

ECONOMIC EVALUATION COMPARING **Center-Based Compulsory Drug Rehabilitation (CCT)** **with Community-Based Methadone Maintenance** **Treatment (MMT)** **in Hai Phong City, Vietnam**

REPORT ON RESEARCH FINDINGS

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Acronyms

| | |
|-------------|--|
| BBV-TRAG-SV | Blood Borne Virus Transmission Risk Assessment Questionnaire Short Version |
| CEA | Cost-effectiveness analysis |
| CCT | Center-based compulsory drug rehabilitation |
| DATCAP | Drug Abuse Treatment Cost Analysis Program |
| DOLISA | Department of Labor, Invalid and Social Affairs |
| DSEP | Department/Division of Social Evils Prevention |
| HIV | Human Immunodeficiency Virus |
| HMU | Hanoi Medical University |
| HPMU | Hai Phong University of Medicine and Pharmacy |
| HREC | Human Research Ethics Committee (of the University of New South Wales) |
| ICER | Incremental Cost Effectiveness Ratio |
| MMT | Methadone Maintenance Treatment |
| MOLISA | Ministry of Labor, Invalid and Social Affairs |
| NCADP | The National Committee on HIV/AIDS, Drugs and Prostitution Control |
| PHSC | Protection of Human Subjects Committee (of FHI 360) |
| UNSW | The University of New South Wales; Sydney, Australia |
| VAAC/MOH | Vietnam Administration of AIDS Control (Ministry of Health) |
| DONG | Vietnamese Dong |
| US\$ | United States Dollars |

Executive summary

1. This economic evaluation research follows internationally recognized economic evaluation principles and methods. The research aims to compare the **cost-effectiveness** of the two dominant drug dependence treatment approaches in Vietnam: the center-based compulsory rehabilitation approach (CCT) and community-based voluntary methadone treatment (MMT), using three years of data on costs and effectiveness (2012-2015) in Hai Phong City. This is the first research on this topic ever conducted in Vietnam as well as in Southeast Asia.
2. With the approval of the People's Committee of Hai Phong City, the Department of Labor, Invalids and Social Affairs provided official data on the costs of CCT modality and the Department of Health provided official data on the costs of MMT clinics.

The independent research teams of UNSW Australia, Hanoi Medical University, and Hai Phong University of Medicine and Pharmacy collected the data on costs and effectiveness and conducted the data analysis.

Within the partnership framework between FHI 360 and the Advisory Board to the Chairman of the National Committee on HIV/AIDS, Drugs and Prostitution Control (NCADP) signed on 24 June 2014, the Advisory Board organized a meeting for the research team to present the preliminary research findings. The Advisory Board facilitated the discussions for input and comments from the relevant national government agencies. Based on this input and comments, the research team finalized the data analysis and prepared the final research report.

The Advisory Board organized another meeting on 17 April 2015 for the research team to present the official research findings to the relevant national government agencies and international organizations as the first step in disseminating the research findings. This report has incorporated the comments and input of the participants of the meeting on 17 April 2015.

3. The ultimate goal of this research is to provide scientific evidence to assist Vietnamese government leaders in evidence-based drug policy decision making for more effective allocation of resources, particularly in the context of declining international funding and a limited national government budget.

Key research findings

I. Key findings on effectiveness:

Based on the analysis of the effectiveness data collected from **208** CCT-released participants and **384** methadone participants across five time-points over three years, the research finds conclusive evidence that MMT is more effective than CCT for a range of outcomes, specifically:

1. CCT participants were nearly **3 times more likely** to have a positive opioid urine sample compared to MMT participants;

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2. CCT participants were **3.3 times more likely** to report use of all drugs (including synthetic drugs) compared to MMT participants;
3. On average one CCT participant used drugs on **324 MORE DAYS** compared to one MMT participant, over 3 years;
4. CCT participants were **5.6 times more likely** to engage in an illegal behavior compared to MMT participants; and
5. CCT participants were nearly **7 times more likely** to report HIV risk behaviors compared to MMT participants.

II. Findings on cost-effectiveness:

1. To provide treatment for one trainee in CCT centers over one year, it costs the government **19,670,000 dong** (not including costs to the trainee or their family), which is **2.5 times higher** than the cost to the government for one MMT patient over one year (**7,880,000 dong**, including cost of methadone syrup).
2. The cost incurred to one CCT participant (including the opportunity cost: cost of loss of productivity and income that could be earned at the free market rate and costs of food and other expenses during the two-year placement in the CCT centers) was **37,750,000 dong** over one year. The cost to one MMT participant (opportunity cost and cost of travel to the MMT clinic every day) was **5,470,000 dong** over one year. Over one year, the cost incurred by one CCT participant was **7 times higher** than the cost incurred by one MMT participant.

III. Conclusion:

For the government:

- ✓ It will cost the government **15,690,000 dong LESS** to pay for treatment for one dependent heroin user by providing MMT, compared to providing CCT, over three years. For CCT rehabilitation, the cost for year three = zero (post-release costs were not included).

Calculation: (19,670,000 dong/CCT trainee/year x 2 years) – (7,880,000 dong/MMT patient/year x 3 years) = 15,690,000 dong

For dependent heroin users:

- ✓ One MMT participant used drugs on **324 FEWER DAYS** compared to one CCT participant over three years. On average, each Vietnamese heroin dependent user spends 150,000 dong on drugs a day. Therefore, the amount of money saved by having 324 fewer drug-using days (for one dependent heroin user) would be 48,600,000 dong.
- ✓ By undergoing MMT treatment, one dependent heroin user can **save 59,090,000 dong** in terms of the cost of attending treatment over three years, compared to undergoing CCT rehabilitation.

Calculation: (37,750,000 dong/CCT trainee/year x 2 years) (5,470,000 dong/MMT patient/year x 3 years) = 59,090,000 dong

IV. Implications of the research findings

1. Implications for Hai Phong City:

Three scenarios were developed and the costs to the government of Hai Phong City for each scenario were calculated. The first two scenarios are realistic for the purpose of estimating the amount of budget required by the government of Hai Phong City both for short-term and long-term planning purposes. The third scenario is hypothetical for the purpose of estimating the amount of budget that can be hypothetically saved by the government of Hai Phong City if MMT is chosen over CCT for all dependent heroin users.

1. Scenario 1: A realistic situation of **co-pay MMT** for 60% of dependent heroin users (4,800 people) and CCT rehabilitation for 20% of dependent heroin users (1,600 people). This scenario is for short-term planning. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to 1,600 dependent heroin users in Hai Phong City, the cost to the government will be **63 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
- ✓ If **co-pay MMT** is provided to 4,800 dependent heroin users in Hai Phong City (patients pay 10,000 dong/day), the cost to the government will be **61 billion dong** over three years.
- ✓ The cost to the government to implement Scenario 1 will be: 63 billion dong + 61 billion dong = **124 billion dong** over three years.

2. Scenario 2: A realistic situation of **co-pay MMT treatment** for 75% of dependent heroin users (6,000 people) and CCT rehabilitation for 5% of dependent heroin users (400 people). This scenario is for long-term planning. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to 400 dependent heroin users in Hai Phong City, the cost to the government will be **16 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
- ✓ If **co-pay MMT** is provided to 6,000 dependent heroin users in Hai Phong City (patients pay 10,000 dong/day), the cost to the government will be **77 billion dong** over three years.
- ✓ The cost to the government to implement Scenario 2 will be: 16 billion dong + 77 billion dong = **93 billion dong** over three years;

3. Scenario 3: A hypothetical situation comparing **co-pay MMT treatment** for all 8,000 dependent heroin users (100%) with a co-pay of 10,000 dong/day to the provision of CCT treatment for all 8,000 dependent heroin users. Results of this scenario are interpreted as below:

- ✓ If CCT rehabilitation is provided to all 8,000 dependent heroin users in Hai Phong City, it will cost the government **315 billion dong**.

Calculation: 19,670,000 dong/CCT trainee/year x 2 (year) x 8,000 (dependent heroin users) = 315 billion dong.

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- ✓ If **co-pay MMT treatment** is provided to all 8,000 dependent heroin users (the patient contributes 10,000 dong/day as currently), it will cost the government **102 billion dong**.

Calculation: [7,880,000 dong/MMT patient/year – 3,650,000 dong/MMT patient/year (co-pay)] x 3 (years) x 8,000 (dependent heroin users) = 102 billion dong.

- ✓ The cost to the government to implement Scenario 3 will be: 315 billion dong – 102 billion dong = **213 billion dong** over three years;

In 2014, a total budget of 72.47 billion dong was allocated by the Hai Phong City Government to the three CCT centers (according to the Hai Phong People's Committee's letter no. 2804/QD-UBND). This suggests that the Hai Phong City Government has already had sufficient financial resources to pay for all the realistic scenarios from Scenario 3 to Scenario 6. However, Scenarios 5 and 6 are the best options because the total budget required is smaller and the return on investment is higher.

2. Implications for Vietnam:

The following three scenarios were developed and the costs to the Government of Vietnam for each scenario calculated. The first two scenarios are realistic for the purpose of estimating the amount of budget required by the Government of Vietnam both for short-term and long-term planning purposes. The third scenario is hypothetical for the purpose of estimating the amount of budget that can be saved by the Government of Vietnam if MMT treatment is chosen over CCT for all dependent heroin users.

The first two scenarios were developed based on the context of the Decision no. 2596/QD-TTg dated 27 December 2013 by the Prime Minister, which approves the renovation plan for drug dependence treatment in Vietnam until 2020. In the framework of the Decision no. 2596/QD-TTg, the national target is to reduce the proportion of dependent illicit drug users who are sent to CCT centers for compulsory treatment from 20% in 2015 to 5% in 2020. The scenarios were also developed based on the context of the national target to provide MMT treatment for 80,000 heroin dependent users by 2015.

1. Scenario 1: A realistic situation of **co-pay MMT treatment** for 80,000 of heroin dependent users (approximately 50% of 163,200) and CCT treatment for 40,800 dependent illicit drug users (which is 20% of the national registered dependent illicit drug users numbering 204,000). This scenario is for short-term planning. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to 40,800 dependent illicit drug users in Vietnam, the cost to the government will be **1,606 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
- ✓ If **co-pay MMT** is provided to 80,000 dependent heroin users in Vietnam, the cost to the government will be **1,020 billion dong** over three years.
- ✓ The cost to the government to implement Scenario 1 will be: 1,606 billion dong + 1,020 billion dong = **2,326 billion dong** over three years;

2. Scenario 2: A realistic situation of **co-pay MMT treatment** for 100,000 dependent heroin users (approximately 60% of 163,200) and CCT rehabilitation for 10,200 dependent illicit drug users (which is 5% of the national registered dependent illicit drug users numbering 204,000). This scenario is for long-term planning (until 2020). Results of this scenario are interpreted as below:

- ✓ If CCT is provided to 10,200 dependent illicit drug users in Vietnam, the cost to the government will be **402 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
- ✓ If **co-pay MMT** is provided to 100,000 dependent heroin users in Vietnam, the cost to the government will be **1,275 billion dong** over three years.
- ✓ The cost to the government to implement Scenario 2 will be: 402 billion dong + 1,275 billion dong = **1,677 billion dong** over 3 years.

3. Scenario 3: A hypothetical situation of **co-pay MMT treatment** for all 163,200 dependent heroin users (100%) with a co-pay of 10,000 dong/day compared to provision of CCT treatment for all 163,200 dependent heroin users. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to all 162,300 dependent heroin users in Vietnam, it will cost the government **6,426 billion dong** over three years. The cost of CCT rehabilitation for year three = zero (post-release costs were not included).

Calculation: 19,670,000 dong/CCT trainee/year x 2 (year) x 163,200 (dependent heroin users) = 6,426 billion dong.

- ✓ If **co-pay MMT treatment** is provided to all 163,200 dependent heroin users (the patient contributes 10,000 dong/day as currently), it will cost the government **2,081 billion dong** over three years.

Calculation: [7,880,000 dong/MMT patient/year – 3,650,000 dong/MMT patient/year (co-pay)] x 3 (years) x 163,200 (dependent heroin users) = 2,081 billion dong.

- ✓ For this scenario, the government can save **4,345 billion dong** by choosing MMT over CCT (6,426 billion dong – 2,081 billion dong = 4,345 billion dong).

In 2012, the total budget allocated for all 123 CCT centers was approximately 1,025 billion dong for a year, as reported by the National Committee on AIDS, Drugs and Prostitution Control (NCADP) at its annual review meeting in December 2012. This suggests that the Government of Vietnam has already had sufficient financial resources to pay for all of the realistic scenarios from Scenario 3 to Scenario 6. However, Scenarios 5 and 6 are the best options because the total budget required is smaller and the return on investment is higher.

The above calculations focus solely on costs and do not account for the benefits of MMT in reduction of illicit drug use, reduction in drug use-related illegal behaviors, and reduction in drug use-related HIV risk behaviors. A reduction in illicit drug use can contribute to a reduction in economic burdens for families and society. A reduction in illegal behaviors can contribute to a reduction in costs for the police and court sectors, and a reduction in the level of anxiety of local people in regards to community safety. A reduction in drug use-related HIV risk

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behaviors can contribute to a reduction in new HIV cases among the drug using population and the community at large.

Financially, the savings to the government by implementing MMT can be allocated to other activities within the national HIV program to ensure sustainability in the wake of shrinking international funding. In recent years, nearly 100% of funding for the methadone program has been provided by international donors. With the anticipated savings from implementing MMT over CCT, there will be sufficient government funding for the methadone program and other HIV programs. This can help to reduce dependence on external funding.

Background and rationale

The burden of illicit drug use on the healthcare system in Vietnam is considerable. The Ministry of Public Security (MoPS), the government body responsible for official registration of illicit drug users in Vietnam, estimates that in 2014 there were approximately 204,000 people nationwide using illicit drugs, including heroin injection (accounting for 80% of illicit drug users), opium, synthetic drugs, and cannabis [1]. In 2006, 65% of all reported HIV cases in Vietnam were among people who injected drugs [2]. The 2009 Integrated Biological and Behavioral Survey (IBBS) suggested that in some parts of Vietnam over half of all drug users were HIV positive [3]. People who inject drugs in Vietnam are also disproportionately affected by Hepatitis B (80.9%) and C (74.1%) [4, 5], as well as premature death through opiate overdose that accounts for 27% of all causes of death [6, 7].

Over the past decade, Vietnam has made significant advances toward reducing the harms associated with illicit drug use. The HIV Law passed in 2006 paved the way for the MMT program [8] and rapid scale up of needle and syringes programs, from 21 provinces/cities in 2005 to 42 provinces/cities by the end of June 2007 and 60 provinces/cities by 2009 [9]. In 2009, the Penal Code was revised and decriminalized the use of drugs (with the removal of Article 199), a partial shift from viewing drug use behavior as a criminal activity towards viewing drug addiction as a clinical condition that requires clinical treatment [10].

During the last 20 years, the primary approach of drug dependence treatment in Vietnam has been center-based compulsory drug rehabilitation (CCT) where illicit drug users are provided with legal education, labor therapy, and vocational training. It was reported by MOLISA in 2010 that there were 45,000 illicit drug users placed in these centers across the country [1]. However, there is a lack of scientific evidence for the clinical effectiveness and cost-effectiveness of this treatment modality in Vietnam.

In 2008, MMT was introduced in Vietnam. A cohort study conducted by the Ministry of Health with FHI 360's technical assistance showed strong positive results with a significant reduction in illicit drug use, a reduction in self-reported drug use-related criminal behaviors, and an improvement in family and social relationships [11]. Taking into consideration this evidence of effectiveness, on 18 June 2011, the Hai Phong City Department of Labor, Invalids and Social Affairs (DOLISA) opened the first methadone treatment clinic run by their sector. (All other methadone clinics up to this point had been operated by the health sector.)

This is a co-pay methadone clinic where patients pay a small contribution of the treatment cost. This is also the first MMT clinic where the Vietnamese government (through DOLISA of Hai Phong) pays for the majority of the costs (personnel, infrastructure, and operations costs). Methadone medication, equipment, and training were provided by the US Government through the United States Agency for International Development (USAID). Nevertheless, through 2014, the

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majority of Vietnamese government funding for drug dependence treatment remained allocated to center-based compulsory rehabilitation, while a much smaller proportion was allocated to community-based MMT treatment. By the end of 2014, the majority of funding sources for MMT treatment were provided by international donors.

Vietnam became a middle income country in 2010 [12]. This has had significant implications on funding from international donors for existing community-based drug dependence treatment services. Starting in 2015, funding from international donors is scheduled for systematic reduction.

Providing the government of Vietnam with scientific evidence for the effectiveness and cost-effectiveness of the two dominant heroin dependence treatment modalities (CCT and MMT) is critical. Comparative data will enable the government to undertake evidence-informed decision-making in resource allocation for drug dependence treatment. Within this context, the Atlantic Philanthropies (AP) granted a four-year project (2011-2015) to FHI 360 Vietnam to conduct a number of research activities to provide local evidence to support drug policy advocacy in Vietnam. With AP support, the following research was proposed.

Research objective and research questions

3.1. Research objective

To compare the effectiveness and cost-effectiveness of center-based compulsory rehabilitation (CCT) for substance abuse with community-based Methadone Maintenance Treatment (MMT) in Hai Phong City, Vietnam.

3.2. Research questions

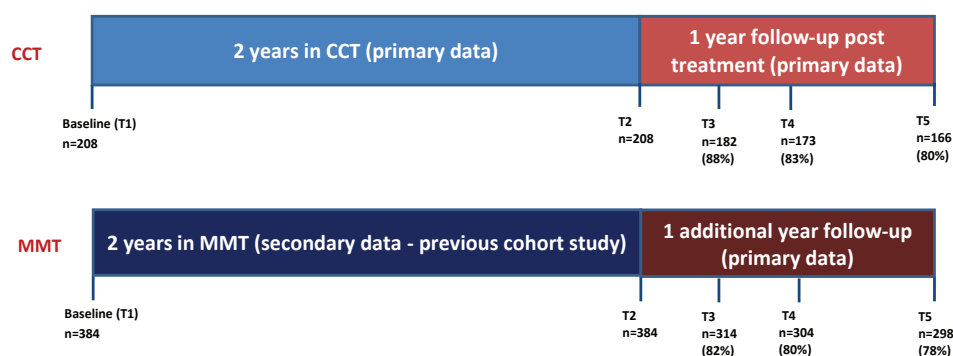
In Hai Phong City, Vietnam:

- A. What is the effectiveness of CCT rehabilitation compared to MMT treatment in improving health and social outcomes for dependent heroin users? Health and social outcomes were measured in terms of: 1) heroin use; 2) any illicit drug use; 3) number of days using illicit drugs; 4) drug use-related criminal behaviors; 5) drug use-related HIV risk behaviors; 6) overdose incidents; and 7) monthly expenditure on drugs.
- B. Is CCT rehabilitation more cost-effective compared to MMT treatment for the following outcome measures? 1) Reduction in the proportion of people using heroin; 2) reduction in the proportion of people using any illicit drug; 3) reduction in the number of days using illicit drugs; 4) reduction in the proportion of people engaging in criminal behaviors; 5) reduction in the proportion of people who practice HIV risk behaviors; 6) reduction in the proportion of people experiencing overdose; and 7) reduction in monthly expenditures on drugs.

The study design was a combined retrospective and prospective quasi-experimental cohort study that followed up CCT-released participants and MMT participants across five time-points (baseline, two years after treatment commencement, then three months, six months, and twelve months after the initial two years). The study combined primary data and secondary data to assess the effectiveness of the two treatment modalities. The economic component measured the costs of the two treatment modalities to compare cost-effectiveness outcomes.

The design of the study is visually presented in Figure 1 below.

Figure 1: Three-year time horizon for comparing CCT and MMT modalities:



The design demonstrates five time-points of data for both groups, which are denoted with descriptions as below:

1. T1 Baseline = before treatment (behaviors during previous three months)
2. T2 Two years post-treatment commencement = at the end of two years of treatment
3. T3 Follow-up 1 = three months after T2
4. T4 Follow-up 2 = three months after T3
5. T5 Follow-up 3 = six months after T4

4.1. MMT participants: combination of secondary and primary data

Prior Hai Phong MMT Study (2009-2011): A MMT cohort study was conducted by the Vietnam Ministry of Health and FHI 360 Vietnam to measure the effectiveness of the MMT program in Hai Phong City. A total of 462 MMT patients (representing

98.70% of the total number of MMT patients in Hai Phong City during this period) were recruited at treatment entry and were reassessed at 3, 6, 9, 12, 18, and 24 months. Recruitment of the 462 MMT participants was on a voluntary basis. All MMT patients who were enrolled in MMT treatment in Hai Phong during the period of January 2009 to October 2009 were asked if they agreed to participate in the study; only 10 people refused [13]. At the two-year follow-up interview, 384 patients (83% out of 462) were interviewed.

All of these 384 MMT participants were invited to participate in this current research study; 314 MMT participants agreed to participate (T2). The first follow-up interviews took place from January to March 2013. Participants continued to be interviewed over the course of a further 12-month follow-up.

4.2. CCT-released participants: primary data

All newly released CCT trainees from three CCT centers in Hai Phong City were invited to take part in the current research. A total of 550 invitation letters were sent to eligible CCT participants. Approximately 30% of the letters were returned due to unidentifiable postal addresses. This suggests that approximately 385 people received their invitation letters. A total of 208 CCT participants were enrolled in the research. Interviews for this group were conducted between July and November 2013. At the baseline interview, data on behaviors three months prior to entry to CCT centers was collected retrospectively. Data on behaviors at two years after treatment were also collected at this time. Changes in behaviors of interest continued to be examined over the course of the 12-month follow-up.

4.3. Sample size and follow-up rate

Table 1 below provides the recruited sample sizes for the two groups and follow-up percentages over time.

Table 1: Sample size and follow-up rates

| MMT group | CCT-released group |
|--|---|
| n = 384 at T1 baseline (100%) | n = 208 at T1 baseline (100%) |
| n = 384 at two years into treatment (100%) | n = 208 at two-year post treatment (100%) |
| n = 314 at T3 (82%) | n = 182 at T3 (88%) |
| n = 304 at T4 (80%) | n = 173 at T4 (83%) |
| n = 298 at T5 (78%) | n = 166 at T5 (80%) |

4.4. Three-year time horizon

Comparing a two-year center-based drug rehabilitation (time-limited) approach with MMT (on-going) represents a time in-equivalent comparison. In order to minimize this “in-equivalence in time horizon,” this research framed a three-year time horizon comparison, which included the two-year rehabilitation period of drug users in CCT centers and a one-year community follow-up of CCT released participants. The parallel time horizon for methadone treatment included a two-year retrospective MMT cohort study and a one-year prospective cohort follow-up. The cost-effectiveness analysis comparing the two treatment modalities was analyzed for this three-year time horizon.

5.1. Inclusion and exclusion criteria for MMT participants

The current study used the same inclusion criteria for MMT participants as the 2009 MMT cohort study:

Inclusion criteria:

1. 18 years of age and older;
2. Heroin dependence, measured by self-reported daily use of heroin during the three months prior to index treatment, a proxy to measure heroin dependence;
3. Participated in MMT treatment in Hai Phong City from 2008-2009; and
4. Consented voluntarily to participate in this research, as assessed and determined by the researcher providing the informed consent documentation.

Exclusion criteria: Younger than 18 years old; severe cognitive impairment or mental retardation; inability to grant consent; non-dependent use of heroin.

5.2. Inclusion and exclusion criteria for CCT-released participants

The CCT participants were CCT trainees who were newly released in 2013 from the three CCT centers, according to the following inclusion and exclusion criteria:

Inclusion criteria:

1. 18 years of age and older;
2. Heroin dependence, measured by self-reported daily use of heroin during the three months prior to index treatment, a proxy to measure heroin dependence;
3. CCT-released participants who enrolled in the CCT centers under the compulsory track;
4. CCT-released participants who received the recruitment letter sent by CCT center staff and who could provide either the recruitment letter or a certificate of CCT treatment completion at the time of first contact with a researcher as proof that they were newly CCT-released participants. This was to avoid a situation in which other drug users in the community might attempt to participate in the research. The recruitment letters were printed in color and included logos of all research institutions to ensure that reproductions could not easily be made;

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5. CCT-released participants who received the information leaflets provided by peer educators (who were research collaborators) and who could provide a certificate of CCT treatment completion at the time of contact with a researcher as proof that they were newly CCT-released participants; and
6. Consented voluntarily to participate in this research, as assessed and determined by the researcher providing the informed consent documentation.

Exclusion criteria: Younger than 18 years old; severe cognitive impairment or mental retardation; inability to grant consent; non-dependent use of heroin.

Identification of outcomes

As stated previously, the current study focuses on the following seven outcome measures:

1. Heroin use: Proportion of people free from heroin use
2. Illicit drug use: Proportion of people free from use of all illicit drugs
3. Number of days using illicit drugs (in prior 30 days)
4. Drug-related criminality: Proportion of people free from drug use-related criminal behaviors
5. Overdoses: Proportion of people free from overdose incidents
6. HIV risk behaviors: Proportion of people free from HIV risk behaviors
7. Drug spending: Expenditure on illicit drugs

Table 2 below provides a summary of the seven outcome measures and how these outcomes were defined.

Table 2: Identification of outcome measures

| Outcome measures | How to identify these outcomes |
|---|--|
| 1. Proportion of people free from heroin use | Based on urine drug screening (tested for opioids including heroin, opium, and morphine) |
| 2. Proportion of people free from any drug use | Based on self-reported responses. A list of illicit drugs used in Vietnam were compiled and questions were asked specifically for each drug type |
| 3. Reduction in the number of days using drugs | Based on self-reported responses to one question in the structured questionnaire |
| 4. Proportion of people free from drug use-related criminal behaviors | Based on self-reported responses. A list of questions about drug use-related criminal behaviors was asked at baseline and all follow-up interviews |
| 5. Proportion of people reporting HIV risk behaviors with score > 0 | BBV-TRAQ-SV ¹ questionnaire was used |

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| Outcome measures | How to identify these outcomes |
|--|--|
| 6. Proportion of people free from overdose incidents | Based on self-reported responses. Questions related to overdose experience were asked at baseline and all follow-up interviews to identify if the participants experienced overdose during the previous three months |
| 7. Monthly expenditure on drugs | Retrieved by using a simple math formula based on a group of responses (number of drug-free days, daily use frequency, weekly use frequency, monthly use frequency for each drug type, amount spent on the most commonly used drugs) |

6.1. Quantification of outcomes for MMT participants

The first interview for MMT participants under the current research was conducted during the period of 15 January – 30 March 2013. At the first interview, a structured questionnaire was administered by trained interviewers. The questionnaire asked about participants’ socio-demographic information, drug use behaviors, drug use-related criminal behaviors, HIV risk behaviors, overdose experience, and expenditure on drugs, for their lifetime, for the period of time three months prior to their commencement of MMT treatment, and for the period of time three months prior to the interview. Similar 3-month, 6-month and 12-month follow-up interviews were carried out. The urine test results of MMT participants were retrieved from patient records at MMT clinics. As per treatment protocol, opioid urine testing is carried out at random for MMT patients at the clinic on a monthly basis.

6.2. Quantification of outcomes for CCT participants

After the CCT participants gave consent, a baseline interview was carried out during the period of 15 July – 30 November 2013. Similarly as for MMT participants, a structured questionnaire was administered by trained interviewers. The baseline questionnaire asked about participants’ socio-demographic information, drug use behaviors, drug use-related criminal behaviors, HIV risk behaviors, overdose experience and expenditure on drugs, for their lifetime, for the period of time three months prior to their placement into CCT centers, and from the date of release to the date of the baseline interview. At 3-month, 6-month and 12-month follow-up interviews, the same questions were asked for the period of time encompassing the previous three months. At the end of each interview, a urine sample was provided by the participant for opioid drug screening at the site.

Identification and quantification of costs

Table 3 below summarizes the cost components of both MMT and CCT modalities.

Table 3: Cost components of CCT and MMT modalities

| Program costs (cost to government) | Costs to participants |
|--|---|
| <p>CCT:</p> <p>Capital costs:</p> <ul style="list-style-type: none"> 10% annual depreciated values of buildings and equipment/vehicles <p>Recurrent costs: <i>variable costs</i> (salary for staff, medicines, biological tests, and consumables), and <i>fixed costs</i> (center operation and maintenance)</p> <p>Data collection tool: Modified DATCAP questionnaire – program version</p> | <p>CCT:</p> <p>Cost of treatment during the two years in CCT centers:</p> <ul style="list-style-type: none"> Rehabilitation cost paid by families/participants to the centers 50% cost of food and other supplies provided by families to the participants monthly <p>Opportunity costs:</p> <ul style="list-style-type: none"> Loss of productivity due to two-year placement in CCT centers (based on self-reported monthly income and employment status at three-month period prior to CCT placement) <p>Data collection tool: questions included in the outcome questionnaire used at baseline interview</p> |
| <p>MMT:</p> <p>Capital costs:</p> <p>10% annual depreciated values of buildings and equipment/vehicles</p> <p>Recurrent costs: <i>variable costs</i> (salary for staff, methadone, urine tests, and consumables), and <i>fixed costs</i> (site operation and maintenance, medication import and distribution)</p> <p>Data collection tool: secondary data of the 2009 MMT cost study; 2013 data of budgetary expenditure provided by Hai Phong City Department of Health</p> | <p>MMT:</p> <p>Cost of treatment: zero because MMT treatment was free</p> <p>Opportunity costs:</p> <ul style="list-style-type: none"> Cost of travel time to MMT clinic on a daily basis including waiting time Cost of petrol for travel to the MMT clinic on a daily basis Potential impact of MMT treatment on the prospect of employment <p>Data collection tool: Modified DATCAP questionnaire – outpatient version, used at baseline interview only</p> |

ECONOMIC EVALUATION COMPARING

7.1. Cost of MMT modality

The MMT treatment cost per participant was calculated as the sum of two cost components: 1) program cost of MMT treatment; and 2) opportunity costs to MMT participants. During the period from 2008 to 2013, MMT treatment was provided free of charge because the program was funded by international donors. Starting in 2014, the Government of Vietnam put into place a patient co-payment mechanism wherein MMT patients pay 14,000 dong/day (equivalent to US\$0.70) in order to improve the feasibility of the scale up of MMT treatment from 17,500 patients by the end of 2013 to 80,000 patients by the end of 2015. Because the timeframe of this study is three years from 2009, program cost to MMT patients was calculated as zero.

7.1.1. Program cost of MMT treatment

The program cost data of MMT treatment was retrieved from two sources:

1. Secondary data from the 2009 MMT cost study conducted by the Health Policy Project, funded by USAID; and
2. Primary data on budget expended for the MMT program for 2013, provided by the Hai Phong Department of Health.

Data on the cost of providing MMT services in three pilot clinics in Hai Phong City in 2009 have been made available (Health Policy Initiative, 2009) and analyzed. In addition, as MMT started in 2008, the program cost per patient/year during the early start-up stage varied among clinics though the cost norms were the same within the methadone project, due to the fact that clinics had very different patient admission progress. The capacity of the three MMT clinics in Hai Phong reached 57% by the end of 2009 and 100% by the end of 2012. Therefore, the average program cost per patient/year gradually declined as the number of patients treated increased. In order to ensure the most realistic costs of MMT treatment, data on budget expended for the three MMT clinics for the year 2013 was also used in this analysis in addition to the aggregated data from the 2009 MMT cost study.

7.1.2. Cost incurred by MMT participants

A separate questionnaire was used to collect data on opportunity costs by MMT participants. The questionnaire included seven questions that aimed to collect data on: 1) distance of travel from home to MMT clinic; 2) average daily travel time; 3) average daily wait time; 4) average monthly petrol cost; 5) employment gained prior to or after starting methadone treatment; 6) average monthly income; and 7) possible impact of daily methadone administration on the prospect of employment (whether methadone treatment is an enabling or disabling factor). This questionnaire was used together with other outcome questionnaires at the first interview of MMT participants conducted under the current research. By using a simple arithmetic formula, the responses to these seven questions gave a net monetary amount of opportunity cost for each MMT participant.

7.2. Cost of CCT modality

The same cost categories that were used for MMT modality were also generated for CCT modality to ensure comparability. CCT modality cost per participant was calculated as the sum of three cost components: 1) program cost of CCT centers for two years; 2) rehabilitation cost paid by CCT participants/families; and 3) opportunity cost incurred by CCT participants. Primary data for all three cost components was collected.

7.2.1. Program cost of CCT centers

In July 2013, the research team sent the CCT modality cost questionnaire to the managers of three CCT centers. The managers assigned their respective financial staff to fill out the questionnaire. Two weeks later, the research team visited the respective centers for face-to-face meetings with the managers and financial staff to provide clarification on items in the questionnaires, if required, in order to ensure accuracy. The completed questionnaires were sent back to the research team in August 2013.

Land costs for CCT modality. CCT centers use a large area of agricultural or forestry land. However, inclusion of land costs in the study would have required a complicated assessment of land value (with specific procedures required by the Ministry of Finance) that was not feasible within the study framework and resources. In addition, the current government accounting excludes the land value from the cost of public services. The research, therefore, excludes the cost of land from the data collection; as a result, estimates of CCT start-up costs are diminished.

Six questions were designed to collect data on costs incurred by the CCT participants and/or their families. The aim of these six questions was to collect information on: 1) total number of months in CCT rehabilitation; 2) total one-time treatment cost paid to the center on entry for the entire two-year placement; 3) monthly expenses paid for food; 4) monthly expenses paid for medicines (if any); 5) monthly expenses paid for clothing and other personal items; and 6) other costs not listed previously. These questions were embedded in the outcome questionnaire at the baseline interview and only asked once.

7.2.2. Opportunity cost incurred by CCT participants

In the context of CCT modality, opportunity costs are identified as loss of income/productivity as a consequence of two-year placement in CCT centers. Other potential opportunity costs include: 1) loss of education opportunity; 2) loss of freedom; and 3) potential challenge of reintegration into the mainstream upon release as a consequence of being “out-of-touch” with society for two years. However, it is not possible to quantify all these opportunity costs in monetary value. Therefore only loss of income was included as the opportunity cost for this research.

ECONOMIC EVALUATION COMPARING

Decisions on the selection and development of data-gathering instruments were based on the following factors:

1. The research questions;
2. The questionnaires used for the 2009 MMT cohort study to ensure comparability with the 24-month MMT cohort study secondary data; and
3. The specificities of the operationalization of CCT and MMT treatment.

During the design phase (March – June 2012), the following questionnaires were adopted and developed:

For cost data (with modifications to fit the context of Vietnam):

1. DATCAP Cost Questionnaire – Program Version
2. DATCAP Questionnaire – Inpatient Client Version for costs incurred to CCT-released participants
3. DATCAP Questionnaire – Outpatient Client Version for costs incurred to MMT participants¹

For outcome data the following tools were used for both groups:

1. Revision to the questionnaire of the 2009 MMT cohort study was made to create a 18-page questionnaire that aims to collect the following outcome data:
 - Demographics
 - Education
 - Drug use history
 - Employment
 - Income
 - Family relationship
 - Drug use behaviors (types of drug used, route of administration, frequency)
 - Amount of money spent of drugs
 - Drug use-related criminal behaviors
 - Overdose history and overdose experience
 - Utilization of community-based health services
2. BBV-TRAQ-SV was used for measuring drug use-related HIV risk behaviors

¹ DATCAP questionnaires were developed by French and colleagues to measure costs of drug dependence treatment programs in the United States.

9.1. Comparison of effectiveness

The following statistical tests were used to test research question #1:

1. Standard descriptive statistics (chi-square test and *t*-test) were used to examine the differences between proportions and means of baseline variables. Logistic regression was used to compare the rate differences controlling for associated factors; and
2. The key statistical test was the mixed effects regression model, which was used to identify the differences on each of the identified outcome measures between the two groups across five time-points.

Mixed-effects regression models were used to analyze and compare the change of outcomes (primary outcome and secondary outcomes) for both groups over five time-points, controlling for a number of potential predicting factors (age, education, marital status, lifetime drug use behaviors, and history of compulsory rehabilitation).

Mixed effects regression models are the most powerful analytical technique to analyze longitudinal data. The strengths of the mixed effects regression technique include but are not limited to the following:

1. examining the differences at baseline on identified set of covariates;
2. allowing modeling outcomes across more than two time-points;
3. allowing for irregularly spaced measurements across time; and
4. allowing for complete-case analysis even in the presence of incomplete data at any given time-point.

Handling selection bias in estimating treatment effects

The lack of randomization of this study requires appropriate strategies during the data analysis phase to handle potential selection bias to ensure unbiased estimates. This sub-section explains the strategies that were undertaken.

First, the two study populations were compared at baseline on a range of demographic characteristics (age, employment status, addiction severity, and drug treatment history). It was expected that there would be baseline differences between the two groups due to the non-randomized nature of the study. The following were the potential covariates assessed:

| | |
|--------------------------------|---------------------------------|
| 1. Age | 7. Heroin injection |
| 2. Education | 8. Ever been to CCT |
| 3. Marital status | 9. Number of treatment episodes |
| 4. Number of years using drugs | 10. Ever overdosed |
| 5. Poly drug use | 11. Ever been to prison |
| 6. Employment | |

Where a significant difference was found, observed covariates were included in mixed-effects regression modeling in a step-wise fashion to obtain more accurate estimates of the effects comparing CCT and MMT.

Handling missing data as a consequence of lost-to-follow-up

At the final time-point, the lost-to-follow-up (LTFU) rates were 20% for CCT and 22% for MMT. To handle missing data as a consequence of LTFU, we used a conservative assumption for imputing missing data for each follow-up time-point. This method assumes that the LTFU participants had outcomes similar to their baseline data for all seven outcome measures. These data were imputed for all LTFU.

9.2. Comparison of cost-effectiveness

The central measure used in cost-effectiveness analysis (CEA) is the incremental cost-effectiveness ratio (ICER). An ICER estimates the cost per additional unit of outcome achieved, where the outcome is measured in some “natural unit” [14]. Such analysis allows comparison of the efficiency of different treatment modalities that are designed to produce a given outcome [15]. Once mean costs and mean outcomes are determined, incremental cost-effectiveness ratios (ICER) can be estimated using the following formula:

$$ICER = \frac{C1 - C2}{E1 - E2}$$

where C1 and E1 are the mean cost and mean outcome of one treatment group and C2 and E2 are the mean cost and mean outcome of the comparator group. Treatment modalities that have a relatively low ICER may be considered ‘good buys’ and thus have high priority for resource allocation.

Participants were provided with a copy of the Participant Information Statement and Consent Form. To ensure that all participants fully understood the study, risks, and requirements, the researchers read the consent form and provided an opportunity for questions and clarification to ensure that participants understood the contents of the form before signing. All study procedures were confidential and all information was filed securely at study points. All participants' information was filed in a locked cabinet that could only be accessed by the research team. Collection and management of data, administrative templates, urine samples, and other materials were identified by code only and all databases were encrypted. Templates, lists, tracking books, and other lists connected to participant codes were filed separately and always locked at a location where only authorized personnel could access them.

Ethics approvals were granted by three institutions: the University of New South Wales, FHI 360, and Hanoi Medical University (HMU). In addition, the research proposal, the Participant Information Statement, Consent Form, and questionnaires were submitted to a local review committee comprised of Hai Phong City local government agencies and MOLISA/DSEP.

Both CCT-released participants and MMT participants were recruited following the principle of an "arms-length" approach wherein participants should not feel any coercion regarding their decision to participate or not participate. Participants were informed that participation is entirely voluntary, that they are under no obligation to take part in the research, and that they may withdraw themselves and their data from the research at any time. They were assured that information they provide would not be presented in a manner that could make them identifiable, and that refusal to participate would not jeopardize their relationship with the treatment providers, DOLISA/DSEP, UNSW, FHI 360, or HMU.

Urine drug screening was used for CCT-released participants during their follow-up interviews. There are no infectious risks as a result of taking a urine sample. However, there might be some risk to the participants if the results of the screening were to become known by their family or the local authorities. Possible risks could include a confrontation between family members, local authorities, and CCT-released participants, or a decision to return CCT-released participants to the CCT. Therefore, in this research confidentiality was extremely critical. Standard confidentiality procedures were in place to ensure that only the researchers involved in the research would know the results. The urine collection procedure was explained by the researcher and then the participant was invited to provide a urine sample. All samples were destroyed after the drug screen result was identified by the interviewer.

ECONOMIC EVALUATION COMPARING

Organizational involvement and partnerships

1. Government collaboration and co-operation: The government authorities of Hai Phong City agreed to the design and implementation of this research from the onset. The political endorsement of the People's Committee in February 2012 provided a platform for the research institutions to engage with leaders of the Department of Labor, Invalids and Social Affairs and the Division of Social Evils Prevention. Government co-operation enabled the presentation and discussion of research results between research institutions and relevant national and local government organizations. These meetings took place during June 2014 and April 2015.
2. Technical expertise and research implementation: Four research institutions contributed their research expertise for this research: UNSW Australia, FHI 360 in Vietnam, Hanoi Medical University, and Hai Phong Medical University. UNSW Australia provided guidance and supervision to Ms. Vuong Thi Huong Thu (a former Program Manager at FHI 360) in application of best practices in outcome and economic evaluation research. FHI 360 Vietnam played a key role in coordination with government organizations and monitoring of fieldwork data collection. Hanoi Medical University ensured ethical standards were adhered to during research implementation and took responsibility for the quality of data collection and data entry. Finally, the Hai Phong Medical University undertook a critical role in implementation of fieldwork data collection with the involvement of 10 experienced researchers throughout the course of 18 months.
3. Funding: The implementation of this research was funded by Atlantic Philanthropies as part of a larger project commissioned through FHI 360 Vietnam. Funding also came in the form of PhD scholarships from the Australian Government's Endeavour Awards and from the National Drug and Alcohol Research Center (NDARC) at UNSW Australia where the PhD candidate was primarily located and supervised.

This report presents the research findings in four parts:

Part 1: Comparison of baseline characteristics

Part 2: Comparison of the effectiveness of two treatment modalities from five time-points (baseline and two subsequent time-points)

Part 3: Cost analysis

Part 4: Cost-effectiveness analysis

12.1. Part 1: Baseline comparison

Part 1 aims to: 1) Provide a snapshot of baseline characteristics of the two groups; and 2) If baseline differences exist, include these differences in the analysis of Part 2 to ensure unbiased results.

Table 4 (participants' demographics) shows that:

1. The CCT group was younger (mean=33.26 vs 37.32 years), more likely to be single (51.70% vs 43.40%), more likely to be employed (76.40% vs 66.70%), and had higher legal monthly incomes (3 mil dong vs 1.5 mil dong); and
2. The level of education for both groups was not statistically different with 40.10% of the CCT group and 46.20% of the MMT group having completed high school at minimum.

Table 4: Participants' demographics

| | CCT (n=208) | MMT (n=384) | Test result and P-value |
|--|----------------|----------------|---------------------------------|
| Age (mean & SD) | 33.26 (7.60) | 37.32(8.23) | t(590)=-5.624; p<0.001 |
| Education (%) | | | |
| ≥ High school | 40.10 | 46.20 | X ² (1)=1.95; p=0.16 |
| < High school | 59.90 | 53.80 | |
| Marital status (%) | | | |
| Single | 51.70 | 43.40 | X ² (1)=4.16; P=0.04 |
| Married, divorced, separated, or widowed | 48.30 | 56.60 | |
| | | | |

ECONOMIC EVALUATION COMPARING

| | CCT (n=208) | MMT (n=384) | Test result and P-value |
|--|----------------------|-----------------------|-------------------------------|
| Employment (%) | | | |
| Unemployed | 23.60 | 33.30 | $\chi^2(2)=11.46$; $P=0.003$ |
| Full-time | 17.10 | 21.30 | |
| Part-time | 59.30 | 45.40 | |
| Average legal monthly income (median & range) | 3 mil (0.8-15mil) | 1.5 mil (0-35 mil) | $U=28,617$; $p<0.001$ |

Table 5 (drug use history 1) shows that:

- Both groups started to use drugs at a similar age: early 20's;
- The CCT group had a higher proportion who started with heroin (85.70% vs 80.70%) but their daily use frequency was lower (3 times/day vs 4 times/day) and they had been using drugs for fewer years (11.01 years vs 13.17 years); and
- The proportion of people who used heroin daily was not statistically different between the two groups (CCT=97.50%; MMT=99.96%).

Table 5: Drug use history (1)

| | CCT (n=208) | MMT (n=384) | Test result and P-value |
|---|----------------|----------------|--------------------------------|
| Age of first intoxication (mean & SD) | 22.35 (5.79) | 23.22 (6.40) | $t(590)=-1.68$; $p=0.09$ |
| Drugs of first intoxication (%) | | | |
| Heroin | 85.70 | 80.70 | $\chi^2(2)=7.26$; $p=0.03$ |
| Opium | 10.40 | 16.50 | |
| Other drugs | 4.80 | 2.20 | |
| Number of years used (mean & SD) | 11.01 (6.20) | 13.17 (4.63) | $t(590)=-5.08$; $p<0.001$ |
| Daily HEROIN use (%) | 97.50 | 99.96 | $\chi^2(1)=3.57$; $p=0.06$ |
| Daily HEROIN use frequency (median & range) <i>*of those who used everyday</i> | 3 (0-20) | 4 (0-18) | $U=64,077$; $p<0.001$ |

Table 6 (drug use history 2) shows that:

- 1. During the 30 days prior to treatment, a smaller proportion of the CCT group reported using drugs on a daily basis (80.60% vs 96.40%);
- 2. From the commencement of drug use until treatment entry, the CCT group spent less money on drugs on a monthly basis (4.55 mil dong vs 6.05 mil dong), which is consistent with using less frequently;
- 3. A smaller proportion of the CCT group ever injected heroin (66.40% vs 82.70%); although
- 4. The CCT group was more likely to be poly drug users (50.50% vs 28.90%), with 28.30% also using methamphetamine. Among those who were poly users, CCT groups used a higher number of more drug classes (3 vs 2).

Table 6: Drug use history (2)

| | CCT (n=208) | MMT (n=384) | Test result and P-value |
|--|--------------------------|---------------------------|-------------------------------|
| % daily drug use (during 30 days before treatment) | 80.6 | 96.4 | $\chi^2(1)=46.74$; $p<0.001$ |
| Monthly expenditure on drugs (median & range) | 4.55 mil dong (0–84 mil) | 6.20 mil dong (0–225 mil) | $U=60,171$; $p<0.001$ |
| Heroin injection ever (%) | 66.40 | 82.70 | $\chi^2(1)=30.79$; $p<0.001$ |
| Poly drug use ever (%) <i>*Methamphetamine second drug of choice: 28.30% for CCT and 11.60% for MMT</i> | 50.50 | 28.90 | $\chi^2(1)=29.99$; $p<0.001$ |
| Mean number of drug classes used <i>*of those who were poly users</i> | 3 (1.25) | 2 (0.82) | $t(214)=4.69$; $p<0.001$ |

Table 7 (history of drug dependence treatment) shows that:

- 1. CCT participants were less likely to have sought treatment (78.77% vs 96.60%). For those who did, the median number of treatment episodes was smaller (2 vs 5); and
- 2. CCT participants were less likely to have previously been in a CCT center (38.00% vs 49.90%) and less likely to have undergone home-based detoxification (66.70% vs 84.40%).

Table 7: History of drug dependence treatment

| | CCT (n=208) | MMT (n=384) | Test result and P-value |
|--|----------------|----------------|----------------------------------|
| Ever sought drug dependence treatment (%) | 80.77 | 96.70 | $\chi^2(1)=55.14$; $p<0.001$ |
| Number of treatment episodes (median & range) <i>*for those who ever sought treatment</i> | 2 (1-50) | 5 (1-40) | $U=49,581$; $p<0.001$ |
| Ever been to a CCT center (%) | 38.00 | 49.90 | $\chi^2(1)=8.46$; $p=0.004$ |
| Ever home detoxed (%) | 66.70 | 84.40 | $\chi^2(1)=27.67$; $p<0.001$ |

Table 8 (drug use-related illegal and health consequences) shows that:

1. The proportions of people who had ever: 1) committed illegal behaviors (CCT=35.20% and MMT=30.30%); 2) been to prison (CCT=15.70% and MMT=18.30%); and/or 3) overdosed were not statistically different between the two groups (CCT=18.50% and MMT=12.10%) à These data suggest that the two groups experienced “levels of health (overdose) and legal harms (imprisonment)” that are not very different from one another.

Table 8: Drug use-related illegal and health consequences

| | CCT (n=208) | MMT (n=384) | Test result and P-value |
|---|----------------|----------------|-----------------------------|
| Ever committed illegal behaviors (%) | 35.20 | 30.30 | $\chi^2(1)=2.35$; $p=0.13$ |
| Ever been to prison (%) | 15.70 | 18.30 | $\chi^2(1)=1.24$; $p=0.27$ |
| Overdose incident ever (%) | 18.50 | 12.10 | $\chi^2(1)=3.49$; $p=0.06$ |

Summary of findings of Part 1

The results of Part 1 suggest that:

1. CCT participants appear not to be as dependent on drugs as compared to the MMT group. The CCT group had a:
 - higher proportion of people who did not use drugs on a daily basis (~20%)
 - higher proportion who never injected drugs (33.6%)
 - lower proportion who ever sought treatment
2. However, the difference in health consequences (overdose) and legal consequences (being imprisoned) between the two groups was not statistically significant.

3. Heroin continues to be the most commonly used drug reported, implying that treatment services should continue to focus on heroin.
4. Ten years ago, opium was the second drug of choice. Now it is methamphetamine, implying that new services should also focus on methamphetamine treatment.
5. Poly drug use was more common among CCT participants:
 - Poly drug use increases the risk for overdose
 - Health care services need to be redesigned for prevention of overdose targeting CCT-released participants
6. 33.6% of CCT participants had never injected heroin:
 - These are ideal candidates for early intervention to prevent injecting
 - Drug injection is more likely to be associated with blood-borne infections and other health-related consequences

12.2. Part 2: Effectiveness analysis

Part 2 aims to: 1) compare treatment effectiveness by means of seven outcome measures across five time-points; and 2) identify which treatment modality is most effective for each outcome measure.

Below is the presentation of the results with the seven (7) following outcome measures:

1. Opioid use (basing on urinalysis) (yes/no)
2. Use of all drugs (basing on self-report) (yes/no)
3. Number of days using drugs (during the previous 30 days)
4. Illegal behaviors (yes/no)
5. Overdose incident (yes/no)
6. HIV risk score (yes/no for score >0)
7. Monthly expenditure on drugs

Presentation of results:

For this section, graphs display **descriptive imputed data** and the **results from mixed effects regression modeling** are presented underneath each.

The graphs help us in two ways:

1. To visually assess the difference between the two groups for each time-point; and
2. To visually assess the rate of change of each group over the five time-points.

To make an official assessment of whether the change is significant and/or whether the rate of change between the two groups is different, we need to rely on statistical methods, not visual assessment. As discussed in Section 9, the statistical method used for this research is mixed effects regression modeling.

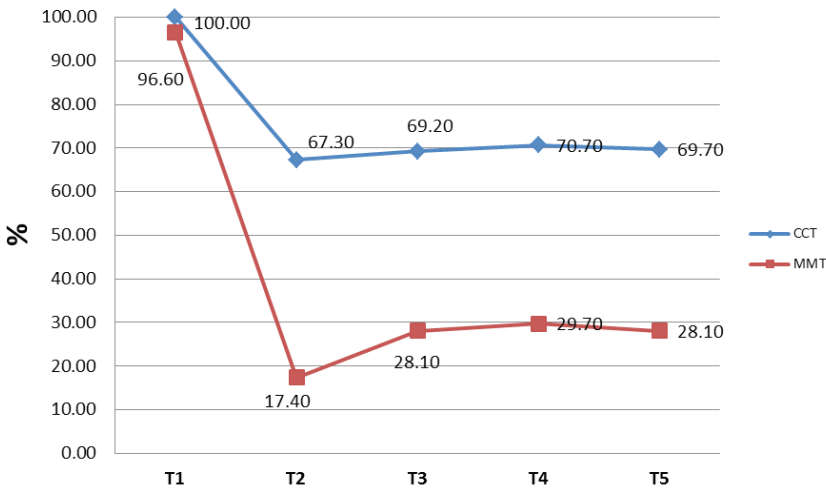
ECONOMIC EVALUATION COMPARING

For some outcome measures, results from mixed effects regression modeling are in agreement with our visual assessment of the graph. However, for other outcome measures, the results from mixed effects regression modeling seem to contradict our visual assessment of the graphs. This happens for two reasons:

1. Mixed effects regression models assess the rate of change (the change over time) and the difference in the rate of change between two groups, not the difference between groups at each time-point; and
2. Mixed effects regression models include 11 controlling variables in the analysis (as discussed in Section 9); results are the reflection of the effects of these controlling variables, even though not all 11 have effects that are statistically significant for a specific model or specific outcome variable.

1) Heroin use (confirmed by drug urine screening)

Figure 2: Proportion of participants who used heroin (based on urine drug screening)



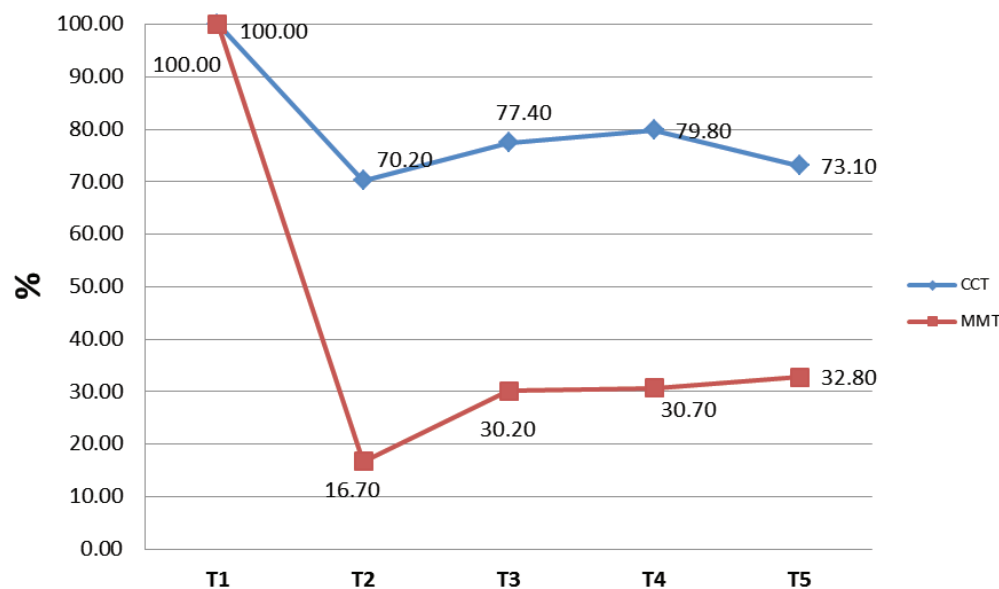
Mixed effects results:

- Across the five time-points, the proportion of people who had a positive opioid urine sample was reduced for both groups. However, CCT-released participants were nearly **3 times more likely** to have a positive opioid urine sample compared to MMT participants (taking into account all baseline differences).

Note: At T2 (at completion of two-year placement in CCT centers), 67.30% of the CCT-released participants had a positive urine sample. This is due to the fact that by the time participants enrolled in the research, they had already been integrated back into the community for weeks and even months (up to three months).

2) Use of any drug (self-report)

Figure 3: Proportion of participants who reported use of any illicit drug

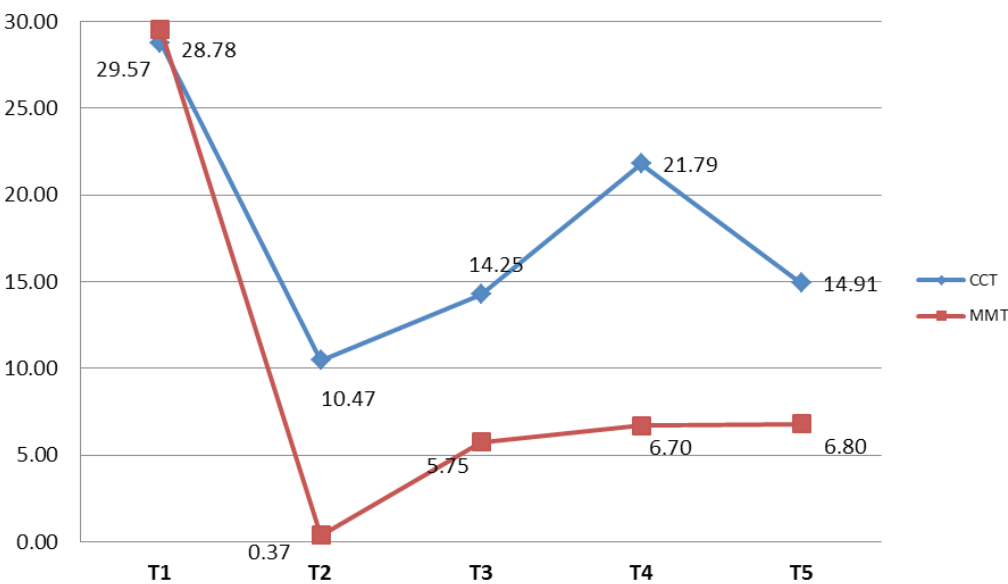


Mixed effects results:

- Over five time-points, the proportion of people who self-reported using any drug was reduced for both groups. However, CCT-released participants were **3.3 times more likely** to report any drug use compared to MMT participants (after taking into consideration baseline differences).

3) The number of days using drugs (in previous 30 days)

Figure 4: Number of days using drugs (in previous 30 days)

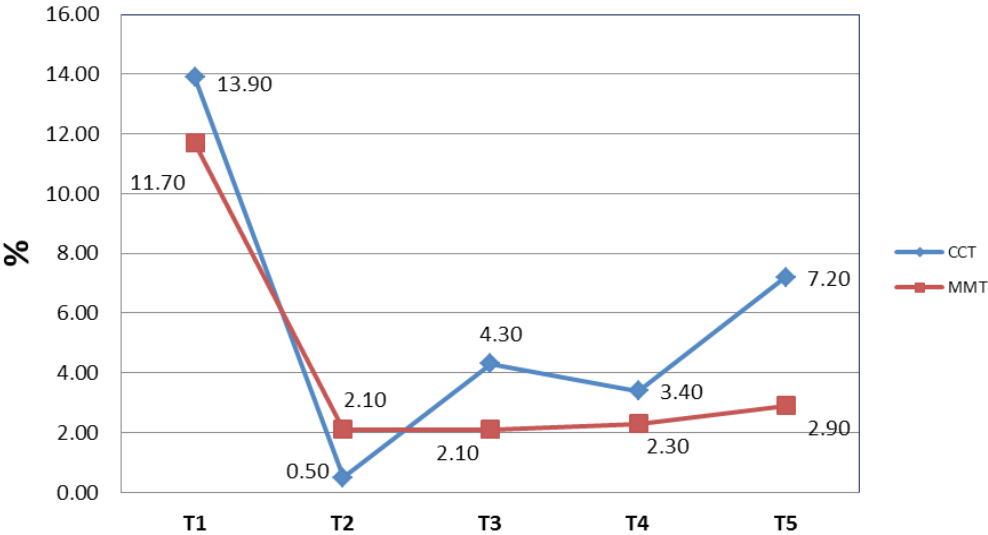


ECONOMIC EVALUATION COMPARING

Mixed effects results: Across five time-points, the mean number of days using drugs in the last 30 days was decreased significantly for both groups. However, on average, one CCT participant reported **9 MORE drug-using days** compared to one MMT participant (taking into account all baseline differences). This means that on average, over one year of the three-year time horizon, one CCT participant had **108 MORE drug-using days** compared to one MMT participant. Over three years, one CCT participant had **324 MORE drug-using days** compared to one MMT participant.

4) Drug use related illegal behaviors

Figure 5: Proportion of participants who reported any illegal behaviors

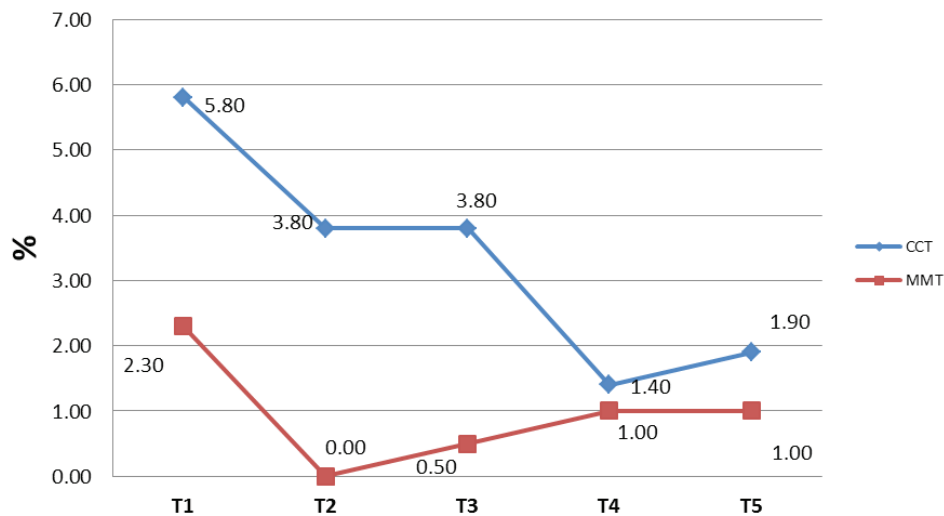


Mixed effects results: Across five time-points, the proportion of participants who engaged in illegal behaviors was reduced for both groups. However, CCT-released participants were **5.6 times more likely** to report an illegal behavior compared to MMT participants (after taking into account all baseline differences).

For the outcome variable on illegal behaviors, results from mixed effects regression models show a difference of 5.6 times while it may appear that there is not much of difference between the two groups by utilizing a visual assessment of the graphs. This is due to the fact that the controlling baseline variables “age” and “ever been to prison” had significant effects. “Age” had a moderate negative effect. This means that older participants were less likely to report illegal behaviors and MMT participants were older. Additionally, the variable “ever been to prison” had a negative effect, which means that participants who had ever been to prison at baseline were less likely to engage in illegal behaviors at follow-up time-points. (MMT participants had a higher proportion of those who had ever been to prison.)

5) Non-fatal overdose

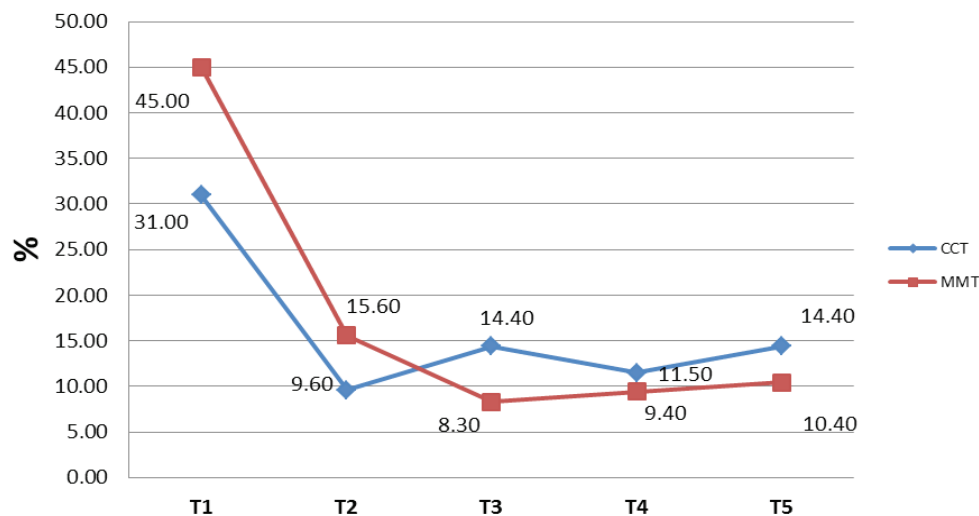
Figure 6: Proportion of participants who reported overdose incidents



Mixed effects results: Across five time-points, the proportion of people who reported having an overdose incident was reduced for both groups. Mixed effects results show that the possibility of having an overdose incident for the MMT group and the CCT group was reduced by **24%** and **30%**, respectively. However, the difference in reduction was **not statistically significant** (after taking into account all baseline differences).

6) Drug use-related HIV risk behaviors

Figure 7: Proportion of participants who reported drug use-related HIV risk behaviors



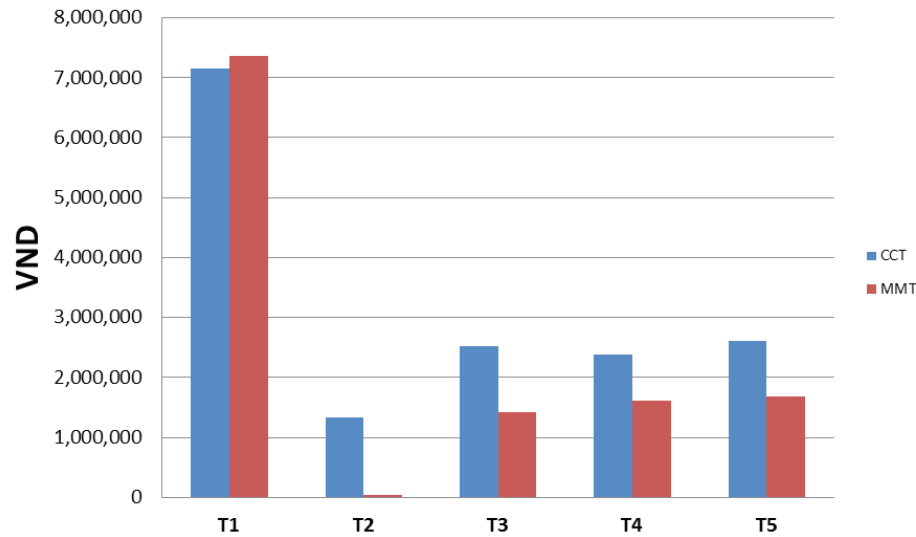
Mixed effects results: Across five time-points, the proportion of participants who reported HIV risk behaviors was reduced for both groups. However, CCT participants were nearly **7 times more likely** to report drug use-related HIV risk behaviors compared to MMT participants (after taking into account all baseline differences).

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For the outcome variable on drug use-related HIV risk behaviors, the results from mixed effects regression models show a difference of 7 times while it may appear that there is not much of difference between the two groups by utilizing a visual assessment of the graphs. This is due to the fact that the controlling baseline variables “education,” “heroin injection ever,” and “number of drug treatment episodes” had significant effects. “Education” had a small negative effect. This means that participants who had a higher education were less likely to report HIV risk behaviors. “Heroin injection ever” had a negative effect, which means that participants who had ever injected heroin were less likely to report HIV risk behaviors. Lastly, the “number of treatment episodes” had a small negative effect, which means that participants who had a higher number of treatment episodes were less likely to report HIV risk behaviors.

7) Monthly expenditure on drugs

Figure 8: Monthly expenditure on drugs



Mixed effects results: Across five time-points, the average monthly expenditure on drugs was decreased significantly for both groups. The MMT group spent 4.4 mil dong less and the CCT group spent 3.6 mil dong less. The **difference** between the two groups in reduction of monthly expenditure on drugs **was not statistically significant**. However, drug spending in months 24-36 was consistently less in MMT patients.

Summary of findings of Part 2

The research findings of Part 2 suggest:

- **MMT treatment is more effective compared to CCT modality for:**
 1. Reducing heroin use (measured by urinalysis): over the three-year time horizon, CCT participants were **3 times more likely** to have a positive opioid urine sample compared to MMT participants;
 2. Reducing any drug use (measured by self-report): over the three-year time horizon, CCT participants were **3.3 times more likely** to report any drug use compared to MMT participants;

3. Reducing the number of days using drugs: over the three-year time horizon, one CCT participant had **9 MORE drug-using days** (in the last 30 days) compared to one MMT participant; this means that on average over the three-year time horizon, one CCT participant had **324 MORE drug-using days** compared to one MMT participant;
 4. Reducing drug use-related illegal behaviors: over the three-year time horizon, CCT-released participants were **5.6 times more likely** to report an illegal behavior compared to MMT participants; and
 5. Reducing drug use-related HIV risk behaviors: over the three-year time horizon, CCT-released participants were nearly **7 times more likely** to report a HIV risk score >0 compared to MMT participants.
- ***There is no difference between MMT and CCT for:***
 1. Reducing overdose incidents: the possibility of having an overdose incident for the MMT group and the CCT group **reduced by 24% and 30%** respectively. The difference of 6% was not statistically significant; or
 2. Monthly expenditure on drugs: over the three-year time horizon, the MMT group spent **4.4 mil dong less** and the CCT group spent **3.6 mil dong less** than compared to before entering treatment. The difference of 0.8 mil dong was not statistically significant; however, drug spending in months 24-36 was consistently less in MMT patients.

12.3. Part 3: Cost analysis

Part 3 aims to: Compare 1) the program cost (cost to the government); 2) the cost to the participant; and 3) the total cost (cost to the government + cost to the participant) of the two treatment modalities.

12.3.1. Cost of MMT treatment

12.3.1.1. The three MMT clinics

Out of the three MMT clinics, Le Chan clinic is the largest and has always been viewed as the MMT “training center” for Hai Phong (as well as for Vietnam as a whole). It was designed to function as a training center from the outset due to its geographical proximity to the Hai Phong Department of Health, thus making required monitoring and supervision activities easy during the program’s beginning and study tours from delegations from other cities and provinces accessible. To this end, a brand-new facility was built in 2008 to fit the purpose of a MMT clinic with a land area of 400m² and office area of 200m². Ngo Quyen clinic is part of an existing small HIV treatment facility (total 80m²). The size and sharing of facilities posed some constraints in patient uptake. Thuy Nguyen clinic only serves patients who are residents of Thuy Nguyen District due to the fact that the district is very widespread with a diameter of approximately 20km. Thuy Nguyen clinic has spacious facilities (250m²) that can provide treatment for more than 250 patients.

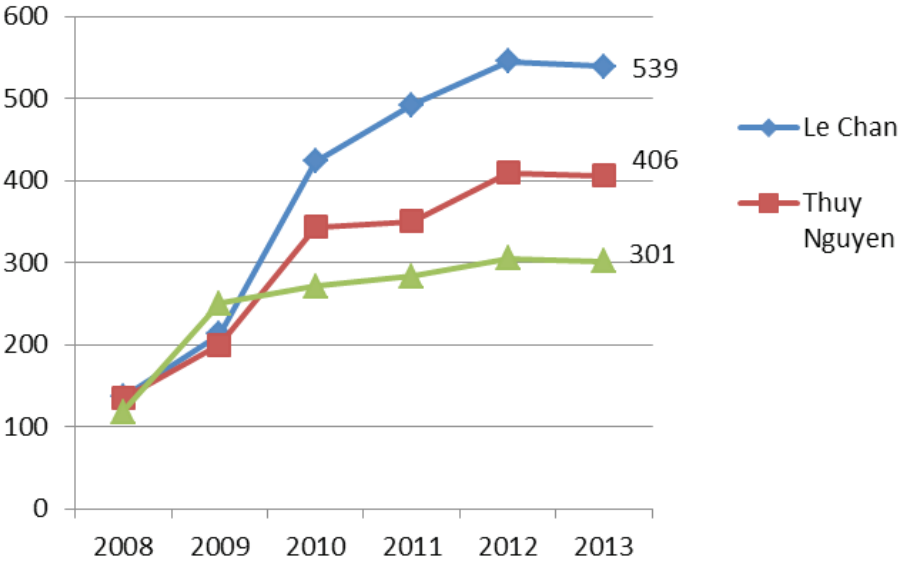
12.3.1.2. Number of MMT participants/patients

Figure 9 illustrates the trajectories in patient uptake of the three MMT clinics from the start of the program in early 2008 until June 2013. By the end of 2008,

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nine months after the start of the program, each clinic provided treatment to 110 patients on average. Patient uptake did not reach full capacity until the end of 2010. Full capacity is defined by the Ministry of Health as 250 patients per clinic [16]. However, due to high demand for methadone treatment, all clinics saw continuous but varied rates of increase in patient admissions up until the end of 2012. The highest number of patients reached by Le Chan clinic was 539, by Thuy Nguyen clinic 406, and 301 by Ngo Quyen clinic. No additional patient admissions were expected beyond these numbers because peak workload for the clinic staff had been reached.

Figure 9: Uptake of MMT participants by clinic 2008 – 2013 (by year end)



12.3.1.3. MMT program cost (cost to the government)

The program costs for the MMT clinics were estimated based on budget expenditures for each of the clinics and depreciated values of buildings and equipment. These costs were then divided by the number of patients at each clinic to derive an average program cost (for one participant/patient per year).

Figure 10: Program cost by MMT clinic – 2009 vs 2013

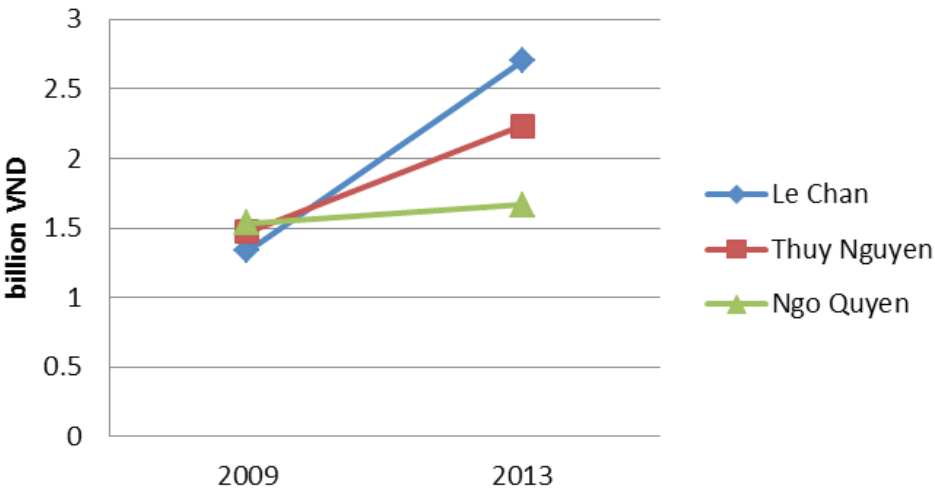
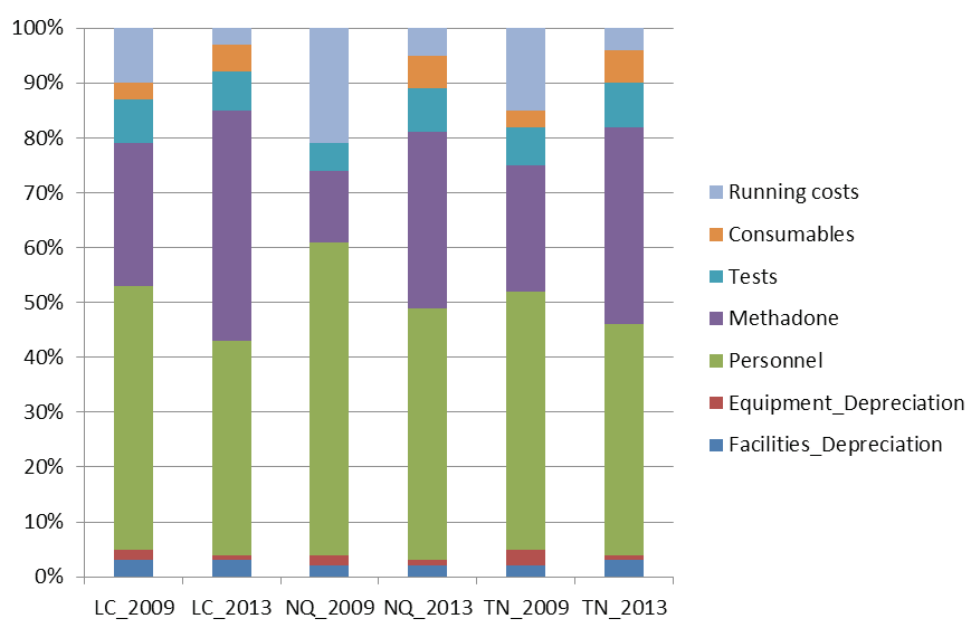


Figure 10 shows the program costs of each clinic in 2009 and 2013. Not surprisingly, as the number of patients increased, the program costs for the clinics also increased. For Le Chan clinic the program costs of 2013 were double those of 2009 (2.7 billion dong vs 1.34 billion dong), which is proportionately equivalent to the rate of increase in patient uptake (539 vs 213). For Ngo Quyen clinic, the program cost increase was insignificant (1.67 billion dong vs 1.53 billion dong) because the number of patients increased from 200 to only 301. Thuy Nguyen’s program cost clinic increased significantly from 1.47 billion dong to 2.24 billion dong, influenced by the increase of patient uptake from 250 to 406. These increases were largely due to increased cost for methadone syrup as the number of patients increased. This trend was confirmed by the proportion of methadone cost in the “cost structure” section below.

Cost structure

The structure of program costs for the three MMT clinics for the years 2009 and 2013 is shown in Figure 11; it is evident that the most significant budget items were personnel costs and methadone costs. The proportion of personnel costs slightly decreased (from 48% to 45% on average) whereas the proportion of methadone costs increased (from 27% to 30% on average). Methadone cost is the combination of the cost of the drug itself and the costs associated with administration such as importation and storage fees. On average the cost per 1mg of methadone is 61dong, which means that **for an average daily methadone dose of 95mg, the cost is 5,795 dong (US\$ 0.28)**. The third significant cost item was operating expenses, which comprised 11% of the program costs on average in 2009 and 8% in 2013. Operating expenses included the cost of electricity and water, telephone and Internet, photo-copying of patient records, stationery, transportation, and organization of the selection committee. The decrease in operating expenses that occurred in 2013 was partly due to the fact that a selection committee was not required after 2012, when the ceiling number of patients had been reached for all three clinics.

Figure 11: Cost structure of total costs by MMT clinic – 2009 vs 2013



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The cost structures of the methadone clinics were quite similar to one another due to the fact that the MMT clinics were established following regulations from the Ministry of Health regarding the specific number of personnel and standard cost norms. By current regulations, a methadone clinic typically employs two receptionists, two pharmacists, two nurses, two counselors, one full-time doctor, and some clinics also have a managing doctor who spends about half of his/her time on treatment. Clinics with a higher proportion of methadone costs such as Le Chan and Thuy Nguyen had a larger number of patients that resulted in slightly different cost structures. Specifically, the cost of methadone syrup accounted for 42%, 32%, and 36% of the total costs of 2013 for Le Chan clinic, Ngo Quyen clinic, and Thuy Nguyen clinic, respectively.

The depreciated value of equipment and facility renovation for the three MMT clinics were relatively small, accounting for 3% and 2% of the program costs, respectively. In the 2009 MMT cost study, a 10% depreciation approach for house renovation and costs of equipment was undertaken. To ensure comparability with the costing methods for MMT modality, the same approach was applied for CCT modality.

In the 2009 MMT cost study, the average program cost was calculated based on the number of patients and expenditures for the first quarter of 2009. The resulting estimates were 6.28 million dong (US\$292) for one patient/year in Le Chan clinic, 7.67 million dong (US\$356) for one patient/year in Ngo Quyen clinic, and 5.88 million dong (US\$273) for one patient/year in Thuy Nguyen clinic. This resulted in an average of 6.72 mil dong for one patient per year for all three clinics combined. As expected, Table 9 shows that the average program cost per patient/year for 2013 for all three clinics, at 5.30 mil dong for one patient per year, was less than that of 2009.

Table 9: MMT Program Cost (Cost to the government)

Unit: dong

| | 2009 | 2013 |
|-----------------------------------|----------|----------|
| Total government budget expended | 4.34 bil | 6.61 bil |
| Number of patients | 646 | 1,246 |
| Program cost per patient per year | 6.72 mil | 5.30 mil |

12.3.1.4. Costs incurred by MMT participants

Calculations of costs incurred by both participant groups and the related assumptions for these calculations adhered to the procedures developed by French and colleagues for the Client DATCAP questionnaires for the costing exercise of drug dependence treatment services in the United States [17]. Following these procedures, costs incurred by participants were grouped into three categories: 1) opportunity cost of time spent in treatment, which is largely based on forgone employment income; 2) other costs that participants incur as a result of attending treatment such as travel costs and parking fees; and 3) costs incurred by traveling back and forth to visit the program.

In order to calculate the total cost incurred by MMT participants, the following formula was developed:

Total yearly costs (incurred by MMT participant) = Total yearly time costs + Total yearly travel costs

of which:

Reported monthly wage

160 (average working hours a month)

Daily time travel to MMT clinic+ Daily wait time (in minute)

60 (minutes for 1 hour)

x 340 (days a year)

Total yearly time costs = Total yearly time (in hour) x hourly wage (at time of entry to treatment)

Total yearly travel costs = Weekly travel costs (petrol costs, bus fare...) x 52 (weeks)

Travel costs represent the cost of traveling back and forth to the program for participating in MMT treatment. The per visit travel cost (daily) was reported directly by the participants in the modified DATCAP questionnaire. Total travel costs were obtained by multiplying the costs per visit by the average number of days attending the clinic per year.

Time spent in treatment represents an opportunity cost of treatment attendance and theoretically can be disaggregated into an employment component. Employment cost represents the value of time forgone during which the participant normally would have engaged in compensated labor and earned wages or a salary. The opportunity cost of work time is traditionally valued at the individual's prevailing rate of pay. For MMT treatment, opportunity costs of time were calculated basing on time spent on treatment and travel time, regardless of whether treatment interfered with employment. This was calculated from data obtained on monthly wage rates as follows: a) for those participants who reported being employed at three months prior to treatment, productivity costs were valued at the monthly wage rate reported; b) for those participants who reported being unemployed during the three months prior to treatment (31.77%), productivity costs were valued at zero. Opportunity cost per month for MMT participants was then calculated by multiplying individual hourly wage rate by the sum of the total number of hours in treatment and time spent traveling to the MMT clinic.

Table 10 shows the cost to the MMT participants for all categories. The cost data presented in Table 10 are presented in 2013 dong, after adjusting for inflation using Consumer Price Index (CPI). This is to ensure that costs that were collected for different years are comparable. The adjusted cost of time (loss of productivity) for one MMT participant per year was 1.22 mil dong (US\$58.45) and the travel cost was 4.25 mil dong (US\$203.62).

Table 10: Cost to MMT participants (in 2013 dong after adjusting for inflation using CPI)

Unit: dong

| | |
|---|-----------------|
| Cost of loss of productivity | 1.22 mil |
| Treatment cost paid by the participants | N/A |
| Travel cost | 4.25 mil |
| TOTAL | 5.47 mil |

12.3.1.5. Total costs – MMT treatment

The total costs for one MMT participant per year was calculated using the following formula:

Total cost per MMT participant/year = Program cost (with methadone)
+ Participant cost

Table 11 showed that the average total cost for one MMT participant/year was 13.35 mil dong (US\$640). This is the cost valued in 2013 dong after adjusting for inflation using CPI. The proportion of the cost to the government over the total cost was 59%.

Table 11: Average total cost – MMT (in 2013 dong after adjusting for inflation using CPI)

Unit: dong

| | ONE YEAR (per participant) |
|---|-----------------------------------|
| Cost to the government | 7.88 mil |
| Cost to the participant | 5.47 mil |
| Total cost (cost to the government + cost to participant) | 13.35 mil |
| % of cost to the government over total cost | 59% |

12.3.2. Cost of CCT rehabilitation

12.3.2.1. The three CCT centers

There are three CCT centers in Hai Phong City and all were included in the current study. Center #06 is the oldest and also the smallest, situated in Hai An urban district. It was established in 1991 using existing facilities with a land area of 6,000 m². The facilities were renovated for a design capacity of 250-300 trainees. An area of 2,150 m² was devoted to houses and offices and an area of 720 m² was set aside for agricultural and animal husbandry activities for the trainees.

The second oldest and the biggest CCT center is Gia Minh Center which began operating in 2004. Gia Minh Center is located in Thuy Nguyen rural district, 30 km northeast of the city. It was built on a total land and mountain area of 68 hectares (1hectare = 10,000m²). An area of 12 hectares was used for building houses, offices, and vocational training facilities, and a land area of 35 hectares was used

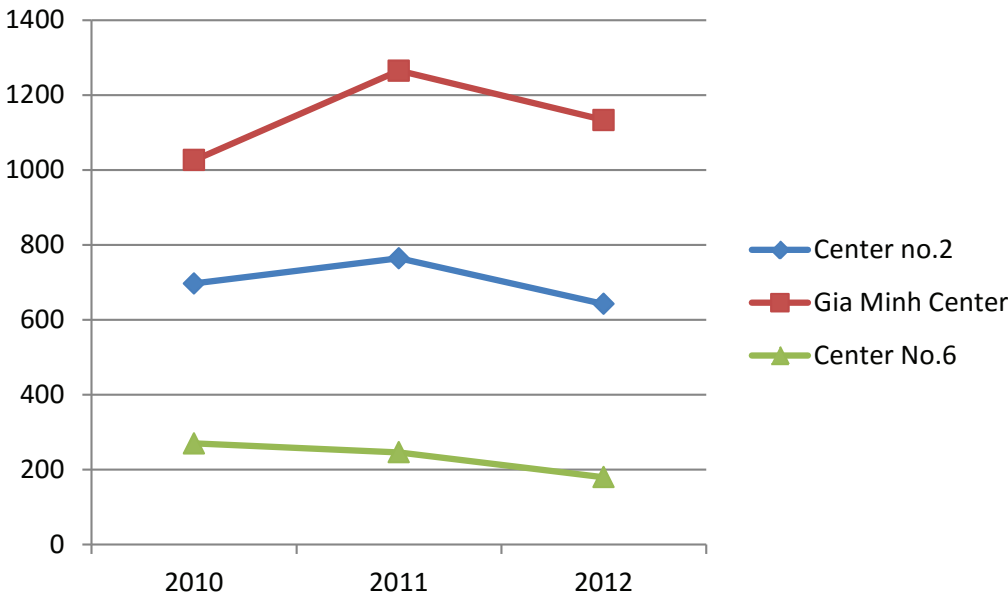
for agricultural and animal husbandry activities. The original design capacity was for 500 trainees. Over time, new houses were built and up to 1,200 trainees were accommodated during the period of 2010-2012 (see Figure 12).

The third center is Center #02, which began operating in 2008. It is located in Tien Lang rural district, 22 km southwest of the city. Center #02 had 40.27 hectares of land, of which houses and other infrastructure occupied 13.47 hectares. The rest was used for vegetable cultivation and animal farming. The facility/center was designed for a capacity of 1,500 - 1,800 trainees.

12.3.2.2. Number of CCT trainees/participants

The three CCT centers vary in size, as shown in Figure 12. The number of trainees in Center #02 and Gia Minh Center increased between 2010 and 2011. However, in 2012 there was a consistent decreasing trend in the number of trainees. Gia Minh, the largest center among the three, had 1,133 trainees in 2012, a reduction from 1,265 trainees. In center #02 and Gia Minh, the number of voluntary trainees represent approximately 10% of the total number of trainees. However, for Center #06, this percentage is approximately 40%. Inclusion of voluntary trainees in this sub-section is for the purpose of calculating the average program costs per year of treatment only. All other analysis in the current study involved only CCT trainees/participants on the compulsory track.

Figure 12: Number of CCT trainees (both compulsory and voluntary) by center, 2010-2012

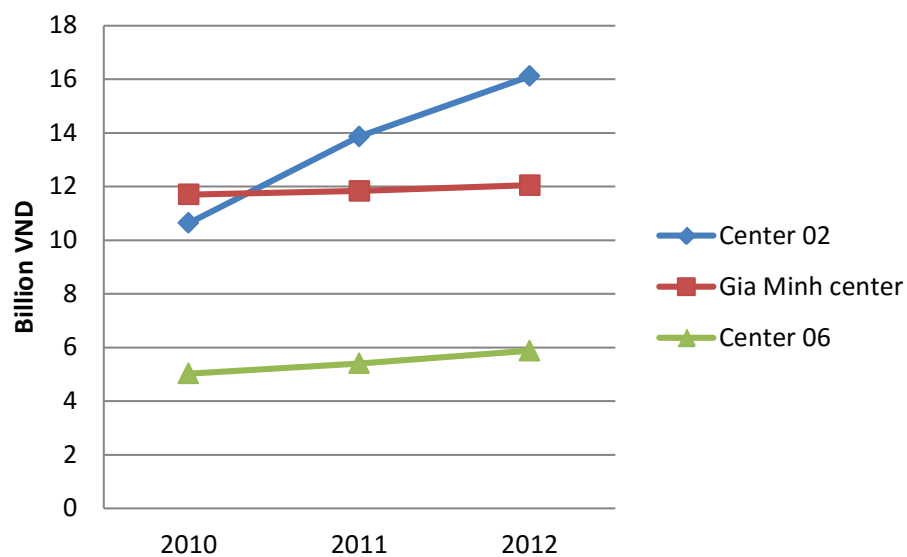


12.3.2.3. CCT program costs

Figure 13 shows the annual budget for each center for the period spanning 2010 to 2012. The annual budgets for Gia Minh Center and Center #06 remained the same during this period. However, the annual budget increased each year for Center #02. This trend contrasts with the decrease in the number of trainees over this period for all three centers.

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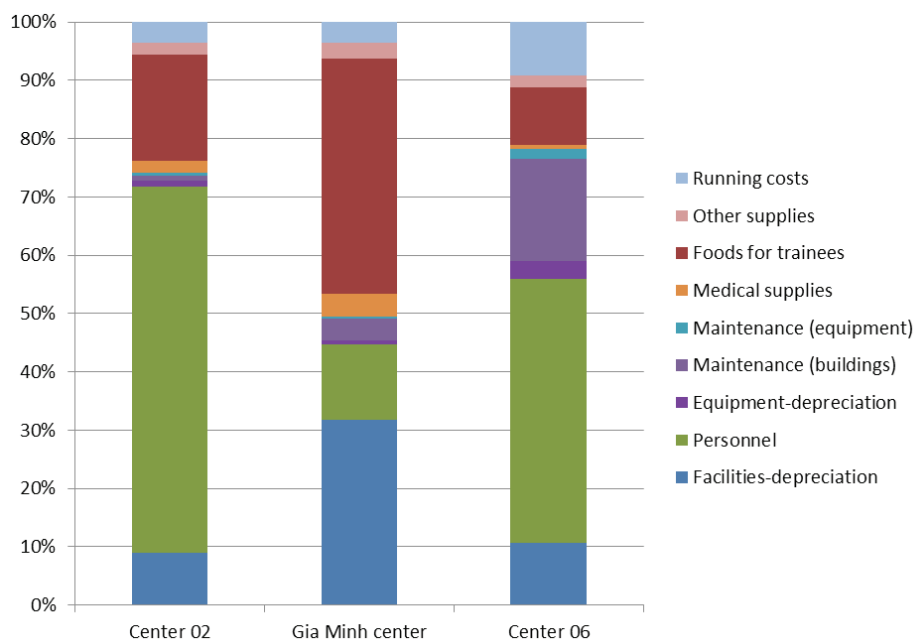
Figure 13: Total annual costs by CCT centers, 2010-2012



Cost structure

Figure 14 illustrates the structure of total costs, which varies significantly across the three CCT centers. For Center #02 and Center #06, the largest proportion of the annual budgets were personnel costs, which represented 63% and 45%, respectively. For Gia Minh Center, the biggest cost components were depreciation of buildings (32%) and food for trainees (40%). These costs could be attributed to the fact that Gia Minh Center required many houses and buildings to accommodate a larger number of trainees – 2.5 times more than the center was originally designed for.

Figure 14: Cost structure of three CCT centers, 2012



CCT program cost per participant/year

Table 12 shows that in 2010, it cost the government 13.74 mil dong (US\$658) to pay for one year for one CCT participant in one CCT center. The cost increased to 17.42 mil dong (US\$835) in 2012.

Table 12: CCT Program Cost (Cost to the government)

Unit: dong

| | 2010 | 2011 | 2012 |
|---|-----------|-----------|-----------|
| Total government budget expended | 27.38 bil | 31.11 bil | 34.05 bil |
| Number of patients/trainees | 1,993 | 2,271 | 1,955 |
| Program cost per patient/trainee per year | 13.74 mil | 13.66 mil | 17.42 mil |

*It is important to note that in 2014, the total budget allocated to the three CCT centers by the Hai Phong City Government was **72.47 bil dong** (Decision #2804/QĐ-UBND), which was twice the amount that the CCT center managers reported in research questionnaires. The cost analysis in this research used the lower cost data as reported by CCT center managers.*

12.3.2.4. Costs incurred by CCT participants

According to government regulations, illicit drug users who undergo compulsory treatment/rehabilitation in compulsory centers do not have to pay for treatment/rehabilitation costs. However, data collected by the structured questionnaire in the first interview with CCT participants indicated that the majority of the CCT participants (or their families) were required to pay for treatment fees. Descriptive statistics from data reported by the 208 CCT-released participants (collected at baseline interview) revealed that the mean rehabilitation fee was 1.54mil dong (US\$75) (SD: 1.52mil dong) with a high level of variability (ranging from zero to 9.0mil dong). The data reported by the 208 CCT-released participants also revealed that for 89 participants (43%), the rehabilitation fee was zero. Specifically, illicit drug users who underwent compulsory treatment in Center #06 in Hai An District were not required to pay treatment fees. For the other two centers (Center #02 in Tien Lang District and Gia Minh Center in Thuy Nguyen District), of those participants who paid, on average the treatment fees were 2,900,000 dong.

In addition to rehabilitation fees paid at entry to treatment, CCT participants incurred other costs during their two-year stay in CCT centers. Other costs incurred by CCT participant were obtained by summing the estimated component costs as follows:

Total yearly opportunity costs (per CCT participant) = (Total monthly time costs + Total medicine costs + Total monthly personal items costs) x 12 (months)

of which:

Total monthly time costs = monthly reported wage (three months prior to treatment)

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Table 13 provides summary statistics for each component in the category of other costs incurred by CCT participants.

Table 13: Summary statistics of other costs incurred by CCT participants (n=208)

Unit: dong

| Name of center | Monthly time cost Mean (SD) | Monthly cost for medicine Mean (SD) | Monthly cost for personal items Mean (SD) |
|-----------------|--------------------------------|---|---|
| Center #02 | 2.91 mil (1.82 mil) | 97% of the participants (202) reported zero for this item | 149,700 (205,000) |
| Gia Minh Center | 2.96 mil (2.13 mil) | | 248,000 (190,000) |
| Center #06 | 2.93 mil (3.10 mil) | | 107,000 (113,000) |

It can be argued that whether the participants were living in CCT centers or at home with their families, they would have to spend money on food, clothes, and other personal items. We argue that the cost for personal items could be excluded from the analysis because participants would have needed to use these items while in the community in any case, and the total cost was insignificant. However, the cost for food, tea, coffee, and snacks should be included for two reasons. First, if living at home, the majority of participants would share their daily meals with their families and the costs of these shared meals would be much lower. Second, according to center rules, trainees can only spend money sent by their families at the center’s grocery store, which many trainees claim is much more expensive than similar food items bought outside the centers [18]. In other words, for the same quantity of food items, the total cost of purchasing these items in the community would have been much lower than in the CCT centers. For these reasons, we included 50% of the cost for food, tea, coffee, and snacks paid by the participants in the cost analysis.

Calculation of opportunity costs for time forgone as a result of attendance to treatment for CCT participants follows the same approach as MMT participants. This was calculated from data obtained on monthly wage rates as follows: a) for those participants who reported being employed at three months prior to treatment, productivity costs were valued at the monthly wage rate reported; and b) for those participants who reported being unemployed during the three months prior to treatment (23%), productivity costs were valued at zero. Opportunity cost per month for CCT participants was then calculated by multiplying individual monthly wage rate by the duration of 24 months in CCT centers.

The cost to the CCT participants include two components: 1) 100% of yearly rehabilitation costs; and 2) 100% of time costs. Cost of medicine was not included because only six participants reported a small cost for medicine.

Data on costs incurred by CCT participants are reported in Table 14 (presented in 2013 dong after adjusting for inflation using CPI). Time cost for CCT participants largely exceeded that of MMT participants, which can be explained by the full-

time placement associated with CCT treatment. The average cost of time (loss of productivity) per participant was 36.98 mil (US\$1,772) for one participant/year. The total costs incurred by each CCT participant was 37.75 mil dong (US\$1,772) per participant/year. Overall, the cost to one CCT participant per year was nearly 7 times higher than the cost incurred by one MMT participant per year (37.75 mil dong vs 5.47 mil dong).

Table 14: Cost to CCT participants (in 2013 dong after adjusting for inflation using CPI*)

Unit: dong

| | |
|---|------------------|
| Cost of loss of productivity | 36.98 mil |
| Treatment cost paid by the participants | 0.77 mil |
| Travel cost | N/A |
| TOTAL | 37.75 mil |

12.3.2.5. Total cost – CCT rehabilitation

The total costs for CCT participants (per participant/year) was calculated using the following formula:

$$\begin{aligned} \text{Total costs (per CCT participant/year)} = & \text{Program costs} \\ & + \text{Yearly rehabilitation fee} \\ & + \text{Yearly other costs incurred by CCT participants} \end{aligned}$$

Details of total costs of CCT centers are presented in Table 15 (presented in 2013 dong). On average, the total cost was 61.52 mil dong (US\$2,948) per participant/year. There was variation between the total costs across the three centers, with Gia Minh having the lowest total cost of 53.08 mil dong, Center #06 having the highest total cost of 70.31 mil dong, and Center #02 having a 66.68 mil dong cost. This variation was primarily influenced by program costs and not by costs incurred by participants. The total cost for one CCT participant per year is nearly 5 times higher than the total cost for one MMT participant per year (61.52 mil dong vs 13.35 mil dong).

Table 15: Total cost - CCT modality (cost to the government + cost to participant) in 2013 dong after adjusting for inflation using CPI*

Unit: dong

| | ONE YEAR (per participant) |
|---|-------------------------------|
| Cost to the government | 19.67 mil |
| Cost to the participant | 37.75 mil |
| Total cost (cost to the government + cost to participant) | 57.42 mil |
| % of cost to the government over total cost | 34% |

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12.3.3. Differences between mean total costs: three-year time horizon

As defined earlier, the time horizon for this economic evaluation was three years (for both costs and effectiveness). Therefore, the total costs of three years were calculated and the mean differences were evaluated using *t*-test and bootstrap methods, with MMT modality being the comparator.

Because MMT treatment is an ongoing intervention, the total cost of the three-year time horizon was calculated using the following formula:

Total three-year cost for MMT modality = total cost for one patient/year x 3

CCT modality is time-limited for two years with no cost incurred in the third year. The total cost of the three-year time horizon was calculated using the following formula:

Total three-year cost for CCT modality = total cost for one trainee/year x 2

Table 16 shows that over three years, the adjusted total costs for one CCT participant was 123.04 mil dong (US\$5,915), which is 3 times higher than the cost for one MMT participant, 40.05 mil dong (US\$1,919).

Table 16: Total cost for one participant over one year vs over three years

Unit: dong

| | ONE YEAR (per participant) | | THREE-YEAR TIME HORIZON (per participant) | |
|---|-------------------------------|-----------|---|-------------|
| | MMT | CCT | MMT | CCT |
| Cost to the government | 7.88 mil | 19.67 mil | 23.65 mil | 39.34 mil* |
| Cost to the participant | 5.47 mil | 37.75 mil | 16.41 mil | 75.50 mil* |
| Total cost (cost to the government + cost to participant) | 13.35 mil | 57.42 mil | 40.05 mil | 114.84 mil* |
| % of cost to the government over the total cost | 59% | 32% | | |

*For CCT, the three-year time horizon comprises two years of costs only (as in the third year the participants were reintegrated back into the community and no additional costs were incurred).

Every evaluation contains some degree of uncertainty, imprecision, or methodological controversy [19]. The current economic study involves patient-level analyses, which are susceptible to sampling variation; this type of uncertainty was handled by statistical analysis using the *t*-test method. In addition, cost data are typically highly skewed due to the fact that a few participants can incur particularly high costs – the cost data of this research is not an exception. There is legitimate concern over the validity of the *t*-test if the data are highly skewed. To overcome this concern, the non-parametric bootstrap method was conducted following the *t*-test and the results of the two methods were compared to ensure confidence in conclusions about the mean differences in total cost for

the three-year time horizon. Table 17 indicates *t*-test and bootstrap results with cost data adjusted for inflation. These results confirm that the mean difference between the three-year total cost of the two treatment modalities are statistically significant with *p*<0.001. Therefore, we can be confident in concluding that there is a difference in the mean total cost of the two treatment modalities over the three-year time horizon and that the difference is 82.99 mil dong (US\$3,977).

Table 17: Mean differences in total costs - three-year time horizon

Unit: dong

| Mean (SD) | | t-test results (mean difference & CI) | Bootstrap results (mean difference & CI) |
|--------------------------|---------------------------|---|---|
| MMT | CCT | | |
| 40.05 mil (10.89 mil) | 114.84 mil (62.40 mil) | <i>t</i> = 20.03; <i>p</i> <0.001; Mean dif.= 74.79 mil (CI: 62.79 mil – 86.79 mil) | Mean dif.= 74.76 mil (CI: 62.67 mil – 86.27 mil) |

12.3.4. Summary of findings of Part 3

The presentation of cost data in this subsection is based on dong for year 2013 after adjusting for inflation using CPI.

The research findings of Part 3 (cost analysis) suggest:

- MMT is **less costly** than CCT:
 - Over one year:
 - ✓ It costs the government 19.67 mil dong (US\$943) to provide treatment for one CCT participant, which is **2.5 times higher** than the cost for one MMT participant of 7.88 mil dong (US\$378).
 - ✓ It costs one CCT participant 37.75 mil dong (US\$1,808), **7 times more** than the cost for one MMT participant of 5.47 mil dong (US\$263). The cost incurred by one CCT participant per year comprised a time cost of 36.98 mil dong and other costs of 0.77 mil dong. The cost incurred by one MMT participant per year comprised a time cost of 1.22 mil dong and other costs of 4.25 mil dong. These results indicate that time costs accounted for the largest share of CCT participant cost estimates, implying that the biggest sacrifice made in CCT center placement was the opportunity cost of labor time forgone. Time costs for CCT participants largely exceeded that of MMT participants, which can be explained by the full-time commitment associated with CCT rehabilitation that prevents employment. These comparisons demonstrate that participant costs appear to be an important component of the total cost of drug dependence treatment.
 - Over three years:
 - ✓ It costs the government 39.34 mil dong (US\$1,885) to provide treatment for one CCT participant, which is **1.67 times higher** than the cost for one MMT participant of 23.65 mil dong (US\$1,133).

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- ✓ The total costs (cost to the government and to the participant) for one CCT participant was 114.84 mil dong, which is **3 times higher** than the cost for one MMT participant of 40.05mil dong.
- ✓ The mean difference in total cost over three years was 74.79 mil dong (US\$3,583) and this difference is statistically significant as confirmed by *t*-test and bootstrap results.

12.4. Part 4: Cost-effectiveness analysis

Part 4 aims to: identify which treatment modality is more cost-effective.

As mentioned in section 9.1, the central measure used in cost-effectiveness analysis (CEA) is the incremental cost-effectiveness ratio (ICER). The ICER can be estimated using the following formula:

$$\text{ICER} = \frac{C1 - C2}{E1 - E2}$$

where C1 and E1 are the mean cost and mean outcome of one treatment group (CCT) and C2 and E2 are the mean cost and mean outcome of the comparator group (MMT).

For this report, the outcome variable “number of drug-free days” (*a continuous outcome variable*) was chosen for the calculation of the ICER because drug use is the primary outcome measure. “Number of drug-free days” is what we want to achieve, which is the opposite of “number of drug-using days.” Due to time constraints, the ICERs for the other outcome variables (*all are dichotomous outcome variables*) are not presented in this report as the calculation of ICERs for dichotomous outcome variables is more technically challenging than the calculation for a continuous outcome variable. A dichotomous outcome variable has two values, typically *yes* and *no*. A continuous outcome variable has a series of values in numerical order (i.e. the number of drug-free days has values from 0 to 30).

The ICER for “number of drug-free days” is calculated as below (for the three-year time horizon):

$$\text{ICER} = \frac{\text{Mean cost CCT} - \text{Mean cost MMT}}{\text{Mean drug free days CCT} - \text{Mean drug free days MMT}}$$

$$\text{ICER} = \frac{39.34 \text{ mil VND} - 23.65 \text{ mil VND}}{-324} = \frac{15.69 \text{ mil VND}}{-324}$$

These numbers mean that by investing in MMT, **over three years** the government will save **15.69 mil dong (US\$730)** in treatment costs for one dependent heroin user, and each heroin user will use drugs on **324 FEWER DAYS**.

12.5. Summary of research findings

The research findings of Part 2 (effectiveness analysis) suggest:

- **MMT treatment is more effective compared to CCT modality for:**
 1. Reducing heroin use (urinalysis): over the three-year time horizon, CCT participants were **3 times more likely** to have a positive opioid urine sample compared to MMT participants;
 2. Reducing any drug use (self-report): over the three-year time horizon, CCT participants were **3.3 times more likely** to report any drug use compared to MMT participants;
 3. Reducing the number of days using drugs: over the three-year time horizon, one CCT participant had **9 MORE drug-using days** (in the last 30 days) compared to one MMT participant; this means that on average over the three-year time horizon, one CCT participant had **324 MORE drug-using days** compared to one MMT participant;
 4. Reducing drug use-related illegal behaviors: over the three-year time horizon, CCT participants were **5.6 times more likely** to report an illegal behavior compared to MMT participants; and
 5. Reducing drug use-related HIV risk behaviors: over the three-year time horizon, CCT participants were nearly **7 times more likely** to report HIV risk behaviors compared to MMT participants.
- **There is no difference between MMT and CCT for:**
 1. Reducing overdose incidents: the possibility of having an overdose incident for the MMT group and the CCT group was **reduced by 24% and 30%** respectively. This difference of 6% is not statistically significant; or
 2. Monthly expenditure on drugs: over the three-year time horizon, the MMT group spent **4.4mil dong less** and the CCT group spent **3.6 mil dong less** than compared to before entering treatment. The difference of 0.8 mil dong is not statistically significant; however, drug spending in months 24-36 was consistently less in MMT patients.

The research findings of Part 3 (cost analysis) suggest:

- MMT is **less costly** than CCT:
 - Over one year:
 - ✓ It costs the government 19.67 mil dong (US\$943) to provide treatment for one CCT participant, which is **2.5 times higher** than the cost for one MMT participant of 7.88 mil dong (US\$378).
 - ✓ It costs one CCT participant 37.75 mil dong (US\$1,808), **7 times more** than the cost for one MMT participant of 5.47 mil dong (US\$263).
 - Over three years:
 - ✓ It costs the government 39.34 mil dong (US\$1,885) to provide treatment for one CCT participant, which is **1.67 times higher** than the cost for one MMT participant of 23.65 mil dong (US\$1,133).

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- ✓ The total costs (cost to the government and to the participant) for one CCT participant was 114.84 mil dong, which is **3 times higher** than the cost for one MMT participant of 40.05mil dong.

The research findings of Part 4 (cost-effectiveness analysis) suggest:

- By investing in MMT, not only would one heroin dependent drug user in Hai Phong City achieve **324 MORE** drug-free days over three years, but the government would save **15.69 mil dong** (US\$730) in achieving 324 drug-free days **for this one drug user**.

This research finds **conclusive evidence** that MMT is more cost-effective than CCT in achieving a range of outcomes for heroin-dependent drug users in Hai Phong City. Based on this evidence, it is recommended that Hai Phong City decision-makers and government leaders of Vietnam consider higher priority for allocation of resources for MMT treatment and scale down CCT modality.

The cost-effectiveness ICER expressed in Section 13.4 above only reflects the cost difference for **one heroin dependent user**. In order to make sense of the implication of this cost-effectiveness result, it is important to put these numbers into the context of Hai Phong City and Vietnam as a whole. The following subsections will apply the cost-effectiveness result to **six different scenarios** (for 1. Hai Phong City, and 2. Vietnam as a whole). Decision-makers can refer to the data of the relevant scenarios that they see as most appropriate for short-term and long-term planning to support their decision-making.

Caution: It is important to re-emphasize that the findings of this research are based on cost data and effectiveness data of CCT rehabilitation modality and MMT treatment in Hai Phong City. The cost norms of other cities/provinces in Vietnam might be different. Therefore, it is important that national and provincial government decision-makers exercise caution in using the data of this research to draw implications for the context of Vietnam as a whole, or for other provinces/cities.

14.1. The three scenarios for Hai Phong City:

Three scenarios were developed and the costs to the government of Hai Phong City for each scenario were calculated. The first two scenarios are realistic for the purpose of estimating the amount of budget required by the government of Hai Phong City both for short-term and long-term planning purposes. The third scenario is hypothetical for the purpose of estimating the amount of budget that can be hypothetically saved by the government of Hai Phong City if MMT is chosen over CCT for all dependent heroin users.

1. Scenario 1: A realistic situation of **co-pay MMT** for 60% of dependent heroin users (4,800 people) and CCT rehabilitation for 20% of dependent heroin users (1,600 people). This scenario is for short-term planning. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to 1,600 dependent heroin users in Hai Phong City, the cost to the government will be **63 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
- ✓ If **co-pay MMT** is provided to 4,800 dependent heroin users in Hai Phong City (patients pay 10,000 dong/day), the cost to the government will be **61 billion dong** over three years.
- ✓ The cost to the government to implement Scenario 1 will be: 63 billion dong + 61 billion dong = **124 billion dong** over three years.

2. Scenario 2: A realistic situation of **co-pay MMT treatment** for 75% of dependent heroin users (6,000 people) and CCT rehabilitation for 5% of

dependent heroin users (400 people). This scenario is for long-term planning. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to 400 dependent heroin users in Hai Phong City, the cost to the government will be **16 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
- ✓ If **co-pay MMT** is provided to 6,000 dependent heroin users in Hai Phong City (patients pay 10,000 dong/day), the cost to the government will be **77 billion dong** over three years.
- ✓ The cost to the government to implement Scenario 2 will be: 16 billion dong + 77 billion dong = **93 billion dong** over three years;

3. Scenario 3: A hypothetical situation comparing **co-pay MMT treatment** for all 8,000 dependent heroin users (100%) with a co-pay of 10,000 dong/day to the provision of CCT treatment for all 8,000 dependent heroin users. Results of this scenario are interpreted as below:

- ✓ If CCT rehabilitation is provided to all 8,000 dependent heroin users in Hai Phong City, it will cost the government **315 billion dong**.

Calculation: 19,670,000 dong/CCT trainee/year x 2 (year) x 8,000 (dependent heroin users) = 315 billion dong.
- ✓ If **co-pay MMT treatment** is provided to all 8,000 dependent heroin users (the patient contributes 10,000 dong/day as currently), it will cost the government **102 billion dong**.

Calculation: [7,880,000 DONG/MMT patient/year – 3,650,000 DONG/MMT patient/year (co-pay)] x 3 (years) x 8,000 (dependent heroin users) = 102 billion DONG.
- ✓ The cost to the government to implement Scenario 3 will be: 315 billion dong – 102 billion dong = **213 billion dong** over three years;

Table 18-a: Scenarios for Hai Phong City (3 years)

| | The gov will pay | | The gov will pay (for both CCT and MMT) (c = a + b) |
|------------|------------------|------------------|--|
| | For CCT (a) | For MMT (b) | |
| Scenario 1 | 63 billion dong | 61 billion dong | 124 billion dong |
| Scenario 2 | 16 billion dong | 77 billion dong | 93 billion dong |
| Scenario 3 | 315 billion dong | 102 billion dong | 213 billion dong |

In 2014, a total budget of 72.47 billion dong was allocated by the Hai Phong City Government to the three CCT centers (according to the Hai Phong People’s Committee’s letter no. 2804/QD-UBND). This suggests that the Hai Phong City Government has already had sufficient financial resources to pay for all the realistic scenarios from Scenario 3 to Scenario 6. However, Scenarios 5 and 6 are the best options because the total budget required is smaller and the return on investment is higher.

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14.2. The three scenarios for Vietnam

The following three scenarios were developed and the costs to the Government of Vietnam for each scenario calculated. The first two scenarios are realistic for the purpose of estimating the amount of budget required by the Government of Vietnam both for short-term and long-term planning purposes. The third scenario is hypothetical for the purpose of estimating the amount of budget that can be saved by the Government of Vietnam if MMT treatment is chosen over CCT for all dependent heroin users.

The first two scenarios were developed based on the context of the Decision no. 2596/QĐ-TTg dated 27 December 2013 by the Prime Minister, which approves the renovation plan for drug dependence treatment in Vietnam until 2020. In the framework of the Decision no. 2596/QĐ-TTg, the national target is to reduce the proportion of dependent illicit drug users who are sent to CCT centers for compulsory treatment from 20% in 2015 to 5% in 2020. The scenarios were also developed based on the context of the national target to provide MMT treatment for 80,000 heroin dependent users by 2015.

1. **Scenario 1:** A realistic situation of **co-pay MMT treatment** for 80,000 of heroin dependent users (approximately 50% of 163,200) and CCT treatment for 40,800 dependent illicit drug users (which is 20% of the national registered dependent illicit drug users numbering 204,000). This scenario is for short-term planning. Results of this scenario are interpreted as below:
 - ✓ If CCT is provided to 40,800 dependent illicit drug users in Vietnam, the cost to the government will be **1,606 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
 - ✓ If **co-pay MMT** is provided to 80,000 dependent heroin users in Vietnam, the cost to the government will be **1,020 billion dong** over three years.
 - ✓ The cost to the government to implement Scenario 1 will be: 1,606 billion dong + 1,020 billion dong = **2,326 billion dong** over three years;
2. **Scenario 2:** A realistic situation of **co-pay MMT treatment** for 100,000 dependent heroin users (approximately 60% of 163,200) and CCT rehabilitation for 10,200 dependent illicit drug users (which is 5% of the national registered dependent illicit drug users numbering 204,000). This scenario is for long-term planning (until 2020). Results of this scenario are interpreted as below:
 - ✓ If CCT is provided to 10,200 dependent illicit drug users in Vietnam, the cost to the government will be **402 billion dong** over three years. The cost for year three = zero (post-release costs were not included).
 - ✓ If **co-pay MMT** is provided to 100,000 dependent heroin users in Vietnam, the cost to the government will be **1,275 billion dong** over three years.
 - ✓ The cost to the government to implement Scenario 2 will be: 402 billion dong + 1,275 billion dong = **1,677 billion dong** over 3 years.
3. **Scenario 3:** A hypothetical situation of **co-pay MMT treatment** for all 163,200 dependent heroin users (100%) with a co-pay of 10,000 dong/day compared

to provision of CCT treatment for all 163,200 dependent heroin users. Results of this scenario are interpreted as below:

- ✓ If CCT is provided to all 162,300 dependent heroin users in Vietnam, it will cost the government **6,426 billion dong** over three years. The cost of CCT rehabilitation for year three = zero (post-release costs were not included).
Calculation: 19,670,000 dong/CCT trainee/year x 2 (year) x 163,200 (dependent heroin users) = 6,426 billion dong.
- ✓ If **co-pay MMT treatment** is provided to all 163,200 dependent heroin users (the patient contributes 10,000 dong/day as currently), it will cost the government **2,081 billion dong** over three years.
Calculation: [7,880,000 dong/MMT patient/year – 3,650,000 dong/MMT patient/year (co-pay)] x 3 (years) x 163,200 (dependent heroin users) = 2,081 billion dong.
- ✓ For this scenario, the government can save **4,345 billion dong** by choosing MMT over CCT (6,426 billion dong – 2,081 billion dong = 4,345 billion dong).

Table 18-b: Scenarios for a realistic situation for Vietnam (3 years)

| | The gov will pay | | The gov will pay (for both CCT and MMT) (c = a + b) |
|------------|------------------|-----------------|--|
| | For CCT | For MMT | |
| | (a) | (b) | |
| Scenario 1 | 1,606 bil. dong | 1,020 bil. dong | 2,326 bil. dong |
| Scenario 2 | 402 bil. dong | 1,275 bil. dong | 1,677 bil. dong |
| Scenario 3 | 6,426 bil. dong | 2,081 bil. dong | 4,345 bil. dong |

In 2012, the total budget allocated for all 123 CCT centers was approximately 1,025 billion dong for a year, as reported by the National Committee on AIDS, Drugs and Prostitution Control (NCADP) at its annual review meeting in December 2012. This suggests that the Government of Vietnam has already had sufficient financial resources to pay for all of the realistic scenarios from Scenario 3 to Scenario 6. However, Scenarios 5 and 6 are the best options because the total budget required is smaller and the return on investment is higher.

This research has the following strengths:

1. High follow-up rates of 80% for both participant groups compared to international norms, especially for the CCT group who are drug users not engaged in drug dependence treatment.
2. The majority of the data of this research are primary data, officially provided by the three CCT centers and three MMT clinics in Hai Phong City.
3. High quality research owing to the leverage of technical strengths of four research institutions:
 - FHI 360: strong connections with government agencies; coordination and quality assurance
 - NDARC/UNSW Australia: expertise in international drug policy research and economic evaluations
 - Hanoi Medical University: expertise in conducting research with special populations and research data management
 - Hai Phong Medical University: a workforce of 10 local well-trained researchers to ensure daily research operation

Observational studies have limitations. The limitations of this research are:

1. Except for opioid use outcome measure, which was confirmed by urine analysis, all other outcomes are based on self-report data, which potentially introduced social desirability bias. Underreporting of risk behavior information would have a conservative effect on the measures of association. However, this is unlikely to affect the comparison of effects between groups because underreporting of risk behaviors, if occurred, would apply equally to both groups. Similar proportions of positive urinalysis and self-reported drug use for both groups indicates truthful reporting of drug use behaviors.
2. Due to convenience of the sampling technique, caution must be undertaken when attempting to generalize the findings for all CCT or MMT participants in Hai Phong City or Vietnam.
3. Due to time and budget limitations, the research chose to recruit MMT patients/participants who participated in MMT treatment during 2009-2011 and who had remained in MMT treatment in 2013. As such, the MMT participants group in fact had been enrolled in MMT treatment for four years at time-point T2, while CCT participants had been enrolled in CCT treatment for two years at T2. This might raise concerns about the time equivalence for comparison. However, we argue that this discrepancy does not have much impact on the validity of the comparison of both effectiveness and cost-effectiveness of the two treatment modalities because the previous MMT cohort study conducted by the Ministry of Health showed that MMT patients achieved significant improvement in most treatment outcomes after only three to six months in treatment.
4. In the cost analysis, three cost components were not included: a) costs incurred by the CCT trainees' families for purchasing and sending food and prescribed medicines, or time spent visiting the trainees; b) cost of land for both treatment modalities; or c) costs of loss of freedom by CCT participants. Within the timeframe of the study, it was not possible to collect data on the costs incurred by CCT participants' families. Quantification of the cost of large farming land and mountain areas is technically and financially challenging. Lastly, putting a monetary value on loss of two years of freedom is not technically feasible.

This is the first research on this topic ever conducted in Vietnam as well as in Southeast Asia. It is also a highly politically sensitive research topic. Given the politically sensitive nature of the material, not all data could be collected and of those collected, the level of accuracy might be questionable. These data include: 1) drug-using behaviors of CCT participants while in CCT centers; 2) income generated by CCT center management by using labor of the CCT participants; and 3) possible discrepancies between cost data reported by CCT managers in the questionnaires and the official budget allocated by the Hai Phong City Government to the three CCT centers.

In principle, CCT participants are not allowed to use illicit drugs while in the CCT centers because these are strictly closed environments. However, there are evidences that suggest that this is not always the case. According to the Vice Minister of Public Security, Mr. Le Quy Vuong, a situation of illicit drugs being brought into closed settings such as prisons and compulsory centers does exist and is of great concern [1]. In addition, research conducted by FHI 360 in Ho Chi Minh City in 2009 revealed that up to 20% of CCT trainees injected heroin while living in the centers. However, due to the political sensitivity of this issue, questions about drug-using behaviors of CCT trainees during their time in CCT centers were not included in the questionnaire of this research. The results of this research are based on analysis of five time-points of effectiveness data, none of which include the time that CCT participants were living in the centers.

Labor work and vocational training activities were organized in all three CCT centers in Hai Phong City on different scopes and scales. There are evidences that suggest that incomes are generated from these activities through contracts with companies. However, within the scope of this research it is not possible to identify whether a proportion of these incomes was given to CCT trainees as a salary and if so, whether these salaries would be equivalent to what one would be paid for the same job outside of the center.

As stated in Section 13.3.2.3, there were discrepancies between the expenditures/costs reported by CCT center management through the questionnaires and the amount of budget officially allocated to the three CCT centers for 2014, based on an official letter issued by the Hai Phong City People's Committee. However, it is beyond the authority of the research team to ask questions for clarification or to enact any action for further triangulation.

Apart from the accuracy and completeness of data, there is another issue that involves possible selection bias pertaining to CCT participants. Specifically, a total of 550 CCT-released participants were eligible to participate in this research. As such, 550 invitation letters were sent to these eligible participants. However, 162 invitation letters (30% of 550) were returned due to unidentified

postal addresses. This means that approximately 388 CCT-released participants received their invitation letters. Of those, 208 voluntarily enrolled, which gives a participation rate of 54%. It is impossible to identify whether the 46% of the CCT-released participants who did not participate would do better or worse in terms of drug use behaviors and other behaviors of interest. Therefore, there is potentially some selection bias among this group.

Finally, 10% of the 208 CCT-released participants enrolled into the community-based MMT treatment at some point during the 12-month follow-up period. This research uses the “intention-to-treat” data analysis approach; therefore, these CCT participants were included in the CCT participant arm in the data analysis. If they had not been included in the CCT arm, the difference in effectiveness of the two treatment modalities could have been bigger, given that MMT is more effective than CCT.

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