across American prisons that showed community based and/or peer education interventions led to return investments of 100% to 700%. Seeing as the Irish Prison Programme is better embedded within the community compared with interventions in the literature, similar (if not superior) savings may be expected.

# Analysis of Mass Viral Screening at Mountjoy Prison

## Background: Hepatitis C Transmission, Prevalence, & Treatment

Infection with the hepatitis C virus (HCV) is a common cause of chronic liver disease. An HCV infection can be acute or chronic, and range from several months to a lifelong illness resulting in liver failure (World Health Organization [WHO], 2017). As HCV is bloodborne, most infections occur through unsafe drug injection procedures, a failure to sterilize syringes and needles, or needle sharing. Additional transmission can occur through unsafe sexual activity (WHO, 2017). In Ireland, the estimated prevalence of HCV in the population is 0.5% to 1.2%, although basing estimates off similar data from Scottish surveys suggests the true prevalence lies closer to 0.5% (Department of Health, 2014). Findings from a 2011 study performed in Irish prisons discovered that 41% of prisoners with a history of injecting drugs had anti-HCV antibodies in their serum, signifying either a past or current infection with HCV (Department of Health, 2014).

HCV has a varying incubation period of between two weeks to six months. During this incubation period, most infected individuals do not exhibit any symptoms, and those that do, exhibit flu-like symptoms in conjunction with jaundice (WHO, 2017). Due to the lack of signs during the incubation period, few individuals with HCV are tested and diagnosed. Individuals whose infection becomes chronic, may not show symptoms for decades after which serious conditions secondary to liver damage begin to appear (WHO, 2017).

There are two separate stages for diagnosing HCV. In the first stage, an individual is screened for antibodies through a serological blood test (WHO, 2017). If the test is positive for anti-HCV antibodies, a secondary test is administered. This second test is an RNA test confirming the presence of an active infection. Individuals with chronic HCV, usually undergo a liver biopsy or fibro scan to assess the level of liver fibrosis or cirrhosis (WHO, 2017). Testing can also be done to determine the genotype of the virus, as there are currently six genotypes of HCV, some of which require a different treatment drug and duration (WHO, 2017). In Ireland, most individuals with an HCV infection fall into either genotype 1 or genotype 3 (56% and 39%). A similar genotype prevalence is observed in the UK and the USA.

| | G 1a | G 1b | G 1c | G 2 | G 3 | G 4 | G 5 | G 6 |
|---|---|---|---|---|---|---|---|---|
| **Ireland** | 42% | 14% | 0% | 4% | 39% | 1% | 0% | 0% |
| **U.K.** | 24.4% | 11.9% | 0% | 7.3% | 43.8% | 3.8% | 0% | 0% |
| **U.S.A.** | 46.2% | 26.3% | 0% | 10.7% | 8.9% | 6.3% | 0% | 1.1% |

Table 1: The prevalence of HCV genotypes in Ireland, the UK, and the USA (Blach et al., 2017).

Treatment is not always required as 30% of individuals infected with HCV are able to fight off the virus with their own immune response (WHO, 2017). Additionally, treatment will depend on other factors including viral load, a history of HCV infection, the degree of liver damage, and whether patients are treatment naïve or treatment experienced. (Department of Health, 2014). Of those infected, 5% to 20% develop cirrhosis within twenty years, and a further 1.5% to 2.5% develop hepatocellular carcinoma (liver cancer) (Department of Health, 2014). In Ireland, approximately ten individuals receive a liver transplant for hepatocellular carcinoma each year (Department of Health, 2014). To be cured from hepatitis C is to have a sustained virological response (SVR) and to have undetectable levels of HCV RNA in the plasma after completion of treatment (Department of Health, 2014).

Since 2014, there have been huge improvements made in the treatment of HCV through the discovery of Directly Acting Anti-virals (DAAs). DAAs have treatment success rates of 90% to 95% compared to older interferon or ribavirin based treatments which have success rates of 45% to 48% (Martin et al., 2017). The treatment duration for HCV has also been dramatically reduced by DAAs, dropping from 24 to 48 weeks with interferon or ribavirin based treatment to 8 to 12 weeks with DAAs (Martin et al., 2017). These benefits come with a cost as DAAs are significantly more expensive than older treatment modalities.

Unfortunately, due to the relative newness of DAAs, the cost of HCV treatment using DAAs is currently unknown in Ireland, the UK, and across many other parts of Europe. In Ireland, these costs are currently being established by the Irish HCV Outcomes and Research Network (ICORN) and the results of this work will be used to inform future cost-effectiveness analysis. A group of researchers from the UK estimated the costs of DAA treatments for genotype 1, genotype 2, and genotype 3, which can be seen in Table 2 (Martin et al., 2016). The costs have been converted into Euros for ease of comparison.

| Treatment | Duration | Weekly cost (£) | Total Cost (£) | Total Cost (€)* |
|---|---|---|---|---|
| **IFN- free DAA All Genotypes** | 12 weeks | £3,300 | £39,600 | €45,805 |
| **IFN-free DAA Genotype 1** | 8 weeks (non- cirrhotic) | £3,300 | £26,400 | €30,536 |
| | 12 weeks (compensated cirrhosis) | £3,300 | £39,600 | €45,805 |
| **IFN-free DAA Genotype 2** | 12 weeks | £3,300 | £39,600 | €45,805 |
| **IFN-free DAA Genotype 3** | 24 weeks | £3,300 | £79,200 | €91,610 |

Table 2: The weekly cost of HCV treatment using DAAs for genotypes 1, 2, and 3 (Martin et al., 2016).
*For conversions, please see Appendix C

Although these costs may seem significant, literature evidence supports that treatment with DAAs can be cost-effective under some circumstances.

## Evidence: Cost-Effectiveness in the Literature

A study performed in the USA compared various HCV screening methods in American prisons (Assoumou et al., 2018). The results showed that based on a willingness-to-pay (WTP) threshold of $100,000 per QALY, the most effective screening strategy was *counsellor-initiated routine rapid testing* which had an ICER of $71,000 per QALY (Assoumou et al., 2018). This strategy was most optimal when the prevalence of persons who inject drugs (PWID) was greater than 0.59% or the HCV prevalence among drug users was greater than 16% (Assoumou et al., 2018). Individuals with HCV who had received therapy were also predicted to have a two-year extended lifespan over those who did not receive treatment (50.18 years versus 48.09 years respectively) (Assoumou et al., 2018).

A cost-effectiveness analysis performed in the USA looked at HCV screening in high-risk communities (Eckman, Talal, Gordon, Schiff, & Sherman, 2013). The researchers used a meta

regression analysis to model the progression of chronic HCV over the life course of an individual. Disease advancement was modeled using probabilities at each stage of illness. Costs were calculated for use of healthcare system resources, however; no opportunity costs were captured. This study used the WTP threshold of $50,000 per QALY. The results of the analysis showed that screening followed by appropriate treatment of individuals with chronic HCV cost $47,276 per QALY (Eckman et al., 2013). The researchers found that if the prevalence of HCV in the population fell below 0.84%, the ICER value would increase above the willingness-to-pay threshold and hence, would not be cost-effective (Eckman et al., 2013).

Another study in American prisons by He et al., (2016) looked at whether screening was cost-effective from a societal perspective. Four different screening methods were captured: a one-time screen of active or former intravenous drug users, and a one-time universal screen followed by: screening in one year, five years, or ten years (He et al., 2016). Costs and QALYs were calculated for each of the five scenarios and up take of screening was assumed to be 75% for risk-based screening and 90% for universal opt-out screening (He et al., 2016). The cost of treatment using DAAs was based on their wholesale price, additionally, there was a further assumption that in 2030, generic drugs would flood the market and reduce drug costs. The cost per identified case associated with each scenario was as follows: $880 for one-year risk screening, $1,300 for one-year universal screening, $1,680 for five-year universal screening, and $2,030 for ten-year universal screening.

Additionally, ICERs were calculated for each scenario compared with no screening (He et al., 2016). The results were summarized in the table below:

| Screening Method | Cost per Case (USD) | ICER ($/QALY) Compared with No Screening | ICER (€/QALY) Converted to Euro (2016)* |
|---|---|---|---|
| **At-Risk Screening (One Time)** | $880 | $19,600 | €15,915 |
| **Universal Screening in 1 Year** | $1,300 | $20,600 | €16,727 |
| **Universal Screening in 5 Years** | $1,680 | $24,000 | €19,488 |
| **Universal Screening in 10 Years** | $2,030 | $29,200 | €23,710 |

Table 3: The cost per case and ICER values for different screening methods, converted to Euro (He et al., 2016).
*For conversions, please see Appendix C

In all instances, the ICERs were below the WTP threshold of $50,000 per QALY. The authors concluded that universal screening was preferable to at-risk screening (He et al., 2016). Furthermore, the authors suggested that most benefits would be seen in the community in the form of reduced HCV transmissions, and a decreased incidence of chronic and/or advanced liver disease (He et al., 2016).

A study by Darke et al., (2016) looked at cost-effectiveness of universal opt-out screening versus targeted screening. Universal opt-out screening was a method whereby all inmates were screened indiscriminately, and those who did not wish to undergo screening procedures actively

opted out. Targeted screening selectively chose inmates deemed to be high-risk for HCV infection due to past or current risk-taking behaviours (Darke et al., 2016). This study of prisons in the UK showed that although universal testing was more expensive than targeted screening, the long-term savings outweighed the short-term costs due to the identification of more HCV positive individuals. Catching and treating HCV positive individuals circumvented the costs of treating chronic morbidity and mortality associated with liver disease (Darke et al., 2016).

Other literature to support universal HCV screening as a means to increase the case finding numbers, which in turn reduced HCV transmissions within the prison environment (Rich et al., 2017). Similarly, Morris, Brown, and Allen (2017) concluded that universal testing was less stigmatizing and led to fewer inmates opting out as a result. Estimated participation rates for HIV screening were improved to 60% to 80% when the universal screening model was adopted (Morris et al., 2017).

Cost-effectiveness studies in the UK by Martin et al., (2013) determined that one of the biggest contributors towards high costs was the lack of continuity of care from the prison to the community. This was especially problematic among individuals with a history of drug abuse as those incarcerated for drug abuse behaviours usually had shorter sentences and were often released prior to completing the course of HCV treatment. The authors determined that when continuity of care was 100%, the ICER value for HCV screening was reduced from £59,400 per QALY to £10,400 per QALY (Martin et al., 2013). Having a continuity of care of 40% led to an 83% probability that the ICER value would remain below the WTP threshold of £30,000 per QALY (Martin et al., 2013). Another factor that increased cost-effective was using DAAs over older drug therapy as shorter treatment periods increased the likelihood of treatment completion. Finally, the authors concluded that increasing the number of individuals initially screened improved cost-effectiveness if case finding was increased (Martin et al., 2013).

The same group of researchers went on to perform another cost-effectiveness study in UK prisons based upon different treatment methods. The researchers compared older treatment methods using pegylated interferon and ribavirin which require 24 to 48 weeks of treatment, to DAAs which require 8 to 12 weeks of treatment (Martin et al., 2017). When treatment in prisons occurred with DAAs, the ICER value was £15,090 per QALY gained compared with £19,850 per QALY gained for older treatment methods (Martin et al., 2017). If DAA treatment was used for 8 weeks only, the evidence indicated that HCV case finding was highly cost-effective, below £13,000 per QALY gained (Martin et al., 2017).

### Hepatitis C Screening at Mountjoy Prison

In June 2017, a group of researchers funded by the European Union (EU) began a project looking at the integration of care models surrounding hepatitis C in four European cities: Dublin, London, Bucharest, and Seville. The project, titled HepCare Europe, consisted of five main components: HepCheck, HepLink, HepFriend, HepEd, and HepCost. The HepCheck and HepFriend components were concerned with mass viral screening in prisons and the value of peer education training. The HepCost component was the cost-effectiveness analysis being performed by the University of Bristol, UK. The entire project is expected to be completed by April 2019.

As part of the HepCheck, HepFriend, and HepCost component, the hepatitis C mass viral screening campaign at Mountjoy Prison in Dublin was arranged by Dr. Jack Lambert, the Coordinator for the HepCare Europe project, and Dr. Des Crowley. Mountjoy Prison is the main committal prison for male offenders aged 18 and over in the Dublin area. It is a medium security prison, and one of the larger capacity prisons in Ireland, having an operational capacity of 554 and a daily average of 515 inmates (Irish Prison Services, 2016). There had been no previous attempts to engage the entire prison population in a mass hepatitis C screening campaign until this study. In 2010, 2011, and 2013 however, mass voluntary HIV screening took place in a similar process across three prisons with IRC volunteers acting as peer educators and advocates for testing. The resulting uptake of screening between 58% and 72% suggested the higher rates of engagement were due to IRC peer education (Irish Red Cross, 2017b).

Although the main findings of the mass viral hepatitis C screening campaign are not yet expected to be published until April 2019, some analysis can be done on preliminary results.

The Prison Programme IRC volunteers and champions were heavily involved with organizing and coordinating the mass viral screening event at Mountjoy Prison. The IRC volunteers were key in persuading inmates to opt in for testing regardless of their HCV status. This tactic masked individuals who were presenting themselves due to risk factors such as drug use or unsafe sexual practices and de-stigmatized the entire event. The IRC volunteers also worked to educate inmates on HIV and HCV infections to reduce misconceptions surrounding the diseases. The IRC champions which included a nurse, educator, governor, chief officer, and psychologist were involved in the planning and implementation phases of the screening process.

On the day of the campaign, prison guards and IRC volunteers were responsible for gathering inmates from each landing and presenting them in groups of six to four rotational stations. The four stations were: a counselling station, a consent station, a screening station, and an exit interview station. Inmates were given an additional chance to opt-out of screening at the consent station before the diagnostic blood test. Results were given approximately one month later by doctors in individually set up stations which maintained confidentiality. Counselling rooms were also available for inmates who deemed themselves in need of counselling services. Within the confines of the prison, a fibro scan room was set up to test the degree of liver fibrosis on the premises.

## Results

The population of Mountjoy Prison on the day of screening was 538 inmates. However, due to factors such as mental illness, refusal to consent, release, or transfer to another prison, 116 prisoners did not meet the inclusion criteria of the study. Out of the 422 eligible inmates, 403 consented to undergo HCV testing. As mentioned previously, the first step to screening checked for HCV antibodies using a standard blood test, after which an RNA test was administered. Out of 403 inmates, 92 tested positive for HCV antibodies. To confirm an active infection, those who tested positive went on to complete an RNA test. The results determined that 53 inmates out of 92 had an active HCV infection, while the other 39 had either a spontaneous clearance of the virus, or a sustained virologic response. Further data from the exit interview showed that among the 53 who had a current HCV infection, 79.7% had a history of or were currently engaged in

drug injecting behaviours. Out of the 53 individuals who were HCV positive, 37 had Genotype 1a HCV and 26 had Genotype 3 HCV. All were treated with DAAs.

Unfortunately, as the study is still ongoing, there is no information on the treatment status of the 53 HCV infected individuals. It can be assumed that some individuals have completed their full course of treatment, while others may not have completed treatment due to factors such as being transferred to another prison, or being released into the community without the proper transition of care. However, discussions with clinical staff have identified that there is currently a prison to community plan for released prisoners to ensure continuity of care. The results of the mass viral screening campaign are summarized in Figure 1 below.

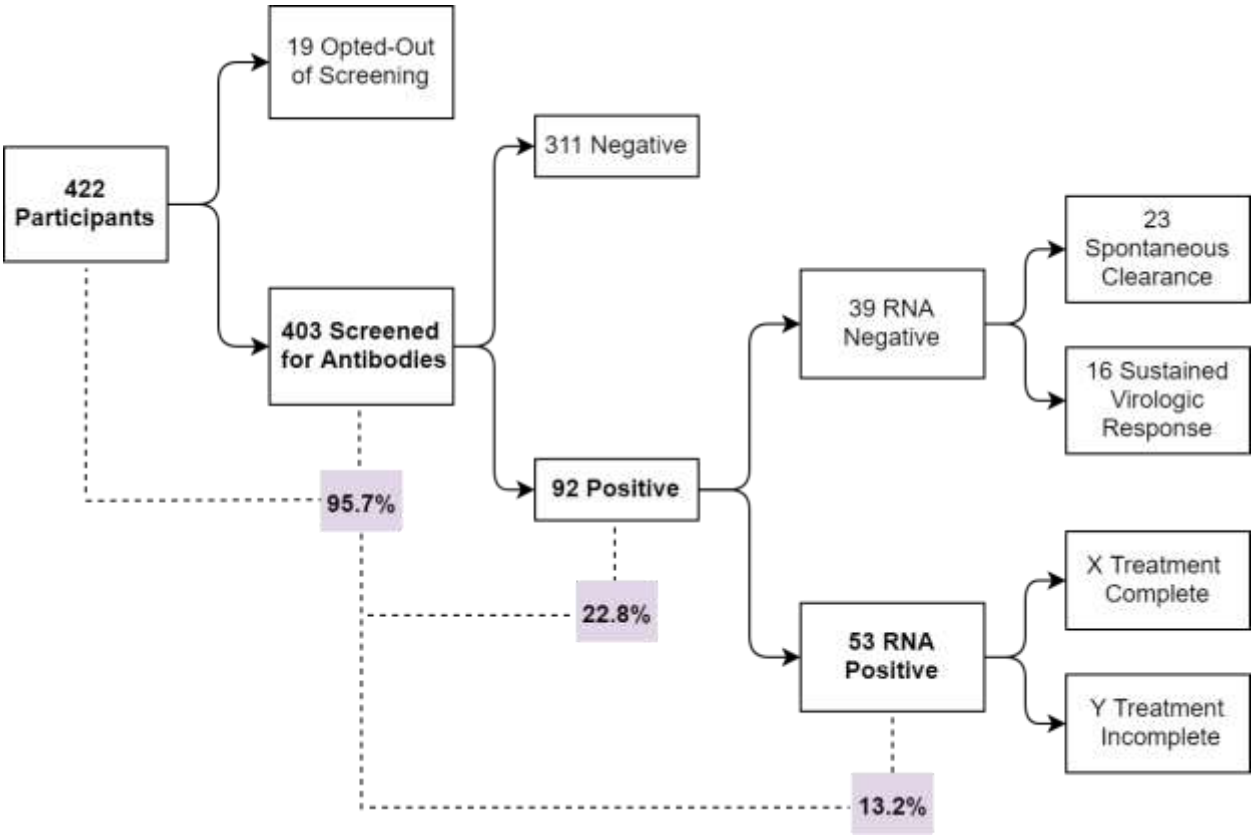


Figure 1: Visual representation of the mass viral (HCV) screening campaign at Mountjoy Prison.

Furthermore, there is no information on whether the number of cases found were previously known to the prison administration or were newly discovered.

## Discussion

Evidence from the literature supports HCV screening in prison environments. If the correct conditions are met, HCV screening can be cost-effective and treatment can impact health in both the prison and the surrounding community. Due to the restrictive and controlled nature of the prison environment, screening and treatment can be highly beneficial from an economic perspective. Additionally, the higher numbers of PWID in the prison environment contributes

towards the higher HCV prevalence, making inmates ideal recipients for screening (Sutton et al., 2008).

Treating and curing inmates of HCV can effectively reduce transmission rates within prisons and in communities upon release. Evidence from research performed in a medium-sized Scottish prison estimated the transmission of HCV among prisoners to be 11.9 individuals per 100-person years (Post et al., 2013). In other words, if 100 prisoners remained in prison during a one-year period, 12 new prisoners would be infected with HCV at the end of the one-year period. As inmates can be re-infected with HCV, transmission is a worrying concern in enclosed and cloistered environments.

Another concern is the difficulty of following-up and monitoring the progression of treatment in an individual. As drug treatments can range from 8 weeks to 48 weeks, many individuals often do not finish the recommended treatment course and are lost to follow-up. Lack of social support, costs, or difficulties navigating the physical environment can impact an individual's ability to complete treatment. However, this is less of a concern in the prison environment, which is a closed community that can more easily supply the appropriate resources to ensure follow-up or the transition of care.

The literature previously summarized identified three factors which negatively influenced the cost-effectiveness of HCV screening in the prison environment:

1. Low rate of case finding due to poor turnout to universal HCV screening
2. Prolonged HCV treatment, extending from 24 to 48 weeks
3. Lack of continuity of care when transitioning from the prison to the community

Ensuring that these factors are addressed before and during the screening and treatment process can improve the cost-effectiveness of HCV screening.

Based on the above factors, it is very likely that the mass viral screening campaign at Mountjoy Prison was cost-effective as evidence from the literature suggests many of the criteria for cost-effectiveness were met. Firstly, the high turnout for HCV screening (95% among those eligible for the study) improved the chances of case finding and coincided with the 90% turn out used by He et al., (2016) to determine cost-effectiveness. In the case of Mountjoy Prison, the high prevalence of screening uncovered 53 HCV cases.

The overall prevalence of HCV in the entire prison population of 538 was 9.85% (or 12.56% of eligible participants). This was higher than the 0.84% case threshold suggested to be cost-effective by Eckman et al., (2013). Additionally, the prevalence of HCV among inmates with a history of or current drug injecting behaviours was 79.7%, also higher than the 16% threshold for effectiveness suggested by Assoumou et al., (2018).

Further data should be collected on the number of individuals who transitioned from the prison to the community before completion of treatment and the number of individuals that successfully completed treatment in the community. Cost-effectiveness as determined by Martin et al., (2013) depends partially on the successful transition of care among those undergoing treatment in the community. Their model showed that a 40% continuity of care would lead to an 83%

probability that the ICER value would be under the £30,000 WTP threshold. Confirmation of the number of inmates who have successfully transitioned to community care could further inform the cost-effectiveness of the mass viral screening campaign at Mountjoy Prison.

Research performed by Kieran et al., (2015) in Irish hospitals, estimated the cost of resources used in the treatment of HCV at various stages of liver disease. These costs, found in Table 4, **do not** include DAA treatment costs, as the authors could not determine those costs within Ireland.

| HCV Health-State | Mean Annual Cost | Resources Valued |
|---|---|---|
| Mild Fibrosis | €398 | - Medical (nurses, doctors)<br>- Administration<br>- Phlebotomy services<br>- Laboratory and radiology investigation<br>- Ambulatory care review<br>- Transplant procedure<br>- Immunosuppressive drugs for liver transplant |
| Moderate Fibrosis | €417 | |
| Compensated Cirrhosis | €1,790 | |
| Decompensated Cirrhosis | €8,303 | |
| Hepatocellular Carcinoma | €21,992 | |
| Liver Transplant | €137,176 | |
| 1 Year Post Liver Transplant | €5,337 | |
| Sustained Virological Response | €44 | |

Table 4: The cost of resources used for HCV treatment in Irish hospitals, excluding DAA drug costs (Kieran et al., 2015).

The prices in Table 4 insinuates there is some value in preventing HCV infections from developing into chronic conditions. As liver disease progresses to more severe stages, costs increase substantially. In contrast, the cost of follow-up after having achieved SVR is only €44 per year. These costs suggest that the initial investment of screening and treatment is preferable to providing medical care during later stages of the disease even though the initial investment in DAA treatment can be a costly endeavour.

## Conclusion

The Prison Programme was paramount in guaranteeing the success of the mass viral screening campaign. Without the support of IRC volunteers, it is unlikely that many inmates would have voluntarily consented for HCV screening. The screening and treatment services could not have been provided without the partnership and trust between the IRC volunteers and prison staff. Evidence from the literature points to certain recommendations that, if not already in place, can improve cost-effectiveness of future mass viral screening campaigns:

1. Ensure increased numbers of case finding by achieving high turn out to HCV screening
2. Treat the HCV infection with DAAs in order to reduce treatment duration to 8 to 12 weeks
3. Ensure continuity of care from the prison into the community

Although the first two criteria were seemingly met by the mass viral screening at Mountjoy Prison, the exact cost savings are difficult to calculate without complex economic modelling. The true cost-effectiveness of the intervention will be determined by the Bristol University researchers involved in HepCare Europe in 2019.

# Cost-Effectiveness of Weapons Amnesty Campaign at Wheatfield Prison

## Introduction

The first weapons amnesty campaign was held at Wheatfield Prison in July 2012. The idea, originally thought up by an IRC volunteer, came to fruition after concerns arose about the increasing number of violent assaults at Wheatfield Prison. Additionally, poor social cohesion between guards and inmates exacerbated the issue. Collaboration and planning between prison management and IRC volunteers set the campaign into motion. Over the course of seven days, the IRC volunteers would visit each wing within Wheatfield Prison to promote the weapons amnesty and to put up posters representing the Red Cross values. Each landing had a sharps container located in an area without cameras. The prison Governors chose not to punish inmates who came forward to give up their weapons during the amnesty period and trusted prisoners not to take weapons from the sharps container during this period. The Governor of Wheatfield Prison played a large role in the amnesty, making it a point to speak at several prisoner congregations about the consequences prisoners would face if they were found with weapons after the amnesty period.

The results following the weapons amnesty campaign were immediate and extremely positive. When compared with the preceding three months, the campaign was responsible for a decline in weapon assaults by 95% and an overall decline in all assaults by 40%. These benefits continued into the next year as weapon assaults remained at only 6% of all assaults. Previously, they had represented 50% of all assaults. Since 2012, the IRC volunteers have held several other weapons amnesty campaigns, which continue to ensure a more congruent and safe prison environment.

A qualitative questionnaire was administered by IRC volunteers at the end of the weapons amnesty campaign to which 458 inmates responded. The results showed that 93% of inmates felt the weapons amnesty campaign was a good idea and 71% felt encouraged to give up their weapons during the amnesty period. A total of 88% of inmates said they would like to participate in another weapons amnesty in the future.

## Methods

**Overview**

The evaluated intervention was the weapons amnesty campaign held at Wheatfield Prison in 2012. A cost-consequence analysis was utilized since the campaign influenced several health outcomes, and an equivalent weight was given to each outcome. The consequences were: number of weapon assaults, number of non-weapon assaults, number of emergency room (ER) visits, number of bed days, and number of escort hours. The evaluation comparator was *no campaign* (status quo). The values of the resources used during the *no campaign* period were derived from statistics collected 6-months prior to the onset of the weapons amnesty campaign. Likewise, the values of the resources used after the weapons amnesty period were derived from statistics collected in the 6-month period following the campaign. Costs were displayed from a societal perspective which encompassed all cost categories including organization costs, health sector costs, and productivity costs. All prices were converted into euros and to the reference

year of 2017. Since the analysis was performed over a short time horizon, no discounting was applied to any of the calculations.

**Model framework**

A spreadsheet model was used to assess the outcomes in the 6-month period prior to the amnesty, and the outcomes in the 6-month period following the amnesty. The budget for the Prison Programme provided by the Irish Red Cross supplied some of the labour costs. Many other prices were obtained through other means through labour contracts and literature from the Education and Training Board, the Irish Prison Services, the Irish Nurses and Midwives Organisation, the Department of Health, the Garda, and WHO-CHOICE.

The model consisted of two components. The first component (Table 6) represented the cost of training an IRC volunteer. This cost was used to value the labour contributed by the IRC volunteers during the weapons amnesty campaign. The second component (Table 7) represented the resources used (parameters) for the *no campaign* period, and the weapons amnesty period.

An assumption of the model was that IRC volunteer time would not be valued at the market wage (minimum wage). This decision was based on the World Health Organization's Guide to Cost-Effectiveness Analysis (WHO-CHOICE Collaboration, 2003). According to the guide, if the volunteer labour used to perform a specific task can always be filled voluntarily, the opportunity cost for that labour is zero. In the prison environment, there is no shortage of volunteer labour. However, the cost to train IRC volunteers was captured as it is presumed that training did influence the effectiveness of the evaluated intervention.

Another assumption was that the number of ER visits was equal to the number of weapon assaults based on expert opinion from the Governor of Wheatfield Prison stating that "virtually all" assaults led to an ER admission. A further assumption was made that ambulance transportation was only required in each of the five bed day admissions.

**Parameters**

Organization Costs:

Wheatfield Prison had 18 landings in operation at the time of the campaign, and each landing required a sharps container. The price of the sharps container was taken from the Fischer Scientific website and multiplied by the number of landings to equal €184.50. Each landing also had a flier, developed by the IRC volunteers, promoting the campaign and counting down to the day of amnesty. The flier was changed everyday for eight days. The price of a flier was obtained from WHO-CHOICE at 0.6 Int$ in 2005. This value was converted into euros and to the reference year of 2017. The total cost of 144 fliers was €99.36.

Some items which include the computers, printers, and projectors were considered fixed costs as these items were not being purchased year after year. Therefore, to not overestimate these costs, a formula was used to determine the yearly cost of the capital good:

$$\text{Annualization Factor} = \frac{[(1+r)^{n} - 1]}{[r(1+r)^{n}]}$$

In the factor formula, **n** is the average lifespan of the item and **r** is the interest rate of 5%, a value taken in accordance with the Irish Department of Expenditure and Reform. The total cost of each item was divided by the annualization factor to determine the cost for a one-year period. All fixed costs were further prorated at 1% due to an assumption that these resources were used for 1% of the item's total usage. The cost of both the computer and printer were obtained from WHO-CHOICE as 1,581.26 Int$ and 312.85 Int$ respectively, and were converted to the reference year of 2017. Both items were assumed to have a life expectancy of 5 years and after annualizing and pro-rating at 1%, the costs were €4.62 and €0.91 respectively.

Health Sector Costs:

An assault with a weapon resulted in the injured prisoner seeing the prison doctor for an average of 30 minutes. The salary for a prison doctor was determined from Locumotion (a doctor-led medical recruitment service) to be €250 for one four-hour session, or €62.50 per hour. However, the prison doctors worked limited shifts from 10:00 am to 4:00 pm, seeing only 30% of all weapon assault victims. Hence costs were pro-rated at 30%. During the *no campaign* period, the doctor spent 6.6 hours with assaulted patients, costing €412.50. After the amnesty period, the doctor spent 0.3 hours with assaulted patients, costing €18.75.

The prison nurse was also utilized for each assault (with or without weapons) and was called to the scene of the assault to attend to the injured individuals. It was assumed that on average, the nurse spent 30 minutes on each assaulted patient. The salary for a nurse was determined to be €23.35 per hour based on the average salary of a clinical nurse II from the Irish Nurses and Midwives Organisation. During the *no campaign* period, the nurse spent 28.5 hours with assaulted inmates, costing €665.48. Following the amnesty period, the nurse spent 17 hours with assaulted patients, costing €396.95.

The cost of an ER visit was taken from previous modelling completed by Audit Scotland in 2008. The average cost of resources used in the ER was determined to be £102 at that time. After conversions, it was determined that the average cost of an ER visit in Ireland was €135.41. Based on the expert opinion of the Governor, virtually all weapon assault victims were referred to the ER for stitches. During the *no campaign* period, 44 ER visits occurred. After the amnesty, only 2 ER visits occurred. The total costs were €5,958.04 and €270.82 respectively.

Prior to the amnesty, the Governor recalled that approximately 5 individuals had been admitted for a bed day due to the severity of their injuries. The cost of a bed day was determined from a report by the Department of Health and Child which looked at the economic costs of treatment in public hospitals. The approximate cost of a bed day at Tallaght University Hospital was €1,122 in 2010. After costs were converted to the reference year of 2017 and multiplied by the number of incidents, the total cost was €5,896.37.

Each patient who was admitted for a bed day was transported to the hospital in an ambulance. The economic cost of ambulance transportation was determined by the National Health Service (England) to be £270 in 2015. After the value was converted, the cost of an ambulance delivery was €317.16. When multiplied by the 5 one-way ER transfers, the total cost was €1,585.80. The cost of petrol was determined by the average market value of petrol in 2017. It was assumed that fuel consumption was 10 kilometres per litre. Tallaght University Hospital is 9 kilometres from Wheatfield Prison meaning that transportation to and from the hospital would

require 1.8 litres of petrol. Prior to the campaign, 44 round trips were made, and after the campaign, 2 round trips were made. The total cost of petrol was €106.92 and €4.86 respectively.

The cost of medical dressings was determined from the Irish Prison Service Hygiene/Medical Order Form to be €2.02 for sterile ambulance dressings. It was assumed that one dressing was used for each assaulted individual, costing €88.88 during the *no campaign* period and €4.04 after the amnesty period.

The final health sector cost was the guard escort time used to escort injured prisoners for the entirety of the hospital visit. Each ER visit averaged 6 hours and required a total of three prison guard escorts. Prisoners who were admitted for a single bed day required 9 guard escorts over the 24-hour period. The prison guard salary was determined to be €16.08 per hour based on the Irish Prison Services pay scales. Before the campaign, 1,284 escort hours were required. Following the campaign, 42 escort hours were required. The total costs of guard escort were €20,646.72 and €675.36 respectively.

Productivity Costs:

The Governor of Wheatfield Prison was largely responsible for the success of the weapons amnesty campaign. He was involved in seven 30-minute planning meetings and gave an additional 25 speeches to inmates on the severity of consequences for those caught with a weapon after the end of the amnesty period. These talks lasted 10 minutes each, totalling 4.16 hours. The Governor's salary was estimated to be €42.40 per hour, the value was obtained from an article written by the Leinster Express which reported management salaries at the Irish Prison Services. The total productivity cost was €326.48.

The salaries for the Chief Officer and Assistant Chief Officer were based off the Garda salary pay scales. The Chief Officer salary was assumed to be equivalent to a Garda Superintendent at €35.91 per hour, and the Assistant Chief Officer salary was assumed to be equivalent to a Garda Sergeant at €25.82 per hour. Both officers spent a total of 3.5 hours in planning the weapons amnesty campaign, costing €125.69 and €90.37 respectively.

Once a prison fight occurs, a sounded alarm draws guards to the vicinity to neutralize the area of conflict. Based on information from the Governor, assumptions were made that each conflict would consume the time of five guards for 45 minutes each. During the *no campaign* period, there were 57 incidences of conflict, requiring 213.75 hours of guard time and costing €3,437.10 in total. After the amnesty, the number of incidences dropped to 34, requiring 127.5 hours of guard time and costing €2,050.20 in total.

Volunteer Training Costs:

As mentioned in the model framework section of the report, an assumption was made that IRC volunteer time would not be valued at the market wage (minimum wage) based on recommendations from the WHO-CHOICE Collaboration. However, the cost required to train IRC volunteers was valued in the analysis. The cost of training was determined by looking at 3 different factors:

1. IRC volunteer training session costs
2. Staff training costs

3. IRC volunteer graduation costs

These costs were depicted in Table 6. Each staff training session ran over the course of one day and was attended by approximately 36 trainees. The total cost of the staff training session was €1,665.23. To find the cost of training an ETB educator and IPS nurse, this number was divided by 36 to obtain €46.26.

The IRC volunteer CBHFA training period spanned several months. The modules were taught by one ETB educator and one IPS nurse. After the resources for teaching were summed, the total cost of the training period was determined to be €4,168.26. This cost was added to the sum of IRC volunteer graduation costs (€1,053.81) for a total of €5,222.07. According to expert opinion from the Director of the Prison Programme, approximately twelve IRC volunteers graduate from the CBHFA programme from each prison, each year. Therefore, the total cost of €5,222.07 was divided by twelve to obtain the cost of training for one IRC volunteer at €435.17.

Since the weapons amnesty represented one project out of approximately 12 projects per year, the cost of training was pro-rated by 8.3% (1 ÷ 12). When pro-rated and multiplied by the number of inmates involved in the weapons amnesty campaign (12), the total value of the contribution from the IRC volunteers was €433.43 (Table 7: Parameters under *IRC Volunteer Training Cost*).

## Results

**Comparison of Consequences**

Table 8 compared different consequences from the 6-month *no campaign* period to the 6-month post campaign period. The number of weapons assaults declined by 95% from 44 to 2. The number of non-weapon assaults increased by 146% from 13 to 32. However, all assaults (weapon and non-weapon) declined by 40% from 57 to 34. The number of ER visits declined by 95% from 44 to 2. In addition to 42 ER visits being averted, 5 bed days were also averted. Finally, the number of hours spent escorting prisoners to and from healthcare services decreased from 1,282 hours to 42 hours, a 97% decrease.

**Comparison of Costs**

Table 9 showed the summation of each cost category. Organization costs were €0.00 and €722.82 for *no campaign* and the weapons amnesty campaign respectively. The productivity costs were €3,437.10 for *no campaign* and €2,592.74 63 for the weapons amnesty period. The difference in productivity cost was €844.36, in favour of the intervention. The largest difference was seen in the health sector costs. Under *no campaign*, the health sector costs were €35,360.71 whereas, under the weapons amnesty campaign, the costs were €1,370.78. This is a €33,989.93 difference. A large part of the health sector costs consisted of the productivity cost associated with escorting prisoners to the hospital. Considering costs are categorized based on the sector in which they are incurred, escort costs were categorized as health sector costs although they may not seem as such.

Other cost comparisons were made between ER visit costs and bed day costs. No campaign incurred €5,687.22 more in ER costs and €5,896.37 more in bed day costs.

The overall societal cost for *no campaign* versus the weapons amnesty campaign was €38,797.81 versus €4,686.34, leading to a total difference of €34,111.47. Therefore, over a six-month period, the weapons amnesty saved €34,111.47 in societal costs.

## Discussion

From the results of the economic analysis, it can be concluded that the weapons amnesty campaign represented excellent value for money in large part due to the healthcare costs that were averted. In comparison to the health sector costs, the organization and productivity costs were minimal. The largest component of the health sector cost was the opportunity cost associated with escorting inmates to healthcare services. As this cost was incurred in the health sector, it was included under health sector costs and not productivity costs.

The campaign would not have been successful without cooperation between prison staff, the IRC volunteers, and the inmates. The campaign required immense trust as sharp containers were placed in areas without cameras and there was no guarantee that inmates would not remove and keep weapons from the sharp containers. The success of the campaign implied that firstly, it is possible for inmates to cooperate with prison staff, and secondly, that collaboration between IRC volunteers and prison management created a safer and healthier prison environment for inmates and staff alike.

Although the analysis was performed on the 6-month period prior to the amnesty and the 6-month period post amnesty, data collected two years after the amnesty still showed reduced weapons assault numbers. One-year post amnesty reported a 5.8% weapons assault rate and two years post amnesty showed only a marginal increase to an 8.8% weapons assault rate. Although many factors could have influenced the reduction in these numbers, it can be safely implied that the weapons amnesty campaign was largely responsible for creating a culture of non-violence.

Since the high number of assaults diverted resources from other more efficient uses, the productivity cost of escorting prisoners also consisted of the forgone activities that would have been overseen by guards during that time. Many of the prison facilities such as the gym, the field, and the education centre were closed at various periods due to lack of guard presence. Losing access to these resources could have influenced the physical and mental health of the inmates, both in the short- and long-term.

Some limitations of the cost-consequence analysis may have led to the under representation of economic savings. Certain parameters were not measured such as the number of hours of counselling and/or psychiatric services used by inmates who had suffered from a weapons assault. The use of these services was assumed to have been greater among those who had suffered from a weapons assault, hence more services would have been required during the *no campaign* period. Limited data prevented these parameters from being collected. There was also limited information on drug usage data. Prisoners who had suffered from weapons assault required additional pain medication, incurring a cost to the health sector. The Governor of Wheatfield Prison described that certain injured prisoners would engaged in drug seeking behaviours, leading to excessive drug consumption. However further information could not be obtained and these resources were not valued in the analysis.

Other limitations of this study include the limited scope and short time horizon of the study. Prison violence can have huge impacts on family members living outside in the community. Well-established gangs within the prison recruit inmates into their circles. Inter-gang conflicts within the prison may lead to reciprocal violence in the community. In some situations, family members have required police protection, relocation, and new identities. This can become a huge financial and social burden for the family members who must give up their careers, houses, and social support networks. For the prisoners affected by slashings, there is also a social cost to bearing a thick “rat” scar across the face. Once the scarred individual has been released from prison, people in society are aware of his or her history of conviction due to the individual’s scarred face. The scar can influence job prospects and social interactions, leading to an overall poorer quality of life. These consequences are difficult to quantify into costs and require economic modelling far beyond the scope of this analysis. However, the burden of these economic costs would no doubt be severe, further supporting the importance of the amnesty.

In conclusion, the analysis did show that across a 6-month period following the weapon amnesty campaign, €34,111.47 in societal costs were saved, and total assaults were reduced by 40%. The value saved is likely an under-representation of the true long-term savings and associated health benefits. The trend of reduced assaults was sustained for two consecutive years following the amnesty. The cost of organising the amnesty was minimal and led to a large payoff for both prison staff and inmates. Without the aide of the IRC volunteers, the amnesty would not have been as successful. The savings proliferated are only a small portion of the total amount saved by the Prison Programme over the years and future economic analysis would be beneficial in understanding the breadth of impact the programme has from a societal perspective.

## Conclusion

The evidence in the literature on peer education interventions have shown that peer education has been successful at improving many health outcomes over the short-term. Inmates who have benefited from peer mentor relationships have reduced risk-taking behaviours, abandoned misconceptions surrounding communicable diseases, and have overall improved physical and mental wellness. Inmates who have taken on the peer mentor role saw significant improvements in self esteem, were more goal-oriented, and were dedicated to contributing back to their prison community and greater society.

Although the literature on cost-effectiveness was limited, the research did conclude that peer education schemes in both American and British prisons were cost saving overall. When comparing the peer-led mass viral screening campaign at Mountjoy Prison to the evidence in the literature, many parallels suggested that the campaign was likely cost-effective if effects were considered in the long-term. Likewise, the economic evaluation performed on the weapons amnesty at Wheatfield Prison also suggested that the peer intervention was excellent value for money as not only were assaults (weapon and non-weapon) reduced by 40%, but €34,111.47 was saved in societal costs over the course of 6 months.

Neither campaign would have been as successful if the IRC volunteers were not at the forefront of planning, and implementing. It is unlikely that inmates would have responded with the same level of engagement to health professionals or prison staff. In the short-term, the Prison Programme has been responsible for shifting the physical environment to a hygienic, safe, and supportive atmosphere. The potential long-term effects of the Prison Programme have yet to be determined although it is likely that inmates who have been involved in mentorship or have received mentorship could have reduced chronic and comorbid conditions. Preliminary statistics also show improved community integration and lower rates of recidivism. Overall the quantitative evidence suggests that the Prison Programme is excellent value for money and may have positive long-term effects on not only the prison environment, but in the surrounding communities as well.

The Prison Programme provides aid to the most vulnerable in the population who are often overlooked by governments and charities alike. Many of the benefits from peer education cannot be easily quantified. Economic costs, although a useful tool for decision making, may not accurately reflect the societal value for the outcomes produced by this programme. Future analysis should be considered to uncover the programme’s immense potential. The economic analysis in this report considered only one of 200 projects that have been implemented by the Prison Programme over several years. Studies looking at long-term costs and effects on the full measure of the programme could produce important conclusions for the future of prison healthcare.

# Appendix A: Tables & Parameters

**Table 6: Total Cost Associated with Training IRC Volunteers**

| Parameter | Unit Cost | Quantity | Total Cost | Source |
|---|---|---|---|---|
| **IRC Volunteer Training Period** | | | | |
| *Educator Cost* | €30.50/ hour | 70 hours | €2,135.00 | Education and Training Board |
| *Nurse Cost* | €23.35/ hour | 70 hours | €1,634.50 | Irish Nurses and Midwives Organisation |
| **Staff Training Cost* | €46.26 | 2 | €92.52 | Cost calculations in Appendix C |
| *Education Space* | €10.18 $m^2$/ month | 49 $m^2$ | €47.89 | WHO-CHOICE, Department of Education and Science |
| *Building Utilities* | €2.62 $m^2$/ month | 49 $m^2$ | €12.32 | Irish Prison Services |
| *Volunteer Manual* | €6.41 | 12 | €76.92 | Printing and Binding |
| *Pencil* | €0.10 | 12 | €1.20 | WHO-CHOICE |
| *Flipchart Pad* | €17.49 | 3 | €52.47 | Hunt Office |
| *T-shirt* | €9.62 | 12 | €115.44 | Reads |
| **Staff Training Costs** | | | | |
| *Programme Director Cost* | €39.80/ hour | 8 hours | €318.40 | Irish Red Cross |
| *Programme Manager Cost* | €28.13/ hour | 8 hours | €225.04 | Irish Red Cross |
| *Governor Cost* | €42.40/ hour | 8 hours | €339.20 | Leinster Express |
| *Chief Officer Cost* | €35.91/ hour | 8 hours | €287.28 | Garda |
| *Educator Cost* | €30.50/ hour | 8 hours | €244.00 | Education and Training Board |
| *Nurse Cost* | €23.35/ hour | 8 hours | €186.80 | Irish Nurses and Midwives Organisation |
| *Training Space* | €10.18 $m^2$/ month | 109 $m^2$ | €12.09 | WHO-CHOICE, Department of Education and Science |
| *Building Utilities* | €2.62 $m^2$/ month | 109 $m^2$ | €3.11 | Irish Prison Services |
| *Computer* | €2,000.23 | 2 | €9.24 | WHO-CHOICE |
| *Projector* | €1,021.99 | 1 | €1.58 | Hunt Office |
| *Flipchart Pad* | €17.49 | 1 | €17.49 | Hunt Office |
| *Catering* | €3.50/ plate | 6 | €21.00 | Irish Prison Services |

| IRC Volunteer Graduation Costs | | | | |
|---|---|---|---|---|
| *Programme Director Cost* | €39.80/ hour | 2.5 hours | €99.50 | Irish Red Cross |
| *Programme Manager Cost* | €28.13/ hour | 2.5 | €70.33 | Irish Red Cross |
| *Governor Cost* | €42.40/ hour | 2.5 | €106.00 | Leinster Express |
| *Educator Cost* | €30.50/ hour | 2.5 | €76.25 | Education and Training Board |
| *Nurse Cost* | €23.35/ hour | 2.5 | €58.38 | Irish Nurses and Midwives Organisation |
| *Chief Officer Cost* | €35.91/ hour | 2.5 | €89.78 | Garda |
| *Prison Officer Cost* | €16.08/ hour | 7.5 | €120.60 | Irish Prison Services |
| *Inspector of the Prison Services Cost* | €48.87/ hour | 2.5 | €122.18 | Inspector of Prison Services, Pay Scale |
| *Graduation Space* | €10.18 $m^2$/ month | 406 $m^2$ | €14.05 | WHO-CHOICE, Department of Education and Science |
| *Building Utilities* | €2.62 $m^2$/ month | 406 $m^2$ | €3.62 | Irish Prison Services |
| *Certificates* | €6.41 | 12 | €76.92 | Irish Red Cross |
| *Computer* | €2,000.23 | 1 | €4.62 | WHO-CHOICE |
| *Projector* | €1,000.00 | 1 | €1.58 | Hunt Office |
| *Catering* | €3.50/ plate | 60 | €210.00 | Irish Prison Services |

See Appendix C: Calculations for cost calculations

**Table 7: Parameters**

| Parameter | Unit Cost | Quantity | Cost | Source |
|---|---|---|---|---|
| **Organization Costs** | | | | |
| *Sharps Container* | €10.25 | 18 | €184.50 | Fischer Scientific |
| *Posters* | €0.69 | 144 | €99.36 | WHO-CHOICE |
| *Computer* | €2,000.23 | 1 | €4.62 | WHO-CHOICE |
| *Printer* | €395.74 | 1 | €0.91 | WHO-CHOICE |
| **IRC Volunteer Training Cost* | €435.17 | 12 | €433.43 | Cost calculations in Appendix C |
| **Health Sector Costs** | | | | |
| *Prison Doctor Cost* | €62.50/ hour | 0.3 | €18.75 | Locumotion Prison Service GP |
| *Prison Doctor Cost (no campaign)* | €62.50/ hour | 6.6 | €412.50 | Locumotion Prison Service GP |

| | | | | |
|---|---|---|---|---|
| *Prison Nurse Cost* | €23.35/ hour | 17 | €396.95 | Irish Nurses and Midwives Organisation |
| *Prison Nurse Cost (no campaign)* | €23.35/ hour | 28.5 | €665.48 | Irish Nurses and Midwives Organisation |
| *ER Visit Cost* | €135.41 | 2 | €270.82 | Emergency Departments Audit Scotland |
| *ER Visit Cost (no campaign)* | €135.41 | 44 | €5,958.04 | Emergency Departments Audit Scotland |
| *Bed Day Cost (no campaign)* | €1,179.27 | 5 | €5,896.37 | Department of Health |
| *Ambulance Cost (no campaign)* | €317.16 | 5 | €1,585.80 | National Health Service (England) |
| *Petrol Cost* | €0.135/ km | 36 | €4.86 | My LPG |
| *Petrol Cost (no campaign)* | €0.135/ km | 792 | €106.92 | My LPG |
| *Guard Escort Cost* | €16.08/ hour | 42 | €675.36 | Irish Prison Services |
| *Guard Escort Cost (no campaign)* | €16.08/ hour | 1,284 | €20,646.72 | Irish Prison Services |
| *Prison Medical Dressing* | €2.02 | 2 | €4.04 | Irish Prison Services |
| *Prison Medical Dressing (no campaign)* | €2.02 | 44 | €88.88 | Irish Prison Services |
| **Productivity Costs** | | | | |
| *Governor Cost* | €42.40/ hour | 7.7 | €326.48 | Leinster Express |
| *Chief Officer Cost* | €35.91/ hour | 3.5 | €125.69 | Garda |
| *Assistant Chief Officer Cost* | €25.82/ hour | 3.5 | €90.37 | Garda |
| *Guard Cost* | €16.08/ hour | 127.5 | €2,050.20 | Irish Prison Services |
| *Guard Cost (no campaign)* | €16.08/ hour | 213.75 | €3,437.10 | Irish Prison Services |

See Appendix C: Calculations for cost calculations

**Table 8: Comparison of Consequences, Weapons Amnesty Campaign at Wheatfield Prison, 6 Months Prior and 6 Months Post**

| | No Campaign | Weapons Amnesty Campaign | Difference |
|---|---|---|---|
| *No. of Weapon Assaults* | 44 | 2 | 42 |
| *No. of Non-Weapon Assaults* | 13 | 32 | -19 |
| *No. of ER Visits* | 44 | 2 | 42 |
| *No. of Bed Days* | 5 | 0 | 5 |
| *No. Hours Escorted* | 1,284 | 42 | 1,242 |

**Table 9: Comparison of Costs, Weapons Amnesty Campaign at Wheatfield Prison**

| | No Campaign | Weapons Amnesty Campaign | Difference |
|---|---|---|---|
| *Organization Costs* | €0.00 | €722.82 | -€722.82 |
| *Health Sector Costs* | €35,360.71 | €1,370.78 | €33,989.93 |
| *Productivity Costs* | €3,437.10 | €2,592.74 | €844.36 |
| ***Societal Perspective (All Cost Categories)*** | **€38,797.81** | **€4,686.34** | **€34,111.47** |
| *Cost of ER Visit* | €5,958.04 | €270.82 | €5,687.22 |
| *Cost of Bed Day* | €5,896.37 | €0.00 | €5,896.37 |

# Appendix B: Search Strategies

**Topic #1:** Community based Hepatitis C screening in prisons
Database: Web of Science
Restrictions: English, Journal Article
Years: 2000 – 2018

| **Term 1** | **Term 2** | **Term 3** | **Term 4** |
|---|---|---|---|
| Community based | Hepatitis C | Screening | Prison |
| **Alternative Terms** | | | |
| Community initiat*<br>Community health<br>Community run | Hep C<br>Hepatitis | Screen* | Penitentiary<br>Jail<br>Incarcera*<br>Custod* |

**Search Strategy: 1 AND 2 AND 3 AND 4**
9 results, 5 after abstract review.
**4 in total after full text review**

**Topic #2:** Cost effectiveness of community based Hepatitis C screening in prisons
Database: Web of Science
Restrictions: English, Journal Articles
Years: 2000 – 2018

| **Term 1** | **Term 2** | **Term 3** | **Term 4** | **Term 5** |
|---|---|---|---|---|
| Cost effective* | Community based | Hepatitis C | Screening | Prisons |
| **Alternative Terms** | | | | |
| Cost utility<br>Cost benefit<br>Cost saving*<br>Cost analysis | Community initia*<br>Community health<br>Community run | Hep C<br>Hepatitis | Screen* | Penitentiary<br>Jail<br>Incarcera*<br>Custod* |

**Search Strategy: 1 AND 2 AND 3 AND 4**
13 results, 4 after abstract review.
**Search Strategy: 1 AND 3 AND 4 AND 5**
17 results, 5 after abstract review.
**6 in total after full text review**

**Topic #3:** Cost-effectiveness of community health programmes in prisons
Database: Web of Science
Restrictions: English, Journal Articles
Years: 2000 – 2018

| Term 1 | Term 2 | Term 3 | Term 4 |
|---|---|---|---|
| Cost effective* | Community health | Programmes | Prisons |
| **Alternative Terms** | | | |
| Cost utility<br>Cost benefit<br>Cost saving*<br>Cost analysis | Community based<br>Community initia*<br>Community run<br>Community | Service<br>Campaign<br>Initiative | Penitentiary<br>Jail<br>Incarcera*<br>Custod* |

**Search Strategy: 1 AND 2 AND 3 AND 4**
56 results, 3 after abstract review. Waiting for full text review
**2 in total after full text review**

**Topic #4:** Cost-effectiveness of health promotion in prisons through mentorship and lived experience
Database: Web of Science
Restrictions: English, Journal Articles
Years: 2000 – 2018

| Term 1 | Term 2 | Term 3 | Term 4 |
|---|---|---|---|
| Cost effective* | Health promotion* | Prisons | Mentor* |
| **Alternative Terms** | | | |
| Cost utility<br>Cost benefit<br>Cost saving*<br>Cost analysis | Health campaign*<br>Health programme*<br>Health service*<br>Health educat*<br>Health Promotion*<br>Campaign*<br>Service*<br>Programme* | Penitentiary<br>Jail<br>Incarcera*<br>Custod* | Lived experience*<br>Teach*<br>Educator*<br>Peer*<br>Peer educat* |

**Search Strategy: 1 AND 2 AND 3 AND 4**
11 results, 4 after abstract review.
**3 in total after full text review.**

Appendix B: Search Strategies

**Topic #5:** Cost-effectiveness of health promotion in vulnerable populations through mentorship and lived experience
Database: Web of Science
Restrictions: English, Journal Articles
Years: 2000 – 2018

| **Term 1** | **Term 2** | **Term 3** | **Term 4** |
|---|---|---|---|
| Cost effective* | Health promotion* | Vulnerable population* | Mentorship |
| **Alternative Terms** | | | |
| Cost utility<br>Cost benefit<br>Cost saving*<br>Cost analysis | Health campaign*<br>Health programme*<br>Health service*<br>Health educat*<br>Health Promotion*<br>Campaign*<br>Service*<br>Programme* | Disadvantaged population*<br>Marginalized population*<br>Vulnerable group*<br>Disadvantaged group*<br>Marginalized group* | Mentor*<br>Lived experience*<br>Teach*<br>Educator*<br>Peer*<br>Peer educator* |

**Search Strategy: 1 AND 2 AND 3 AND 4**
13 results, 2 after abstract review.
**2 after full text review.**

# Appendix C: Calculations

**Calculation for Converting 1985 USD to 2017 USD (pg. 7)**
Base Year 1985: CPI 100
Comparison Year 2017: CPI 250
CPI 250/CPI 100 = 2.5
2.5 x $51,058 = $127, 645 USD
Source: Consumer Price Index for USA, base year 1985 (https://tradingeconomics.com/united-states/consumer-price-index-cpi)

**Calculations for Table 2 (pg. 10)**
Ireland PPP for 2016 = 0.812
USD = International (Int) $
International (Int) $ x 0.812 = Local Currency Unit (€)

$19,600 (Int) x 0.812 = €15,915
…
$29,200 (Int) x 0.812 = €23,710
Source: OECD Purchasing Power Parity Conversion data
(https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm)

**Calculations for Table 3 (pg. 11)**
Ireland PPP for 2016 = 0.812
UK PPP for 2016 = 0.702
0.702/0.812 = 0.864532

Price in £ /0.864532 = Price in €
£39,600/ 0.864532 = €45,805
…
£79,200/ 0.864532 = €91,610
Source: OECD Purchasing Power Parity Conversion data
(https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm)

**Table 6: Total Cost Associated with Training IRC Volunteers Calculations**

**IRC Volunteer Training Session:**

**Educator Costs:** Train IRC volunteers for 2 hours each week from October to May (35 weeks) for a total of 70 hours. The salary of €30.50/ hour was determined from the Education and Training Board salary scales for an Adult Education Officer.

€30.50/ hour x 70 hours = €2,135.00

**Nurse Costs:** Train IRC volunteers for 2 hours each week from October to May (35 weeks) for a total of 70 hours. The salary of €23.35/ hour was determined from the Irish Nurses and Midwives Organisation salary scales for a Clinical Nurse (Level II).

€23.35/ hour x 70 hours = €1,634.50

***Staff Training Costs:*** This amount is calculated by summing all costs in the "Staff Training Costs" category and dividing by 36 (number of trainees in attendance).

Total of Staff Training Costs: €1,665.23
€1,665.23 ÷ 36 trainees = €46.26
€46.26 x 2 = €92.52

**Education Space:** WHO-CHOICE was used to determine the rent cost per $m^2$ per month based on the national level as Irish Prison Services are a national organization. The cost in 2005 was 8.9 Int$. This was converted to euros using PPP and then converted to the reference year of 2017 using CPI.

Ireland's PPP in 2005 = 1.012
8.9 $m^2$ x 1.012 = €9.0068 $m^2$

Conversion to 2017 reference year:
CPI 125.6 (2017) ÷ CPI 111.3 (2005) = 1.13
€9.0068 $m^2$/ month x 1.13 = 10.18 $m^2$/ month

The area of 49 $m^2$ was determined using standards from The Department of Education and Science based on the size of an average classroom. The area of 49 $m^2$ was used to calculate the cost per $m^2$. There are 8,760 hours in a year and the classroom is in use for 70 hours in the whole year. Therefore, the calculation should be pro-rated at 0.8% (70 ÷ 8,760).

€10.18 $m^2$/ month x 49 $m^2$ x 12 months = €5,985.84
€5,985.84 x 0.008 = €47.89

**Building Utilities:** The cost of building utilities includes electricity, gas, oil, and water as determined by the Irish Prison Services for Wheatfield Prison in 2015 to be €1,411,052.54 for the year. The total area of Wheatfield prison is 45,000 $m^2$ (also determined by the Irish Prison Services). Therefore, the total cost of utilities was divided by 12 months, and divided by the total area of 45,000 to determine the cost per $m^2$ per month.

Conversion to 2017 reference year:
CPI 125.2 (2017) ÷ CPI 124.7 (2015) = 1.004
€1,411,052.54 x 1.004 = €1,416,696.75
(€1,416,696.75 ÷ 12) ÷ 45,000 $m^2$ = €2.62 $m^2$/ month

Now calculate the cost per $m^2$. This calculation is similar to the "Education Space" calculation above.

€2.62 $m^2$/ month x 49 $m^2$ x 12 months = €1,540.56
€1,540.56 x 0.008 = €12.32

Appendix C: Calculations

**Staff Training Costs:**

**Labour Resources***:* The value of labour resources (Programme Director, Programme Manager, Governor, Chief Officer, Educator, Nurse) are determined by the market wage and multiplied by the time spent in preparation and training (8 hours).

The Programme Director and Manager wage rates were determined from the Prison Programme Budget.

The Governor wage was found in an article by Leinster Express which summarized wage rates for Prison management.

The Chief Officer cost was determined using the salary structures from the Garda. The Chief Officer salary was assumed equivalent to the salary of a Super Intendant.

**Training Space:** There are 730 hours in one month, and the training space is in use for 8 hours during this time. Therefore, results should be pro-rated at 1.09% (8 ÷ 730).

The area of 109 $m^2$ was determined using standards from The Department of Education and Science based on the size of an average lecture room. The area of 109 $m^2$ was used to calculate the cost per $m^2$.

€10.18 $m^2$/ month x 109 $m^2$ = €1,109.62
€1,109.62 x 0.0109 = €12.09

**Building Utilities***:* This calculation is similar to the "Training Space" calculations above.
€2.62 $m^2$/ month x 109 $m^2$ = €285.58
€285.58 x 0.0109 = €3.11

**Computer:** The cost of a computer as determined by WHO-CHOICE was 1,581.26 Int$ in 2000. First this amount will be converted into euro and then converted to the reference year of 2017. Then the cost will be annualized.

Ireland's PPP in 2000 = 0.944
1,581.26 Int$ x 0.944 = €1,492.71

Conversion to reference year of 2017:
148.4 (2017) ÷ 110.4 (2000) = 1.34
€1,492.71 x1.34 = €2,000.23

Annualization Factor Formula:
$= [(1+r)^n - 1] / [r(1+r)^n]$
$= [(1+0.05)^5 -1]/ [0.05 (1+0.05)^5]$
= 4.33

Annualization:
€2,000.23/4.33 = €461.94

Total cost, prorated at 1%:
€461.94 x 0.01 = €4.62
€4.62 x 2 computers = €9.24

**Projector:** The cost of a projector was found from Hunt Office supplies to be €1,021.99 for meeting room multimedia projectors. The cost of the projector was annualized.

Annualization Factor Formula:
$= [(1+r)^{n} - 1] / [r(1+r)^{n}]$
$= [(1+0.05)^{8} -1]/ [0.05 (1+0.05)^{8}]$
= 6.46

Annualization:
€1021.99/6.46 = €158.21

Total cost, prorated at 1%:
€158.21 x 0.01 = €1.58

**IRC Volunteer Graduation Costs:**

**Labour Resources:** Programme Director, Programme Manager, Governor, an educator, a nurse, the Chief Officer, three guards, and Inspector of the Prison Service. The ceremony lasted for 2.5 hours.

The Inspector of the Prison Services cost is based on the average salary of a Chief Executive Officer from Pay Scale Ireland.

**Graduation Space:** There are 730 hours in one month, and the graduation space is in use for 2.5 hours during this time. Therefore, results should be pro-rated at 0.34% (2.5 ÷ 730).
The area of 406 $m^2$ was determined using standards from The Department of Education and Science based on the size of a small PE hall for 200 – 499 people. The area of 406 $m^2$ was used to calculate the cost per $m^2$.

€10.18 $m^2$/ month x 406 $m^2$ = €4,133.08
€4,133.08 x 0.0034 = €14.05

**Building Utilities:** This calculation is similar to the “Graduation Space” calculations above.

€2.62 $m^2$/ month x 406 $m^2$ = €1,063.72
€1,063.72 x 0.0034 = €3.62

**Computer:** Cost of computer is €2,000.23 (price from the WHO-CHOICE value conversion completed above).

Annualization Factor Formula:
$= [(1+r)^{n} - 1] / [r(1+r)^{n}]$
$= [(1+0.05)^{5} -1]/ [0.05 (1+0.05)^{5}]$
= 4.33

Annualization:
€2,000.23/4.33 = €461.94
Total cost, prorated at 1%:
€461.94 x 0.01 = €4.62

**Projector:** The cost of a projector was found from Hunt Office supplies to be €1,021.99 for meeting room multimedia projectors. The cost of the projector was annualized.

Annualization Factor Formula:
$= [(1+r)^{n} - 1] / [r(1+r)^{n}]$
$= [(1+0.05)^{8} -1]/ [0.05 (1+0.05)^{8}]$
= 6.46

Annualization:
€1021.99/6.46 = €158.21

Total cost, prorated at 1%:
€158.21 x 0.01 = €1.58

**Table 7: Parameters Calculations**

**Organization Costs:**

**Posters:** One flier was put up in each landing (18 landings) for 8 days. The cost of a flier was 0.6 Int$ in 2005 according to WHO-CHOICE. First PPP was used to convert to euros. Then CPI was used to convert to the reference year of 2017.

Ireland's PPP in 2005: 1.012
0.6 Int$ x 1.012 = €0.6072

Conversion to reference year of 2017:
CPI 125.6 (2017) ÷ CPI 111.3 (2005) = 1.13
€0.6072 x 1.13 = €0.69
€0.69 x 144 posters = €99.36

**Computer:** Cost of computer is €2,000.23 (price from the WHO-CHOICE value conversion completed above).

Annualization Factor Formula:
$= [(1+r)^{n} - 1] / [r(1+r)^{n}]$
$= [(1+0.05)^{5} -1]/ [0.05 (1+0.05)^{5}]$
= 4.33

Annualization:
€2,000.23/4.33 = €461.94

Total cost, prorated at 1%:
€461.94 x 0.01 = €4.62

**Printer:** The cost of a printer as determined by WHO-CHOICE was 312.85 Int$ in 2000. First this amount will be converted into euro and then converted to the reference year of 2017. Then the cost will be annualized.

Ireland's PPP in 2000 = 0.944
312.85 Int$ x 0.944 = €295.33

Conversion to reference year of 2017:
CPI 148.4 (2017) ÷ CPI 110.4 (2000) = 1.34
€295.33 x1.34 = €395.74

Annualization Factor Formula:
$= [(1+r)^{n} - 1] / [r(1+r)^{n}]$
$= [(1+0.05)^{5} -1]/ [0.05 (1+0.05)^{5}]$
= 4.33

Annualization:
€395.74/4.33 = €91.40

Total cost, prorated at 1%:
€91.40 x 0.01 = €0.91

***IRC Volunteer Training Costs:*** This cost is the summation of "IRC Volunteer Training Session Costs" and "IRC Volunteer Graduation Costs" divided by 12 (number of volunteers in each session).

Total IRC Volunteer Training Session Costs: €4,168.26
Total IRC Volunteer Graduation Costs: €1,053.81

(€4,168.26 + €1,053.81) ÷ 12 volunteers = €435.17

Since the weapons amnesty campaign is one project of all projects run by IRC volunteers, the cost of training is pro-rated at 8.33%. This number is based on the fact that approximately 12 to 14 campaigns are run in a one-year period. Assuming each campaign has an equal amount of time devoted to it, 1 campaign out of 12 campaigns in a year is equal to 8.33%.

€5,222.07 x 0.0833 = €433.43

**Health Sector Costs:**

**Prison Doctor Cost:** Includes time of assault with weapon only. According to expert opinion, the doctor spends approximately 30 minutes with each patient who has been assaulted with a weapon. However due to doctors working shifts, only 30% of assaulted patients were seen by doctors. Hence costs were pro-rated by 30%.

2 incidents x 0.5 hours = 1 hour
1 hour x 0.3 = 0.3
€62.50/ hour x 0.3 hours = €18.75

**Prison Doctor Cost (no campaign):** Includes time of assault with weapon only. According to expert opinion, the doctor spends approximately 30 minutes with each patient who has been assaulted with a weapon. However due to doctors working shifts, only 30% of assaulted patients were seen by doctors. Hence costs were pro-rated by 30%.

44 incidents x 0.5 hours = 22 hours
22 hours x 0.3 = 6.6 hours
€62.50/ hour x 6.6 hours = €412.50

**Prison Nurse Cost:** Includes time of assault with a weapon and without a weapon. Nurse time is estimated at 30 minutes for each patient who has been assaulted with and without a weapon.

34 incidents x 0.5 hours = 17 hours
€23.35/ hour x 17 hours = €396.95

**Prison Nurse Cost (no campaign):** Includes time of assault with a weapon and without a weapon. Nurse time is estimated at 30 minutes for each patient who has been assaulted with and without a weapon.

57 incidents x 0.5 hours = 28.5
€23.35/ hour x 28.5 hours = €665.48

**ER Visit Cost:** The cost for an ER visit was taken from a Scottish model of an Emergency Department audit. The cost was £102 in 2008. This cost was first converted to euros and then converted to the reference year of 2017 using CPI.
Ireland's PPP in 2008 = 0.944
The UK's PPP in 2008 = 0.702
0.944 ÷ 0.702 = 1.345
£102 x 1.345 = €136.16

Conversion to reference year of 2017:
CPI 125.6 (2017) ÷ CPI 126.3 (2008) = 0.9945
€136.16 x 0.9945 = €135.41

Cost determined by weapon assault incidents:
€135.41 x 2 = €270.82

**ER Visit Cost (no campaign):** Costs determined by weapon assault incidents:

€135.41 x 44 = €5,958.04

**Bed Day Cost (no campaign)***:* The economic cost of a bed day in 2010 was €1,122 for a Category 1 (teaching) hospital as determined by The Department of Health and Child, Ireland.

Conversion to reference year of 2017:
CPI 125.6 (2017) ÷ CPI 119.5 (2010) = 1.051
1.051 x €1,122 = €1,179.27

Total bed days over a 6-month period were 5.
€1,179.27 x 5 = €5,896.37

**Ambulance Cost (no campaign):** Data was used from the National Health Service (England) which stated that the average cost per call and transfer was £270 in 2015. PPP was used to convert this value into euros.

Ireland's PPP in 2015 = 0.813
The UK's PPP in 2015 = 0.697
0.813 ÷ 0.697 = 1.17
£270 x 1.17 = €315.9

Conversion to reference year of 2017:
CPI 125.6 (2017) ÷ CPI 125.1 (2015) = 1.004
€315.9 x 1.004 = €317.16

It is assumed that there were 5 ambulance transfers to the ER for those inmates who were later admitted for one bed day.
€317.16 x 5 = €1,585.80

**Petrol Cost**: Tallaght University Hospital is 9 km from Wheatfield Prison.
Assuming 1 litre of petrol = 10 km, then 1 km will cost €0.135 in petrol. In the period succeeding the weapons amnesty, 4 trips were taken totalling 36 km.

€0.135/ litre per km x 36 km = €4.86

**Petrol Cost (no campaign):** Tallaght University Hospital is 9 km from Wheatfield Prison.
Assuming 1 litre of petrol = 10 km, then 1 km will cost €0.135 in petrol. In the period succeeding the weapons amnesty, 88 trips were taken totalling 792 km.

€0.135/ litre per km x 792 km = €106.92

**Guard Escort Cost:** The average emergency room wait is 6 hours. The guard escort time is determined by counting the wait time plus total time in transportation (30 minutes in each direction). Three guards escort a single prisoner to the ER room.

3 guards x 7 hours x 2 ER trips = 42 hours
€16.08/ hour x 42 hours = €675.36

**Guard Escort Cost (no campaign):** The cost is calculated in the same way above, however included is 5 one-day admissions as an inpatient. In this situation, 9 guards are required for a 24-hour period of observation, (3 guards required for each 8-hour shift).

Time spent in ER: 3 guards x 7 hours x 44 ER visits = 924
Time spent in IP: 9 guards x 8 hours x 5 IP days = 360

(924 + 360) x €16.08/ hour = €20,646.72

Appendix C: Calculations

**Productivity Costs:**

**Governor Cost:** The Governor was involved in 7 x 30-minute meetings (3.5 hours) and an additional 25 talks of about 10 min each (4.16 hours). In total 7.7 hours of his time was used.

€42.40/ hour x 7.7 hours = €326.48

**Chief Officer Cost:** The Chief Officer was involved in 7 x 30-minute meetings (3.5 hours).

€35.91/ hour x 3.5 hours = €125.69

**Assistant Chief Officer:** The Assistant Chief Officer was involved in 7 x 30-minute meetings (3.5 hours).

€25.82/ hour x 3.5 hours = €90.37

**Guard Cost:** When a prisoner is being assaulted, all available guards are directed to the area to diffuse the situation. The assumptions are that approximately 5 guards diffuse the situation in 45 minutes.

5 guards x 0.75 hours x 34 incidents = 127.5 hours
€16.08/ hour x 127.5 hours = €2,050.20

**Guard Cost (no campaign):** The calculations are similar to the above calculations.

5 guards x 0.75 hours x 57 incidents = 213.75 hours
€16.08/ hour x 213.75 hours = €3,437.10

# Appendix D: Economic Terms & Definitions

## Economic Evaluations

When comparing costs and consequences between two viable alternatives, economists perform an economic evaluation. The two most common types performed are a cost-effectiveness analysis and a cost-utility analysis, however these terms are often used interchangeably. An economist may have performed a cost-utility analysis yet refer to it as a cost-effectiveness analysis.

A cost-effectiveness analysis measures costs and natural units however, in a cost-effectiveness analysis one consequence is deemed to be the most important.

A cost-utility analysis measures costs and healthy years in either quality adjusted life years (QALYs) or disability adjusted life years (DALYs).

The report on the weapons amnesty campaign is a cost-consequence analysis, which measures costs and natural units, similar to a cost-effectiveness analysis. However, in this analysis, several consequences are analyzed and no consequence is deemed more important than another.

## Quality Adjusted Life Years (QALY)

A QALY measures the health state of an individual. A QALY of 1 represents perfect health whereas a QALY of 0 indicates death. An individual's QALY can improve or degrade as time progresses. QALYs are calculated by multiplying time spent in the health state by the utility score. A utility score can be derived using direct or indirect elicitation methods. Direct methods usually consist of asking a sample of the population to put a numerical value to a health state description whereas the indirect methods use standardizes tools that have been pre-developed to obtain utility scores.

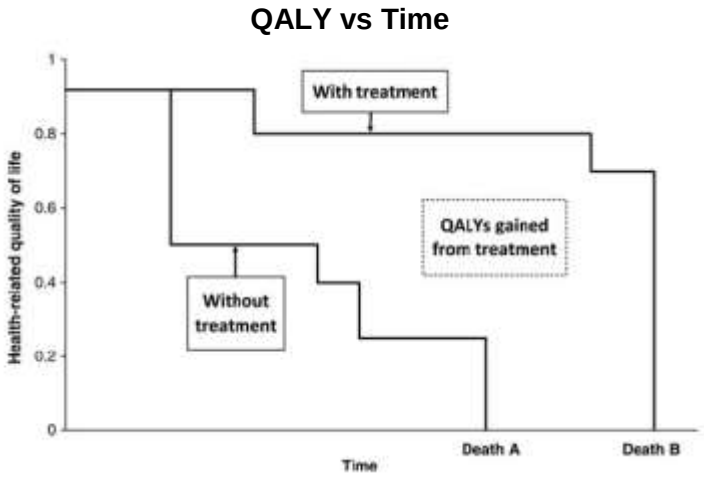


Figure 2: QALYs gained over time (Drummond et al., 2015).

The figure above shows how QALY scores are calculated. The y-axis represents the QALY score while the x-axis reflects time. Total QALYs achieved over a period are calculated by

summing the products of QALY and time. The figure depicts are a higher quality of life associated with treatment and an extended life span. QALYs gained is the difference between quality of life with treatment and quality of life without treatment.

## Incremental Cost-Utility and Cost-Effectiveness Ratios

When both costs and QALYs are known for each alternative scenario, an incremental cost-utility ratio (ICUR) can be calculated. An ICUR divides the change in costs by the change in QALYs to show the amount spent per each QALY gained.

$$\text{Incremental Cost-Utility Ratio (ICUR)} = \frac{C_n - C_0}{QALY_n - QALY_0}$$

When performing a cost-effectiveness analysis, an incremental cost-effectiveness ratio (ICER) can be calculated. An ICER divides the changes in costs by the changes in effects to show the cost per each marginal change in effect.

$$\text{Incremental Cost-Effectiveness Ratio (ICER)} = \frac{C_n - C_0}{Effect_n - Effect_0}$$

Just as cost-effectiveness and cost-utility are terms used interchangeably, so too are the terms incremental cost-utility ratio (ICUR) and incremental cost-effectiveness ratio (ICER) used interchangeably.

## Cost-Effectiveness Threshold

Due to resource restraints, many organizations are interested in the benefits gained for each additional resource spent to maximize efficiency in the budget. Cost-effectiveness thresholds can be used to help decision makers determine where to put resources so that they can be used most efficiently.

When looking at healthcare costs, the most commonly used threshold is the willingness-to-pay (WTP) threshold. The WTP threshold depicts the amount an organization is willing to pay to gain one additional unit of health outcome, often QALYs. In American literature it is common to find WTP thresholds of either $50,000 or $100,000 per QALY (Bertram et al., 2016). In the UK, the WHO has estimated the WTP threshold to be £20,000 to £30,000 per QALY (Bertram et al., 2016). In Ireland, the generally accepted WTP is €45,000 per QALY (Department of Health, 2014).

The WHO-CHOICE Collaboration does not recommend that organizations base decisions solely on a fixed WTP threshold as there are many other considerations to be made when deciding whether an intervention presents good value for money.

## Cost-Effectiveness Plane

A cost-effectiveness ratio can be visualized using a cost-effectiveness plane where costs are depicted on the y-axis and effects are depicted on the x-axis. The origin of the plane represents the existing programme and the slope running through the origin represents the willingness to pay.

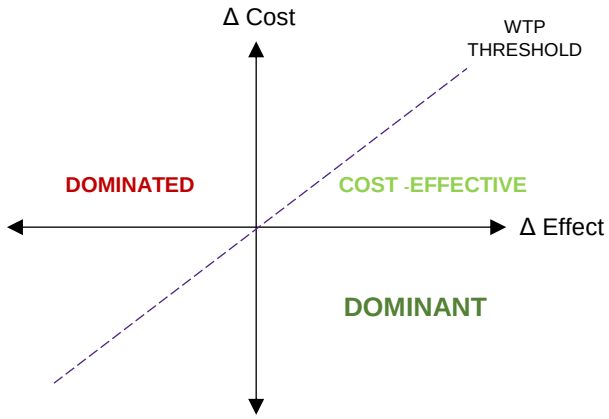


Figure 3: A cost-effectiveness plane (Drummond et al., 2015).

Cost-effectiveness ratios in the top left quadrant lay above the WTP threshold and are costlier and less effective, hence these scenarios are called “dominated”. Cost-effectiveness ratios in the bottom right quadrant below the WTP threshold are less costly and more effective, hence these scenarios are called “dominant” (this quadrant is ideal but not commonly achieved). Cost-effectiveness ratios in the top right quadrant may be cost-effective if they remain below the willingness-to-pay threshold.

Values above the WTP threshold, although not cost-effective, may still be worth investing in. An economic analysis is one part of a larger analysis and may not accurately reflect societal value for the intervention in question.

## Economic Costs

To come up with the costs of a specific programme or intervention, identification of all cost items involved in the delivery of the programme or intervention must be completed. Additionally, the changes in the costs of associated health services and non-health services must also be considered. Originally, costs have been thought of as direct and indirect or tangible and intangible. However, the new standard by Drummond et al., (2015) with respect to healthcare costs is to splits costs into four different categories:

1. Health sector costs: costs intrinsically incurred by the health sector (e.g. hospitalization, diagnostic tests)
2. Other sector costs: costs incurred in sectors other than health (e.g. social services, education)
3. Patient/client out-of-pocket costs: costs not covered by health insurance plans
4. Productivity costs: cost of a lost ability to do work and/or cost of lost leisure

For an economic evaluation, costs are determined by the sector in which the expense is incurred (John-Baptiste, 2018). This means the cost of transporting oneself to and from the doctor’s office is considered a health sector cost.

## Economic Cost Perspectives

Costs can be viewed from a variety of perspectives. A perspective can include one or more cost category. A societal perspective is the broadest and encompasses all cost categories, whereas

a patient and/or client perspective is the narrowest and encompasses only out-of-pocket costs borne by the patient and/or client (John-Baptiste, 2018).

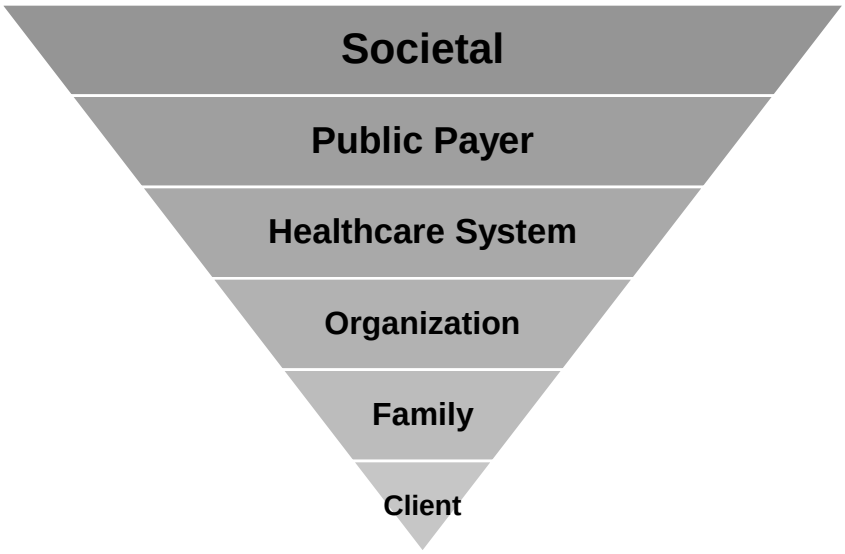


Figure 4: Cost-perspectives from most encompassing to least encompassing.

## Opportunity Costs

An economic cost is not only measured in monetary terms but also in opportunity costs. These are the costs of forgone productivity while directing resources away from one use to another use. For example, an individual who performs other non-contractual duties during working hours incurs an opportunity cost to their employer. That time spent doing other duties should be valued at the market wage of that individual (John-Baptiste, 2018).

Depending on the time frame selected for the economic analysis, a method called discounting may be used. For time frames that exceed one year, discounting is a way to show that individuals have a positive time preference and prefer to receive benefits in the present and prefer to incur costs in the future (John-Baptiste, 2018). Since the economic analysis performed on the weapons amnesty in this report did not exceed a one-year time frame, no discounting was applied.

## Consumer Price Index (CPI)

In an economic analysis, prices for various resources may not be recorded according to the selected reference year. In these cases, a price adjustment can be made using the consumer price index (CPI) which considers inflation year-to-year. Most governments calculate CPI and freely post this information online.

Inflation index = CPI (reference year) ÷ CPI (original year)

## International Dollar

The international dollar (Int$) is a fictional currency used as a reference point when converting costs from one currency to another. One international dollar is equivalent to the purchasing power of one US dollar.

## Purchasing Power Parity (PPP)

According to the World Health Organization:

> The purchasing power parity conversion factor is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as the U.S. dollar would buy in the United States (WHO, n.d.).

This method is more accurate than converting values based on currency conversions. Both purchasing power parity and the international dollar are used to convert currency to the local currency unit (LCU).

Price (Int$) x PPP (LCU/I$) = Price (LCU)

## Annualization

There are some costs that are considered fixed costs. These fixed costs are usually capital goods that are not purchased year after year, such as computers, photocopiers, and printers. It would not make sense for these costs to be charged in full over a short time period, hence costs are annualized. The annualization formula considers discounting, depreciation and the opportunity cost (John-Baptiste, 2016). The factor formula for annualization is:

$$\text{Annualization Factor} = \frac{[(1+r)^{n} - 1]}{[r(1+r)^{n}]}$$

In this equation, **n** is the average lifespan of the item and **r** is a discount rate. The discount rate varies by country and is 5% in Ireland according to the Department of Public Expenditure and Reform (Ireland). The total cost of the item is divided by the factor derived form the formula. This produces the yearly cost of the item.

## Appendix E: Acronyms

CBHFA: Community Based Health and First Aid
CPI: Consumer Price Index
DAA: Directly Acting Anti-Virals
DALY: Disability Adjusted Life Year
ER: Emergency Room
ETB: Education and Training Board
EU: European Union
HCV: Hepatitis C Virus
HIV: Human Immunodeficiency Virus
ICER: Incremental Cost-Effectiveness Ratio
ICUR: Incremental Cost-Utility Ratio
ICORN: Irish HCV Outcomes and Research Network
IFRC: International Federation of the Red Cross and Red Crescent Societies
Int$: International Dollar
IPS: Irish Prison Services
IRC: Irish Red Cross
LCU: Local Currency Unit
MPH: Master of Public Health
QALY: Quality Adjusted Life Year
RNA: Ribonucleic Acid
NHS: National Health Service
OECD: Organisation for Economic Co-Operation and Development
PPP: Purchasing Power Parity
SVR: Sustained Virological Response
UK: United Kingdom
USA: United States of America
USD: United States Dollar
WHO: World Health Organization
WTP: Willingness-to-Pay

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