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# Cost-effectiveness of hepatitis C virus screening and treatment with direct-acting antivirals in people who inject drugs in Nairobi, Kenya

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**Supplementary Table S1.** Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist

| Section/item | Item No | Recommendation | Reported on page No/ line No |
|---|---|---|---|
| **Title and abstract** | | | |
| Title | 1 | Identify the study as an economic evaluation or use more specific terms such as "cost-effectiveness analysis", and describe the interventions compared. | Page 1, lines 1-3 |
| Abstract | 2 | Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base case and uncertainty analyses), and conclusions. | See Abstract, Page 3 |
| **Introduction** | | | |
| Background and objectives | 3 | Provide an explicit statement of the broader context for the study.<br>Present the study question and its relevance for health policy or practice decisions. | Page 4, lines 22-27<br>Page 4, lines 30-40 |
| **Methods** | | | |
| Target population and subgroups | 4 | Describe characteristics of the base case population and subgroups analysed, including why they were chosen. | Page 4, lines 22-27<br>Page 8, lines 12-29<br>Figure 1<br>Supplementary Tables S6-7 |
| Setting and location | 5 | State relevant aspects of the system(s) in which the decision(s) need(s) to be made. | Page 5, lines 3-9 |
| Study perspective | 6 | Describe the perspective of the study and relate this to the costs being evaluated. | Page 4, lines 37-40 |
| Comparators | 7 | Describe the interventions or strategies being compared and state why they were chosen. | Page 4, lines 33-37 |
| Time horizon | 8 | State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate. | Page 7, lines 17-18 |
| Discount rate | 9 | Report the choice of discount rate(s) used for costs and outcomes and say why appropriate. | Page 7, lines 16-17 |
| Choice of health outcomes | 10 | Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed. | Page 7, lines 2-11 |
| Measurement of effectiveness | 11a | Single study-based estimates: Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data. | Page 6, lines 42-45 |

| | | | |
|---|---|---|---|
| | 11b | Synthesis-based estimates: Describe fully the methods used for identification of included studies and synthesis of clinical effectiveness data. | Not applicable |
| Measurement and valuation of preference-based outcomes | 12 | If applicable, describe the population and methods used to elicit preferences for outcomes. | Not applicable |
| Estimating resources and costs | 13a | Single study-based economic evaluation: Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs. | Not applicable |
| | 13b | Model-based economic evaluation: Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs. | Page 5, lines 2-30<br>Page 6, lines 11-38<br>Supplementary Tables S6-11 |
| Currency, price date, and conversion | 14 | Report the dates of the estimated resource quantities and unit costs. Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate. | Page 6, lines 28-31<br>Supplementary materials Page 9-30 |
| Choice of model | 15 | Describe and give reasons for the specific type of decision-analytical model used. Providing a figure to show model structure is strongly recommended. | Page 5, lines 31-47<br>Page 6, 1-9 |
| Assumptions | 16 | Describe all structural or other assumptions underpinning the decision-analytical model. | Page 4, lines 33-50<br>Page 5, 1-8 |
| Analytical methods | 17 | Describe all analytical methods supporting the evaluation. This could include methods for dealing with skewed, missing, or censored data; extrapolation methods; methods for pooling data; approaches to validate or make adjustments (such as half cycle corrections) to a model; and methods for handling population heterogeneity and uncertainty. | Not applicable |
| **Results** | | | |
| Study parameters | 18 | Report the values, ranges, references, and, if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended. | Table 2<br>Supplementary Table S2-S5 |
| Incremental costs and outcomes | 19 | For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios. | Page 9, lines 2-11<br>Table 3 |
| Characterising uncertainty | 20a | Single study-based economic evaluation: Describe the effects of sampling uncertainty for the estimated incremental cost and incremental effectiveness parameters, together with the impact of methodological assumptions (such as discount rate, study perspective). | Not applicable |

| | | | |
|---|---|---|---|
| | 20b | Model-based economic evaluation: Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions. | Page 9, lines 13-38<br>Figure 2 |
| Characterising heterogeneity | 21 | If applicable, report differences in costs, outcomes, or cost-effectiveness that can be explained by variations between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information. | Table 2 |
| **Discussion** | | | |
| Study findings, limitations, generalisability, and current knowledge | 22 | Summarise key study findings and describe how they support the conclusions reached. Discuss limitations and the generalisability of the findings and how the findings fit with current knowledge. | Page 10, lines 1-45 |
| **Other** | | | |
| Source of funding | 23 | Describe how the study was funded and the role of the funder in the identification, design, conduct, and reporting of the analysis. Describe other non-monetary sources of support. | Page 1, lines 31-42 |
| Conflicts of interest | 24 | Describe any potential for conflict of interest of study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors recommendations. | Page 2, lines 1-3 |

**Supplementary Table S2**: Model Parameters from (1).

| Parameter | Prior parameter distribution | Source |
|---|---|---|
| Average duration of injecting (years) | Uniform: 1.75-7.0 | TLC-IDU(2) |
| HIV prevalence amongst new male PWID in 2012 | Uniform: 3.38-6.44% | TLC-IDU(2) |
| HIV prevalence amongst male adults in 2012 | Normal: 3.8% (95%CI: 2.4-5.2) | KAIS 2012 |
| HIV prevalence amongst new female PWID in 2012 | Uniform: 12.2-26.1% | TLC-IDU(2) |
| HIV prevalence amongst female adults in 2012 | Normal: 6.1% (95%CI: 4.2-8.0) | KAIS 2012(3) |
| Proportion of PWID on ART that are virally supressed | Normal: 34.3% (95%CI: 28.3-40.2) | TLC-IDU(2) |
| Mean log HIV viral load if on ART and virally suppressed | Normal: 2.72 (95%CI: 2.70-2.74) | TLC-IDU(2) |
| Mean log HIV viral load if on ART and not virally suppressed | Normal: 3.85 (95%CI: 3.71-4.00) | TLC-IDU(2) |
| Mean log HIV viral load if not on ART and not virally suppressed | Normal: 4.32 (95%CI: 4.22-4.42) | TLC-IDU(2) |
| Proportion of male PWID's partners that are PWID | Uniform: 0.11-0.17 | TLC-IDU(2) |
| Proportion of female PWID's partners that are PWID | Uniform: 0.34-0.50 | TLC-IDU(2) |
| Non-HIV mortality among PWID (/year) | Normal: 3.53 (95%CI: 2.81 – 4.24) | (4) Used to calculate mortality amongst male and female PWID. |
| Ratio of crude mortality rates in male versus female PWID | Normal: 1.32 (95%CI: 1.21-1.44) | (4)Used to calculate mortality amongst male and female PWID. |
| Average duration of the acute stage of HIV infection (months) | Triangular: 2.9 (1.23-6.0) | (5) |
| Average duration of the pre-AIDs stage of HIV infection (months) | Triangular: 9 (4.81-14) | (5) |
| Time to AIDs (Years) | Triangular: 9.4 (5.5-10.1) | (6) Used to calculate average duration of the chronic HIV stage. |
| Time to death from AIDS (months) | Lognormal: 10 (95%CI: 6.79 – 12.7) | (6) |
| Reduction in HIV progression if on ART | Uniform: 0.20-0.30 | (7) |
| Ratio of ART coverage amongst PWID entering the model vs established PWID | Uniform: 0.8-1.2 | Assumption |
| Relative reduction in the risk of HCV transmission if on OST | Lognormal: 0.50 (95%CI: 0.40-0.63) | (8) |

| | | |
|---|---|---|
| Relative reduction in the risk of HCV transmission if on NSP | Lognormal: 0.44 (95%CI: 24-0.80) | (8) |
| Relative reduction in the risk of HIV transmission if on OST | Lognormal: 0.46 (95%CI: 0.32-0.67) | (9) |
| Relative reduction in the risk of HIV transmission if on NSP | Lognormal: 0.42 (95%CI: 0.22-0.81) | (10) |
| Transmissibility in acute stage | Lognormal: 276 (95%CI: 131-509) | (5) |
| Transmissibility in chronic stage | Lognormal: 10.6 (95%CI: 7.61-13.3) | (5) |
| Transmissibility in Pre-Aids stage | Lognormal: 76 (95% CI: 41.3-128.0) | (5) |
| Increase in HIV transmissibility per log increase in HIV viral load. | Lognormal: 2.45 (95%CI 1.85-3.26) | (11) |
| ART LTFU amongst the general population | Uniform: 0.04 - 0.37 | (12-17) |
| Relative risk of ART LTFU amongst PWID vs general population. | Lognormal: 1.36 (95%CI: 1.22-1.52) | (18) |
| Increase in odds of being virally supressed when on ART if on OST vs off OST | Lognormal: 1.45 (95%CI: 1.21-1.73) | (19) |
| Increase in ART initiation rate if on OST vs off OST | Lognormal: 1.87 (95%CI: 1.50-2.33) | (19) |
| Decrease in ART LTFU if on OST vs off OST | Lognormal: 0.77 (95%CI: 0.63-0.95) | (19) |
| Relative effectiveness of ART for reducing injecting transmission vs sexual transmission | Uniform: 0.7 - 1 | Assumption – less empirical evidence regarding injecting transmission than sexual transmission. |
| Increase in HCV transmissibility if HIV positive | Uniform: 1 - 7 | (20) |
| Proportion of HCV infections amongst HIV negatives that spontaneously clear | Uniform: 0.22 - 0.29 | (21) |
| Proportion of HCV infections amongst HIV positives that spontaneously clear | Uniform: 0.115 - 0.193 | (22) |
| Year injecting drug use started | Uniform: 1997 - 2001 | (23) |

**Supplementary Table S3:** Parameters for mortality rates amongst ex-PWID

| Parameter | Sampled parameter distribution | Notes |
|---|---|---|
| Age at which PWID start injecting | Normal(26.94,0.185) | TLC-IDU(2) |
| Life Expectancy in males aged 30 | Uniform(36.4,54.6) | 45.52 years +- 20% |
| Life Expectancy in males aged 35 | Uniform(33.0-49.5) | 41.26 years +- 20% |
| Life Expectancy in females aged 30 | Uniform(39.3-59.0) | 49.13 years +- 20% |
| Life Expectancy in females aged 35 | Uniform(35.7-53.6) | 44.68 years +- 20% |

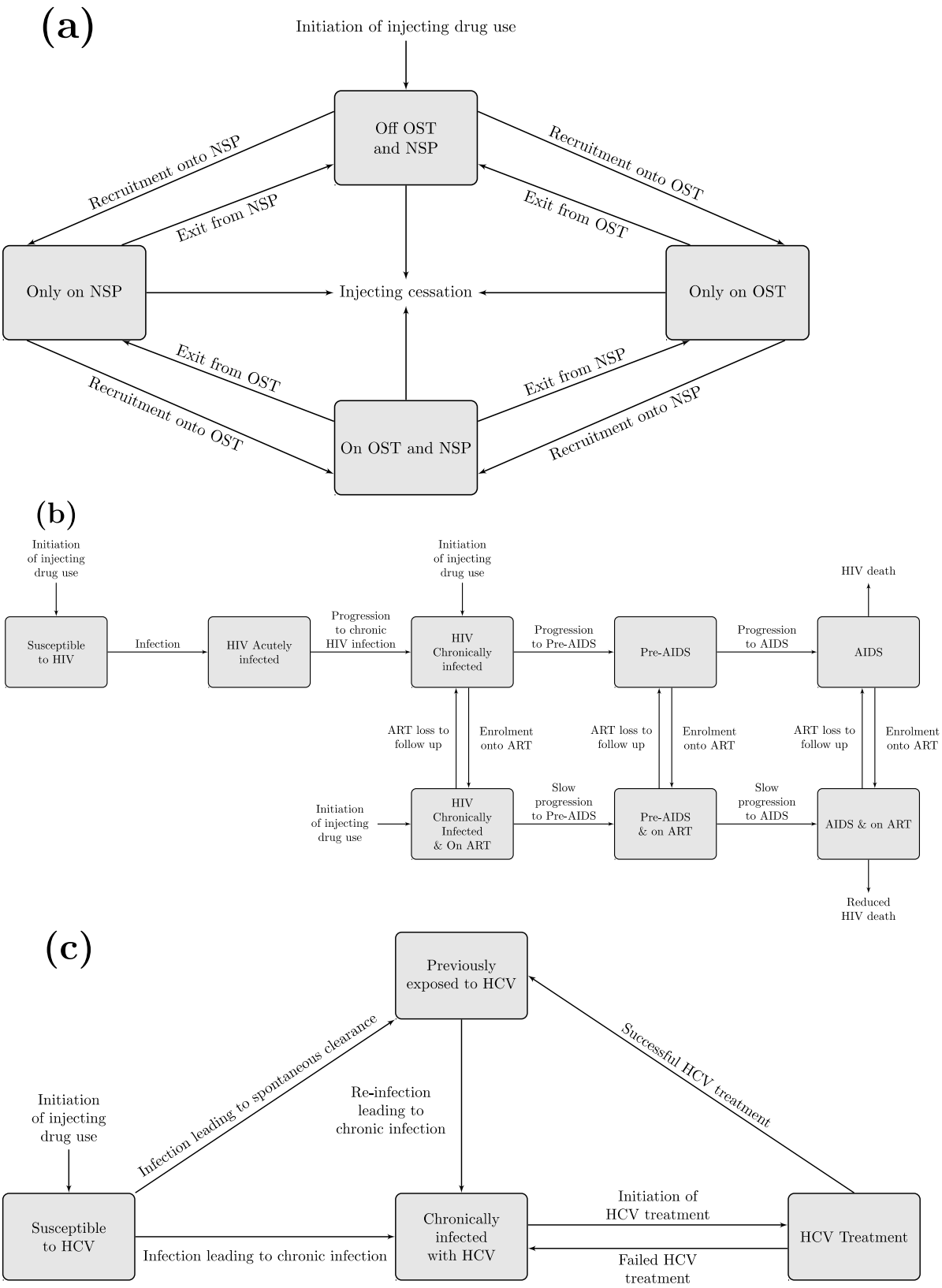
**Supplementary Table S4**: HCV disease progression parameter ranges.

| Parameter | | Sampled parameter distribution | Source |
|---|---|---|---|
| HCV progression rate from F0 to F1 (per year) | | Normal(0.128, 0.0245) | (24). |
| HCV progression rate from F1 to F2 (per year) | | Normal(0.059, 0.012) | (24) |
| HCV progression rate from F2 to F3 (per year) | | Normal(0.078, 0.0112) | (24) |
| HCV progression rate from F3 to F4 (per year) | | Normal(0.116, 0.0232) | (24) |
| Factor increase in HCV disease progression from F0 to F4 if HIV infected | | | |
| | Without ART | Lognormal with mean 2.489 and 95% CI 1.811 – 3.420 | (25) |
| | With ART | Lognormal with mean 1.723 and 95% CI 1.059 – 2.804 | (25) |
| Annual probability of HCV progression from F4 to decompensated cirrhosis | | Beta(14.6168,360.1732) | (26) |
| Annual probability of HCV progression from F4 to hepatocellular carcinoma | | Beta(1.9326,136.1732) | (26) |
| Annual probability of HCV progression from decompensated cirrhosis to hepatocellular carcinoma | | Beta(1.9326,136.1732) | (26) |
| Annual probability of mortality from decompensated cirrhosis | | Beta(147.03,983.97) | (26) |
| Factor increase in mortality rate from decompensated cirrhosis if HIV co-infected. | | Lognormal with mean 2.26 and 95% CI: 1.51-3.38 | (27, 28) |
| Annual probability of mortality from hepatocellular carcinoma | | Beta(117.1033,155.23) | (26) |
| Relative risk of progression from F4 to decompensated cirrhosis following SVR | | Lognormal with mean 0.07 and 95%CI: 0.03-0.2 | (29) |

| | | |
|---|---|---|
| Relative risk of progression from F4 to hepatocellular carcinoma following SVR | Lognormal with mean 0.23 and 95%CI: 0.16-0.35 | (30) |

**Supplementary Table S5: Disability Weights**

| | | Sampling Distribution | Source |
|---|---|---|---|
| **HIV Disease States** | | | |
| | Acute Infection | Equal to ART Value | No GBD estimate so assumed equal to ART. |
| | Chronic Infection | Equal to ART Value | No GBD estimate so assumed equal to ART. |
| | Pre-AIDs | Uniform(0.184,0.377) | (31)HIV: symptomatic, pre-AIDS |
| | AIDs | Uniform(0.406,0.743) | (31)AIDs: not receiving antiretroviral treatment |
| | ART | Uniform(0.052,0.111) | (31)HIV/AIDs: receiving antiretroviral treatment |
| **HCV Disease States** | | | |
| | F0 | 0 | |
| | F1 – F3 | Not sampled | (31)Assumed linear disability increase from F0 to F4. |
| | F4 | Uniform(0.078,0.159) | (31)No GBD estimate so used value for moderate abdominopelvic problem |
| | Decompensated Cirrhosis | Uniform(0.123,0.250) | (31)Decompensated Cirrhosis of the liver |
| | Hepatocellular Carcinoma | Uniform(0.389-0.727) | (31)Cancer: metastatic |
| **HIV/HCV co-infection** | | Not sampled | Disability weights were compounded multiplicatively:<br><br>Disability weight=1- ((1-HIV disability weight)*(1-HCV disability weight)). |




***Supplementary Figure 1.*** *Model schematic of (a) harm reduction interventions; (b) HIV transmission and treatment; (c) HCV transmission and treatment.*

**Kenya MSF/MdM HCV intervention cost analysis**

**Design**

The costs of HCV screening and treatment were estimated directly collected from a pilot intervention study aimed at demonstrating the 'real-world' effectiveness of DAA-based HCV treatment amongst PWID in Nairobi, Kenya using a retrospective, cohort-based, micro-costing approach from the provider's perspective. The pilot treatment program was established in 2016 by two international humanitarian organisations, Médecins Sans Frontières (MSF) in collaboration with Médecins du Monde (MdM). In the program, MdM offered point-of-care screening for HCV antibodies, using a rapid diagnostic test, to people who use drugs as part of comprehensive harm reduction services provided through its Drop-in Centre (DIC) and outreach activities in Nairobi. All clients testing positive for HCV antibodies were referred to MSF staff based in the same DIC. MSF tested these clients for chronic HCV infection using a polymerase chain reaction (PCR) based test, with all diagnosed patients being assessed for treatment eligibility based on international HCV management guidelines(17, 32, 33). Bloods were drawn by the clinic staff and sent to an external laboratory to perform HCV PCR tests, genotyping and other HCV treatment related tests. Patients were escorted by a peer educator to a nearby private hospital where they received a transient elastography (Fibroscan). Eligible clients were treated with daclatasvir and sofosbuvir (86.4%) or ledipasvir and sofosbuvir (13.6%), delivered by MSF within the MdM DICE using directly-observed therapy (DOT). The DOT protocol required all clients on treatment to attend the clinic every day, where a clinical officer dispensed and observed the consumption of the daily drugs. The clinical officer would also provide short counselling sessions or consultations depending on a client's need at each step of the care cascade, including screening, family planning, pre-treatment, treatment initiation, and lifestyle and reinfection advice. All clients were reimbursed for daily transport costs. Peer support before or during treatment and tracing for defaulters was facilitated using peer educators from MdM's harm reduction team. After treatment completion, patients were no longer required to visit the clinic daily but were followed up until at least 12 weeks after treatment , at which point the sustained virologic response (SVR12), defined as undetectable HCV viral load 12 weeks after completion of HCV treatment, was assessed to determine treatment success. Patient characteristics are described in **Supplementary Table S6 and S7.**

Data on resource use and costs were retrospectively obtained from MdM and MSF's financial records over a 17-month observation period (January 2016 – May 2017), and results are presented in 2018 US dollars. The cost analyses followed the standard techniques for conducting micro-cost analyses, which involve the identification, quantification and valuation of all the resources (direct medical and non-medical) used in the screening, diagnosis, treatment and follow-up for each patient in the cohort. We gathered both financial and economic costs, however only economic costs are reported to capture the likely opportunity costs associated with the intervention. The total costs of the intervention included intervention set-up and implementation costs. Research related costs were identified and excluded from the analysis in order to represent real world implementation. Using an ingredients approach, unit costs were applied to patient-level resource use (in terms of type and frequency of visit) to obtain the total cost for each patient.

**Identifying resources used**

A detailed review of the treatment protocol and interviews with key technical staff involved in the planning, implementation and coordination of the intervention were performed to identify all the activities and resources utilized in the treatment of patients with chronic HCV in Nairobi, Kenya. The main activities in the intervention included HCV antibody testing using a rapid diagnostic test, confirmatory testing for HCV chronic infection using an RNA based test, patient counselling/education, baseline medical assessment for treatment eligibility, baseline laboratory work up, DAA treatment initiation, DOTs, treatment follow-up, treatment monitoring laboratory tests, routine management of medical problems, on-treatment referrals to other medical services, post-treatment follow up and SVR assessment. The resources identified included staff time (nurse counsellor, clinical officer), materials (test kits, consumables), laboratory tests (HCV antibody, HCV

RNA, HCV genotype), DAA medicines and overheads. Overheads included facility/buildings, utilities, support staff, coordination staff, vehicles, training, travel, medical and laboratory supplies, non-medical supplies, freight and clearance.

**Measuring resource utilization**

Primary data was collected on the exact number and type of resources consumed in the screening and treatment program. Detailed patient-level data, including the number and type of clinic visits, clinical examinations, laboratory investigations, treatment regimens, and treatment outcomes were extracted from data collected during the study using a Research Electronic Data Capture (REDCap)(34) database (January 2015 – October 2018). The amount of time spent by staff providing services in the program was estimated for each activity using staff time sheets and interviews with the relevant staff (**Supplementary Table S9*)***. Overhead and administrative costs associated with the HCV screening and treatment program were allocated using the step-down costing approach. For example, staff numbers in each department were used to allocate management and administrative costs, service statistics were used to allocate shared recurrent resources, interviews with key personnel (mostly managers or supervisors) were performed to determine ratios for allocating coordination costs and room space was used to allocate buildings space, utilities and building maintenance.

**Valuation of resources**

Valuation of the resources used in the treatment program was based on MdM and MSF programs' financial records and information provided by program staff (finance, logistics, and pharmacy staff). The most up-to-date unit prices/costs were applied to patient-level data on resource use to estimate the costs of treating each patient (**Supplementary Table S10*)***. Unit costs for supplies and consumables, including test kits, were obtained from MdM and MSF financial records and supplemented with interviews with key personnel (finance, logistics, and program managers). Unit costs for valuing staff time were estimated based on staff salaries information provided by MdM and MSF. Valuation of the DAAs was based on the prices paid for the medicines by MSF at the time of purchase. Unit costs for the outsourced laboratory tests were obtained from the external laboratory through MSF. When unavailable, the unit cost for an activity was estimated using micro-costing. Building costs (rentals) and floor layout plans were provided by the MdM's logistics department. Information on the acquisition costs and replacement values for capital items were gathered from the project's program records. Equivalent annual costs for capital items (equipment and furniture) were estimated based on the expected service lives using a discount rate of 3%.

All historical costs were adjusted for inflation to 2018 prices using the Consumer Price Indices obtained for Kenya. Unit prices were gathered in both the local currency (Kenyan Shilling) and USD. Local currency prices were converted to the USD currency using the average market-based exchange rate (1 USD = 105 Kenyan Shilling). The per unit overhead costs for each activity were estimated by dividing the annual total cost for the activity by the annual total number of units of output (for example, number of patient visits or patients). The cost of each activity is the sum of the costs for all the resources used in executing that activity, i.e., labour, consumables and overheads. The activity costs were multiplied by the number of times a patient received each activity and summed to give an estimate of the total cost per patient. The total costs comprised of the following categories: HCV diagnosis costs, HCV-related visit costs, HCV treatment related laboratory costs and DAA costs.

**HCV visit costs:** HCV-related visits comprised of all visits made by patients in preparation for, during and after treatment. These included baseline assessments, treatment initiation, on-treatment follow up (excluding DOTs), end of treatment, post-treatment follow-up and SVR assessment visits (**Supplementary Table S9*)***. Each visit cost included the cost of staff time specific to the visit (estimated using staff time sheets and interviews) and space/materials depending on which area of the clinic was utilized (MSF clinic (consultations), MdM patient support (counselling). For each of these locations, the visit cost incorporated recurrent costs (support personnel costs, medicines (excluding HCV), medical and laboratory supplies, non-medical supplies, transport operating costs, building rental and insurance, maintenance, utilities and bills, freight and clearance, travel, and training) and

capital costs (buildings, vehicles, medical equipment, laboratory equipment, cold chain equipment, non-medical equipment, construction and rehabilitation, and furniture). Building space for each location was determined through site maps, visual inspection and interviews with the logistics manager and allocated as HCV-related by proportion of HCV consultations. Support personnel costs for each category (coordination, administration, human resources, support staff), were determined by their level of involvement in HCV-related activities and allocated using proportion of staff, budget, floor space, or consultations.

**DOTs visits costs**: DOTs visits costs include the costs associated with daily visits made by patients for the purposes of picking up their medications under supervision by the clinical officer. Each visit cost included the cost of staff time specific to the visit (estimated using staff time sheets and interviews) and space/materials depending on which area of the clinic was utilized (MSF clinic (consultations).

**HCV treatment-related laboratory costs:** Laboratory costs included all laboratory tests and investigations performed for each patient in preparation for, during and after treatment according to the MSF treatment protocol and were obtained from MSF financial records or from hospital price lists and from invoices billed to MSF for laboratory tests contracted outside of the program (**Supplementary Table S10)**.

**DAA medicine costs:** Unit costs for DAAs were determined from detailed MSF invoices (**Supplementary Table S10**). DAA costs for each patient were calculated based on the patients-specific treatment regimen and the length of treatment obtained from the REDCap database.

**HCV diagnosis costs:** These include the costs of screening for HCV antibodies, and when positive, HCV-RNA test to confirm presence of chronic infection. The average cost per diagnosis was calculated for the observed HCV antibody and chronic prevalence at the clinic including costs for patients who received an HCV antibody and/or HCV-RNA test but were not reactive. This represented the full cost of HCV case-finding (**Supplementary Table S11)**.

**Supplementary Table S6.** Baseline characteristics of patients in the MSF/MdM HCV cohort

| | Male (N=72) | Female (N=9) | Total (N=81) |
|---|---|---|---|
| **Age (years)** | | | |
| Mean (SD) | 38 (7) | 33 (7) | 37 (7) |
| Median (Q1, Q3) | 38 (33, 43) | 32 (32, 39) | 37 (32, 42) |
| Min - Max | 21 - 53 | 23 - 42 | 21 - 53 |
| **HCV METAVIR fibrosis stage, n (%)** | | | |
| F0 | 49 (68.1%) | 7 (77.8%) | 56 (69.1%) |
| F1 | 10 (13.9%) | 1 (11.1%) | 11 (13.6%) |
| F2 | 3 (4.2%) | 0 (0.0%) | 3 (3.7%) |
| Missing | 10 (13.9%) | 1 (11.1%) | 11 (13.6%) |
| **APRI score** | | | |
| Mean (SD) | 11 (30) | 22 (44) | 12 (32) |
| Median (Q1, Q3) | 0 (0, 1) | 0 (0, 1) | 0 (0, 1) |
| **Liver stiffness, n (%)** | | | |
| <20 kPa | 15 (20.8%) | 3 (33.3%) | 18 (22.2%) |
| 20-29 kPa | 21 (29.2%) | 2 (22.2%) | 23 (28.4%) |
| 30-39 kPa | 16 (22.2%) | 2 (22.2%) | 18 (22.2%) |
| 40-49 kPa | 8 (11.1%) | 1 (11.1%) | 9 (11.1%) |
| >50 kPa | 2 (2.8%) | 0 (0.0%) | 2 (2.5%) |
| Missing | 10 (13.9%) | 1 (11.1%) | 11 (13.6%) |
| **HCV genotype, n (%)** | | | |
| 1 | 36 (50.0%) | 5 (55.6%) | 41 (50.6%) |
| 4 | 21 (29.2%) | 2 (22.2%) | 23 (28.4%) |
| Missing | 15 (20.8%) | 2 (22.2%) | 17 (21.0%) |
| **HCV baseline viral load (million IU/mL)** | | | |
| Mean (SD) | 992209 (3040878) | 1296991 (2231708) | 1022258 (2959311) |
| Median (Q1, Q3) | 207032 (48181, 956349) | 491839 (32584, 1151618) | 219490 (46493, 966234) |
| Min - Max | 45 - 23745490 | 2371 - 6216325 | 45 - 23745490 |
| **Baseline HCV viral load, n (%)** | | | |
| Detectable | 40 (55.6%) | 6 (66.7%) | 46 (56.8%) |
| Undetectable | 3 (4.2%) | 0 (0.0%) | 3 (3.7%) |
| Missing | 29 (40.3%) | 3 (33.3%) | 32 (39.5%) |
| **HCV/HIV co-infection, n (%)** | | | |
| No | 41 (56.9%) | 4 (44.4%) | 45 (55.6%) |
| Yes | 30 (41.7%) | 5 (55.6%) | 35 (43.2%) |
| Missing | 1 (1.4%) | 0 (0.0%) | 1 (1.2%) |
| **HCV Treatment history, n (%)** | | | |

| | | | |
|---|---|---|---|
| No | 72 (100.0%) | 9 (100.0%) | 81 (100.0%) |
| **History of drug /substance, n (%)** | | | |
| Yes, current | 17 (23.6%) | 3 (33.3%) | 20 (24.7%) |
| Yes, past | 54 (75.0%) | 5 (55.6%) | 59 (72.8%) |
| Missing | 1 (1.4%) | 1 (11.1%) | 2 (2.5%) |
| **Medically Assisted Therapy (MAT) status, n (%)** | | | |
| Yes, current | 49 (68.1%) | 7 (77.8%) | 56 (69.1%) |
| Yes, past | 8 (11.1%) | 1 (11.1%) | 9 (11.1%) |
| Missing | 15 (20.8%) | 1 (11.1%) | 16 (19.8%) |
| **NSP status, n (%)** | | | |
| Yes, current | 11 (15.3%) | 0 (0.0%) | 11 (13.6%) |
| Yes, past | 54 (75.0%) | 7 (77.8%) | 61 (75.3%) |
| Missing | 7 (9.7%) | 2 (22.2%) | 9 (11.1%) |

**Supplementary Table S7.** Characteristics of patients who completed treatment in the MSF/MdM HCV screening and treatment intervention.

| Variable | Not achieved SVR (N=8) | Achieved SVR (N=73) | Total (N=81) |
|---|---|---|---|
| **Age (years)** | | | |
| Mean (SD) | 34 (7) | 37 (7) | 37 (7) |
| Median (Q1, Q3) | 36 (30, 38) | 37 (33, 42) | 37 (32, 42) |
| Min - Max | 23 - 44 | 21 - 53 | 21 - 53 |
| **Sex, n (%)** | | | |
| Male | 7 (87.5%) | 65 (89.0%) | 72 (88.9%) |
| Female | 1 (12.5%) | 8 (11.0%) | 9 (11.1%) |
| **HCV METAVIR fibrosis stage, n (%)** | | | |
| F0 | 6 (75.0%) | 50 (68.5%) | 56 (69.1%) |
| F1 | 1 (12.5%) | 10 (13.7%) | 11 (13.6%) |
| F2 | 0 (0.0%) | 3 (4.1%) | 3 (3.7%) |
| Missing | 1 (12.5%) | 10 (13.7%) | 11 (13.6%) |
| **APRI score** | | | |
| Mean (SD) | 13 (35) | 12 (32) | 12 (32) |
| Median (Q1, Q3) | 0 (0, 2) | 0 (0, 1) | 0 (0, 1) |
| **Liver stiffness, n (%)** | | | |
| <20 kPa | 2 (25.0%) | 16 (21.9%) | 18 (22.2%) |
| 20-29 kPa | 1 (12.5%) | 22 (30.1%) | 23 (28.4%) |
| 30-39 kPa | 4 (50.0%) | 14 (19.2%) | 18 (22.2%) |
| 40-49 kPa | 0 (0.0%) | 9 (12.3%) | 9 (11.1%) |
| >50 kPa | 0 (0.0%) | 2 (2.7%) | 2 (2.5%) |

| | | | |
|---|---|---|---|
| Missing | 1 (12.5%) | 10 (13.7%) | 11 (13.6%) |
| **HCV genotype, n (%)** | | | |
| 1 | 3 (37.5%) | 38 (52.1%) | 41 (50.6%) |
| 4 | 2 (25.0%) | 21 (28.8%) | 23 (28.4%) |
| Missing | 3 (37.5%) | 14 (19.2%) | 17 (21.0%) |
| **HCV baseline viral load (million IU/mL)** | | | |
| Mean (SD) | 568,912 (556,700) | 1,064,105 (308,7601) | 1,022,258 (2,959,311) |
| Median (Q1, Q3) | 537,015 (83,530, 1,012,367) | 219,490 (43,115, 908,537) | 219,490 (46,493, 966,234) |
| **Baseline HCV viral load, n (%)** | | | |
| Detectable | 4 (50.0%) | 42 (57.5%) | 46 (56.8%) |
| Undetectable | 0 (0.0%) | 3 (4.1%) | 3 (3.7%) |
| Missing | 4 (50.0%) | 28 (38.4%) | 32 (39.5%) |
| **HCV/HIV co-infection, n (%)** | | | |
| No | 4 (50.0%) | 41 (56.2%) | 45 (55.6%) |
| Yes* | 3 (37.5%) | 32 (43.8%) | 35 (43.2%) |
| Missing | 1 (12.5%) | 0 (0.0%) | 1 (1.2%) |
| **HCV Treatment history, n (%)** | | | |
| Naive | 8 (100.0%) | 73 (100.0%) | 81 (100.0%) |
| **History of drug /substance, n (%)** | | | |
| Yes, current | 4 (50.0%) | 16 (21.9%) | 20 (24.7%) |
| Yes, past | 4 (50.0%) | 55 (75.3%) | 59 (72.8%) |
| Missing | 0 (0.0%) | 2 (2.7%) | 2 (2.5%) |
| **Medically Assisted Therapy (MAT) status, n (%)** | | | |
| Yes, current | 5 (62.5%) | 51 (69.9%) | 56 (69.1%) |
| Yes, past | 1 (12.5%) | 8 (11.0%) | 9 (11.1%) |
| Missing | 2 (25.0%) | 14 (19.2%) | 16 (19.8%) |
| **Needle and Syringe exchange program status, n (%)** | | | |
| Yes, current | 3 (37.5%) | 8 (11.0%) | 11 (13.6%) |
| Yes, past | 5 (62.5%) | 56 (76.7%) | 61 (75.3%) |
| Missing | 0 (0.0%) | 9 (12.3%) | 9 (11.1%) |
| **Treatment visits, Median (Q1, Q3)** | | | |
| Baseline initial visit | 1 (1, 1) | 1 (1, 1) | 1 (1, 1) |
| Baseline subsequent | 0 (0, 1) | 0 (0, 0) | 0 (0, 0) |
| Treatment initiation | 1 (1, 1) | 1 (1, 1) | 1 (1, 1) |
| Treatment follow up | 3 (3, 3) | 3 (3, 3) | 3 (3, 3) |

| | | | |
|---|---|---|---|
| **Discontinued treatment, n (%)** | | | |
| FALSE | 7 (87.5%) | 73 (100.0%) | 80 (98.8%) |
| TRUE | 1 (12.5%) | 0 (0.0%) | 1 (1.2%) |
| **Died, n (%)** | | | |
| FALSE | 6 (75.0%) | 73 (100.0%) | 79 (97.5%) |
| TRUE | 2 (25.0%) | 0 (0.0%) | 2 (2.5%) |
| **HBV vaccination, n (%)** | | | |
| No | 7 (87.5%) | 64 (87.7%) | 71 (87.7%) |
| Yes | 1 (12.5%) | 9 (12.3%) | 10 (12.3%) |
| **Treatment length (days)** | | | |
| Median (Q1, Q3) | 84 (83, 91) | 83 (83, 88) | 83 (83, 88) |
| **DAA regimen, n (%)** | | | |
| LEDND12 | 0 (0.0%) | 10 (13.7%) | 10 (12.3%) |
| LEDND24 | 0 (0.0%) | 1 (1.4%) | 1 (1.2%) |
| SOFDAC | 2 (25.0%) | 0 (0.0%) | 2 (2.5%) |
| SOFDAC12 | 6 (75.0%) | 61 (83.6%) | 67 (82.7%) |
| SOFDAC24 | 0 (0.0%) | 1 (1.4%) | 1 (1.2%) |
| **Total treatment cost ($USD) †** | | | |
| Mean (SD) | 2,397 (803) | 2,621 (4,20) | 2,599 (468) |
| Median (Q1, Q3) | 2,290 (2,128, 2,388) | 2,449 (2,350, 2,709) | 2,436 (2,350, 2,696) |

DAA=directly-acting antivirals, SOFLED12 = sofosbuvir + ledipasvir 12 weeks, SOFLED24 = sofosbuvir + ledipasvir 24 weeks, SOFDAC12=sofosbuvir + daclatasvir 12 weeks, SOFDAC24==sofosbuvir + daclatasvir 24 weeks, SOFDAC=sofosbuvir + daclatasvir 'unspecified' weeks, APRI= Aspartate aminotransferase-to-Platelet Ratio Index, SVR=,Sustained virological response HCV=hepatitis C virus, HBV=hepatitis B virus, FIB-4=Fibrosis-4. All HIV positive patients were on anti-retroviral therapy. †Total excludes the costs of diagnosis ($539). *all HIV positive patients were on ART

**Supplementary Table S8.** Staff types and staff times for the different activities in the MSF/MdM HCV screening and treatment intervention.

| **Activity** | **Personnel** | **Time (minutes)** | | |
|---|---|---|---|---|
| | | **Mean** | **Low** | **High** |
| **Screening** | | | | |
| Pre-RDT group counselling | Nurse counsellor | 20.0 | - | - |
| Pre-RDT counselling | Nurse counsellor | 15.0 | - | - |
| Rapid diagnostic test | Nurse counsellor | 15.0 | - | - |
| Post-RDT counselling + referral to MSF | Nurse counsellor | 15.0 | - | - |
| **HCV Confirmatory test** | | | - | - |
| HCV RDT result consultation | Clinical officer | 37.5 | 30.0 | 45.0 |
| Phlebotomy | Clinical officer | 30.0 | - | - |
| **PCR test results** | | | | |
| PCR results consultation | Clinical officer | 37.5 | 30.0 | 45.0 |
| PCR results counselling | Nurse counsellor | 25.0 | 20.0 | 30.0 |

| | | | | |
|---|---|---|---|---|
| Phlebotomy | Clinical officer | 30.0 | - | - |
| **Fibroscan** | | | | |
| Fibroscan results consultation | Clinical officer | 20.0 | - | - |
| Fibroscan results counselling | Nurse counsellor | 37.5 | 30.0 | 45.0 |
| **Pre-treatment assessment** | | | | |
| Pre-treatment evaluation | Clinical officer | 37.5 | 30.0 | 45.0 |
| Pre-treatment counselling | Nurse counsellor | 37.5 | 30.0 | 45.0 |
| Phlebotomy | Clinical officer | 30.0 | - | - |
| **Treatment initiation** | | | | |
| Treatment initiation consultation | Clinical officer | 52.5 | 45.0 | 60.0 |
| Treatment follow-up consultation | | | - | - |
| **Pharmacy** | | | | |
| Directly Observed Therapy (DOT) | Clinical officer | 20.0 | 10.0 | 30.0 |
| **Treatment follow-up** | | | | |
| Treatment follow-up consultation | Clinical officer | 37.5 | 30.0 | 45.0 |
| On treatment counselling | Nurse counsellor | 37.5 | 30.0 | 45.0 |
| On treatment group counselling | Nurse counsellor | 60.0 | - | - |
| Medical consultation - small case management | Clinical officer | 37.5 | 30.0 | 45.0 |
| Phlebotomy | Clinical officer | 30.0 | - | - |
| **End of treatment** | | | | |
| End of treatment consultation | Clinical officer | 30.0 | - | - |
| End of treatment counselling | Nurse counsellor | 37.5 | 30.0 | 45.0 |
| End of treatment group counselling | Nurse counsellor | 60.0 | - | - |
| Phlebotomy | Clinical officer | 30.0 | - | - |
| **SVR** | | | | |
| SVR consultation | Clinical officer | 30.0 | - | - |
| Phlebotomy | Clinical officer | 30.0 | - | - |
| **SVR results** | | | | |
| SVR results consultation | Clinical officer | 30.0 | - | - |
| SVR results counselling | Nurse counsellor | 37.5 | 30.0 | 45.0 |
| RDT=rapid diagnostic test, PCR=polymerase chain reaction, SVR=sustained virological response, MSF= Médecins Sans Frontières, MdM= Médecins du Monde | | | | |

**Supplementary Table S9.** Activities, resources and estimated unit costs in the MSF/MdM HCV screening and treatment intervention.

| Activity | Ingredients | Type | Financial | Economic |
|---|---|---|---|---|
| HCV Rapid diagnostic test (RDT) clinic visit | DIC/outreach visit | Space/Materials | 24.26 | 24.43 |
| | Patient support visit | Space/Materials | 15.68 | 15.71 |
| Pre-RDT group counselling | Nurse counsellor time | Staff time | 0.26 | 0.26 |
| Pre-RDT counselling | Nurse counsellor time | Staff time | 0.98 | 0.98 |
| HCV RDT test | Nurse counsellor time | Staff time | 0.98 | 0.98 |
| HCV RDT test | RDT consumables | Space/Materials | 3.96 | 3.96 |
| Post-RDT counselling + referral to MSF | Nurse counsellor time | Staff time | 0.98 | 0.98 |
| HCV AB+ consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 6.61 | 6.61 |
| Phlebotomy for PCR | MSF clinical officer | Staff time | 5.29 | 5.29 |
| PCR results consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 6.61 | 6.61 |
| Phlebotomy for baseline tests | MSF clinical officer | Staff time | 5.29 | 5.29 |
| PCR results counselling | Patient support visit | Space/Materials | 36.37 | 36.42 |
| | Nurse counsellor | Staff time | 1.63 | 1.63 |
| Fibroscan results consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 3.53 | 3.53 |
| Fibroscan results counselling | Patient support visit | Space/Materials | 36.37 | 36.42 |
| | Nurse counsellor | Staff time | 2.45 | 2.45 |
| Pre-treatment evaluation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 6.61 | 6.61 |
| Phlebotomy for pre-treatment tests | MSF clinical officer | Staff time | 5.29 | 5.29 |
| Pre-treatment counselling | Patient support visit | Space/Materials | 36.37 | 36.42 |
| | Nurse counsellor | Staff time | 2.45 | 2.45 |
| Treatment initiation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 9.26 | 9.26 |
| Directly Observed Therapy (DOT)-treatment initiation | MSF clinical officer | Staff time | 3.53 | 3.53 |
| | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 3.53 | 3.53 |
| Treatment follow-up consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |

| | | | | |
|---|---|---|---|---|
| | MSF consultation room visit | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 6.61 | 6.61 |
| Directly Observed Therapy (DOT)-follow-up | MSF clinical officer | Staff time | 3.53 | 3.53 |
| On treatment counselling | Patient support visit | Space/Materials | 36.37 | 36.42 |
| | Nurse counsellor | Staff time | 2.45 | 2.45 |
| On treatment group counselling | Nurse counsellor | Staff time | 0.26 | 0.26 |
| Medical consultation - small case management | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 6.61 | 6.61 |
| End of treatment consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 5.29 | 5.29 |
| Phlebotomy end of treatment | MSF clinical officer | Staff time | 5.29 | 5.29 |
| End of treatment counselling | Patient support visit | Space/Materials | 36.37 | 36.42 |
| | Nurse counsellor | Staff time | 2.45 | 2.45 |
| End of treatment group counselling | Nurse counsellor | Staff time | 0.26 | 0.26 |
| SVR12 consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 5.29 | 5.29 |
| Phlebotomy for SVR12 PCR | MSF clinical officer | Staff time | 5.29 | 5.29 |
| SVR results consultation | DIC general visit | Space/Materials | 26.57 | 26.94 |
| | MSF consultation room | Space/Materials | 8.52 | 8.52 |
| | MSF clinical officer | Staff time | 5.29 | 5.29 |
| | Patient support visit | Space/Materials | 36.37 | 36.42 |
| | Nurse counsellor | Staff time | 2.45 | 2.45 |

**Supplementary Table S10.** Unit costs for visits, laboratory tests, test kits and medicines in the MSF/MdM HCV screening and treatment intervention.

| Test | Resource type | Unit cost | |
|---|---|---|---|
| | | Financial | Economic |
| **Consultations/ visits** | | | |
| HCV Rapid diagnostic test | Visit | 5.92 | 5.92 |
| HCV confirmatory test | Visit | 20.42 | 20.42 |
| HCV confirmatory test results | Visit | 58.42 | 58.48 |
| Fibroscan results | Visit | 50.86 | 50.92 |
| Baseline initial assessment | Visit | 59.24 | 59.29 |
| Baseline subsequent assessment | Visit | 59.24 | 59.29 |
| Treatment initiation | Visit | 21.30 | 21.30 |
| Directly observed therapy (DOTs) | Visit | 38.62 | 38.99 |
| Treatment follow-up | Visit | 57.74 | 57.79 |
| Medical small case management | Visit | 15.13 | 15.13 |
| End of treatment | Visit | 58.18 | 58.23 |
| SVR12 | Visit | 32.91 | 32.91 |
| MSF referrals | Visit | 7.32 | 7.32 |
| **Laboratory tests** | | | |
| Albumin | Laboratory test | 6.78 | 6.78 |
| Alanine aminotransferase (ALT) | Laboratory test | 6.78 | 6.78 |
| Aspartate aminotransferase (AST) | Laboratory test | 6.78 | 6.78 |
| Bilirubin profile | Laboratory test | 13.95 | 13.95 |
| Complete blood count (CBC) | Laboratory test | 9.68 | 9.68 |
| Creatinine | Laboratory test | 6.10 | 6.10 |
| Creatinine clearance | Laboratory test | 16.47 | 16.47 |
| Glucose random plasma | Laboratory test | 5.22 | 5.22 |
| Hepatitis B surface antigen (HBsAg) | Laboratory test | 1.15 | 1.15 |
| HCV viral load | Laboratory test | 78.51 | 78.51 |
| HCV Genotyping | Laboratory test | 116.31 | 116.31 |
| HIV viral load | Laboratory test | 78.51 | 78.51 |
| Haemoglobin | Laboratory test | 1.29 | 1.29 |
| HIV Rapid diagnostic test | Laboratory test | 0.93 | 0.93 |
| Pregnancy test | Laboratory test | 0.19 | 0.19 |
| Fibroscan | Laboratory test | 37.81 | 37.81 |
| Prothrombin /International Normalized Ratio (PT/INR) | Laboratory test | 8.71 | 8.71 |
| CD4 count | Laboratory test | 31.01 | 31.01 |
| SD Bioline test kit | Laboratory test | 14.55 | 14.55 |
| Proteinurie | Laboratory test | 8.71 | 8.71 |
| Sofosbuvir 400mg | DAA medicines | 2.87 | 2.87 |
| Daclatasvir 30mg | DAA medicines | 0.89 | 0.89 |
| Daclatasvir 60mg | DAA medicines | 3.75 | 3.75 |

| | | | |
|---|---|---|---|
| Daclatasvir 90mg | DAA medicines | 6.13 | 6.13 |
| Ledipasvir/Sofosbuvir | DAA medicines | 13.14 | 13.14 |
| Ribavirin 200mg | HCV medicines | 0.31 | 0.31 |

**Estimation of the costs of diagnosis**

To estimate the costs of diagnosis, we estimated the costs of the screening test for HCV antibodies, and when positive, an HCV-RNA screening test to confirm chronic infection. All these costs include staff time (for phlebotomy, doing the tests and counselling), test kits and overhead costs (**Supplementary Table S8, S9 & S10**). These were summed up to get the total unit costs for a RDT and RNA test (**Supplementary Table S11**). The average cost per diagnosis was then calculated for the observed HCV antibody (7.7%) and chronic prevalence (76.6%) at the clinic including costs for patients who received an HCV antibody and/or HCV-RNA test but were not reactive. The following formulae were applied to arrive at the full cost of HCV case-finding in this cohort.

Cost of RDT = cost of RDT clinic visit + cost of HCV RDT kit
Cost of PCR = cost of PCR result visit + cost of HCV RNA (Quantitative) test

**Supplementary Table S11.** Total unit costs for screening tests by result ($US) in the MSF/MdM HCV screening and treatment intervention.

| RDT | PCR |
|---|---|
| 20.47 | 125.87 |

Cost per diagnosis = [Cost of RDT *observed HCV antibody prevalence + Cost of RDT *(1- observed HCV antibody prevalence) + observed HCV antibody prevalence* Cost of PCR * observed chronic HCV prevalence + observed HCV antibody prevalence* cost of PCR *(1- observed chronic HCV prevalence)] / (observed HCV antibody prevalence*observed chronic HCV prevalence) = $511

**Kenya TLC study HCV intervention cost analysis**

**Design**

The costs of HCV screening and treatment were estimated directly collected from the Testing and Linkage to care for injecting drug users (TLC-IDU) study that was conducted in Kenya (May 2012 - April 2018). The aim of the study was to evaluate the seek, test, treat, and retain intervention called 'Testing & Linkage to Care for IDUs' (TLC-IDU Kenya) using a multi-site stepped wedge cluster-randomized design. The study used respondent driven sampling (RDS) as the sampling method, where "initial seeds" were selected and trained to recruit a small number of their peers for the research study, using coded recruitment coupons. These recruits are called "peers" who then become study participants and in turn had the opportunity to recruit their peers for the study, thus resulting in several "waves" of recruitment. Testing and counselling for HIV was performed in all 6 rounds of the study while it was only done in round 6 over a 6-month-period for HCV.

Point-of-care anti-HCV rapid testing was offered to all enrolled PWID using the SD Bioline Anti-HCV rapid test (Standard Diagnostics, Inc.). All PWID reactive test results had a confirmatory HCV RNA test was done using venous blood. Confirmatory specimens were sent to the KEMRI CDC laboratory in Kisumu for a qualitative or quantitative HCV viral RNA test. Participants would come back to study site to receive confirmatory HCV results, counselling following national standard of care, and referrals. Before the launch of treatment with Harvoni (sofosbuvir/ledipasvir), participants confirmed to be HCV viraemic provided another blood specimen for HCV genotyping performed by the Centers for Disease Control and Prevention (CDC) in the US prior to the treatment initiation. The non-invasive tests, AST to Platelet Ratio Index (APRI, using AST and platelet counts) and Fib4 scores (using age, AST, ALT and platelet counts) were utilized for fibrosis staging. In addition to HCV viral load, blood chemistries and liver functions tests were done at baseline and some were repeated (monthly) during the course of treatment. Clinical evaluations were performed at baseline, on a monthly basis during treatment and 12 weeks after treatment by either a medical doctor or clinical officer or registered nurse in the partner facilities. All participants received pre, post and ongoing counselling during treatment. Group sensitization and individual counselling for treatment plan before DAA treatment to raise awareness as well as monthly support groups were done. After confirmation that participants with HCV in this cohort had mainly genotypes 1 and 4, all confirmed HCV viraemic patients were treated with Harvoni (ledipasvir 90 mg/sofosbuvir 400 mg) for 12 weeks without or with compensated cirrhosis, or 24 weeks with decompensated cirrhosis. Both active and inactive confirmed HCV viraemic PWID from either Medication Assisted Treatment (MAT) clinics in Nairobi, Mombasa, and Malindi, Kenya or collaborating partners' sites/Drop-in Centres (DICs) in Mombasa and Mtwapa, Kenya were treated with direct acting antiviral (DAA) regimens. The mode of treatment delivery was Directly Observed Therapy (DOT) for 84 consecutive doses (one dose per day). HCV patients were managed by a team of clinicians and nurses to initiate and monitor treatment in conformity with American Association for the Study of Liver Diseases/Infectious Disease Society of America (AASLD/IDSA) guidelines(33). Patients were followed up until at least 12 weeks after treatment, at which point the sustained virologic response (SVR12), defined as undetectable HCV viral load 12 weeks after completion of HCV treatment, was assessed to determine treatment success. Patient characteristics are described in **Supplementary Table S12 and S13.**

Data on resource use and costs were retrospectively obtained from TLC-IDU study's financial records over a 12-month period (May 2017-Apr 2018), and results are presented in 2018 US dollars. The cost analyses followed the standard techniques for conducting micro-cost analyses, which involve the identification, quantification and valuation of all the resources (direct medical and non-medical) used in the screening, diagnosis, treatment and follow-up for each patient in the cohort. We gathered both financial and economic costs, however only economic costs are reported to capture the likely opportunity costs associated with the intervention. The total costs of the intervention included intervention set-up and implementation costs. Research related costs were identified and excluded from the analysis in order to represent real world implementation. Using an ingredients approach, unit costs were applied to patient-level resource use (in terms of type and frequency of visit) to obtain the total cost for each patient.

**Identifying resources used**
A detailed review of the treatment protocol and interviews with key technical staff involved in the planning, implementation and coordination of the intervention were performed to identify all the activities and resources utilized in the treatment of patients with chronic HCV in Nairobi, Kenya. The main activities in the intervention included RDS, HCV antibody testing using a rapid diagnostic test, confirmatory testing for HCV chronic infection using an RNA based test, HCV genotyping, patient counselling/education, baseline medical assessment for treatment eligibility, baseline laboratory work up, DAA treatment initiation, DOTs, treatment follow-up, treatment monitoring laboratory tests, routine management of medical problems, on-treatment referrals to other medical services, post-treatment follow up and SVR assessment. The resources identified included staff time (medical doctor, clinical officer, nurse), materials (test kits, consumables), laboratory tests (HCV antibody, HCV RNA, HCV genotype, blood chemistries and liver functions), DAA medicines and overheads. Overheads included facility/buildings, utilities, support staff, coordination staff, vehicles, training, travel, medical and laboratory supplies, non-medical supplies, freight and clearance.

**Measuring resource utilization**
Primary data was collected on the exact number and type of resources consumed in the screening and treatment program. Detailed patient-level data, including the number and type of clinic visits, clinical examinations, laboratory investigations, treatment regimens, and treatment outcomes were extracted from data collected during the study using an excel based database. The amount of time spent by staff providing services in the program was estimated for each activity using staff time sheets and interviews with the relevant staff (**Supplementary Table S14*)***. Overhead and administrative costs associated with the HCV screening and treatment program were allocated using the step-down costing approach. For example, staff numbers in each department were used to allocate management and administrative costs, service statistics were used to allocate shared recurrent resources, interviews with key personnel (mostly managers or supervisors) were performed to determine ratios for allocating coordination costs and room space was used to allocate buildings space, utilities and building maintenance.

**Valuation of resources**
Valuation of the resources used in the treatment program was based on TLC-IDU study's financial records and information provided by study administrator. The most up-to-date unit prices/costs were applied to patient-level data on resource use to estimate the costs of treating each patient (**Supplementary Table S15*)***. Unit costs for supplies and consumables, including test kits, were obtained from TLC-IDU study's financial records and supplemented with interviews with key personnel (project director, study administrator, study team leader). Unit costs for valuing staff time were estimated based on staff salaries information provided by the TLC-IDU study. Valuation of the DAAs was based on the prices paid for the medicines by MSF at the time of purchase. Unit costs for the outsourced laboratory tests were obtained from the external laboratory through the TLC-IDU study. When unavailable, the unit cost for an activity was estimated using micro-costing. Building costs (rentals) and floor layout plans were provided by the TLC-IDU study. Information on the acquisition costs and replacement values for capital items were gathered from the project's program records. Equivalent annual costs for capital items (equipment and furniture) were estimated based on the expected service lives using a discount rate of 3%.
All historical costs were adjusted for inflation to 2018 prices using the Consumer Price Indices obtained for Kenya. Unit prices were gathered in both the local currency (Kenyan Shilling) and USD. Local currency prices were converted to the USD currency using the average market-based exchange rate (1 USD = 105 Kenyan Shilling). The per unit overhead costs for each activity were estimated by dividing the annual total cost for the activity by the annual total number of units of output (for example, number of patient visits or patients). The cost of each activity is the sum of the costs for all the resources used in executing that activity, i.e., labour, consumables and overheads. The activity costs were multiplied by the number of times a patient received each activity and summed to give an estimate of the total cost per patient. The total costs comprised of the following categories: HCV diagnosis costs, HCV-related visit costs, HCV treatment related laboratory costs and DAA costs.

**HCV visit costs:** HCV-related visits comprised of all visits made by patients in preparation for, during and after treatment. These included baseline assessments, treatment initiation, on-treatment follow up, DOTs visits, end of treatment, post-treatment follow-up and SVR assessment visits (**Supplementary Table S14*)***. Each visit cost included the cost of staff time specific to the visit (estimated using staff time sheets and interviews) and space/materials depending on which area of the clinic was utilized ( consultations, DOTs and counselling). For each of these locations, the visit cost incorporated recurrent costs (support personnel costs, medicines (excluding HCV), medical and laboratory supplies, non-medical supplies, transport operating costs, building rental and insurance, maintenance, utilities and bills, freight and clearance, travel, and training) and capital costs (buildings, vehicles, medical equipment, laboratory equipment, cold chain equipment, non-medical equipment, construction and rehabilitation, and furniture). Building space for each location was determined through site maps, visual inspection and interviews with the logistics manager and allocated as HCV-related by proportion of HCV consultations. Support personnel costs for each category (coordination, administration, human resources, support staff), were determined by their level of involvement in HCV-related activities and allocated using proportion of staff, budget, floor space, or consultations.

**HCV treatment-related laboratory costs:** Laboratory costs included all laboratory tests and investigations performed for each patient in preparation for, during and after treatment according to the TLC-IDU study treatment protocol and were obtained from hospital price lists and from invoices billed to the TLC-IDU study for laboratory tests contracted outside of the program (**Supplementary Table S16*)***.

**DAA medicine costs:** Unit costs for DAAs were based on actual prices paid for the drugs by the TLC-IDU study (**Supplementary Table S16).** DAA costs for each patient were calculated based on the patients-specific treatment regimen and the length of treatment obtained from the patient database.

**HCV diagnosis costs:** These include the costs of screening for HCV antibodies, and when positive, HCV-RNA test to confirm presence of chronic infection. The average cost per diagnosis was calculated for the observed HCV antibody and chronic prevalence at the MdM clinic (data from the TLC-IDU study was not available at the time of analysis) including costs for patients who received an HCV antibody and/or HCV-RNA test but were not reactive. This represented the full cost of HCV case-finding (**Supplementary Table S17*)***.

**Supplementary Table S12.** Baseline characteristics of patients in the TLC study cohort analyzed

| Variable | Male (N=28) | Female (N=50) | Total (N=78) |
|---|---|---|---|
| **Age (years)** | | | |
| Mean (SD) | 36 (6) | 36 (6) | 36 (6) |
| Median (Q1, Q3) | 34 (31, 41) | 36 (32, 42) | 36 (31, 42) |
| **HCV METAVIR fibrosis stage, n (%)** | | | |
| F0 | 10 (35.7%) | 13 (26.0%) | 23 (29.5%) |
| F1 | 5 (17.9%) | 10 (20.0%) | 15 (19.2%) |
| F2 | 6 (21.4%) | 12 (24.0%) | 18 (23.1%) |
| F3 | 4 (14.3%) | 8 (16.0%) | 12 (15.4%) |
| F4 | 2 (7.1%) | 7 (14.0%) | 9 (11.5%) |
| Missing | 1 (3.6%) | 0 (0.0%) | 1 (1.3%) |
| **APRI score** | | | |
| Median (Q1, Q3) | 0 (0, 1) | 1 (0, 1) | 1 (0, 1) |
| Min - Max | 0 - 2 | 0 - 5 | 0 - 5 |
| **FIB-4 score** | | | |
| Median (Q1, Q3) | 1 (1, 2) | 1 (1, 2) | 1 (1, 2) |
| Min - Max | 0 - 6 | 0 - 10 | 0 - 10 |
| **HCV genotype, n (%)** | | | |
| 1a | 6 (21.4%) | 29 (58.0%) | 35 (44.9%) |
| 4a | 1 (3.6%) | 21 (42.0%) | 22 (28.2%) |
| Missing | 21 (75.0%) | 0 (0.0%) | 21 (26.9%) |
| **HCV/HIV co-infection, n (%)** | | | |
| Negative | 10 (35.7%) | 35 (70.0%) | 45 (57.7%) |
| Positive | 18 (64.3%) | 15 (30.0%) | 33 (42.3%) |
| **HBV/HCV co-infection, n (%)** | | | |
| Negative | 27 (96.4%) | 49 (98.0%) | 76 (97.4%) |
| Positive | 1 (3.6%) | 1 (2.0%) | 2 (2.6%) |
| **Anti-retroviral therapy, n (%)** | | | |
| No | 1 (3.6%) | 2 (4.0%) | 3 (3.8%) |
| Yes | 2 (7.1%) | 14 (28.0%) | 16 (20.5%) |
| Defaulted | 16 (57.1%) | 2 (4.0%) | 18 (23.1%) |
| Missing | 9 (32.1%) | 32 (64.0%) | 41 (52.6%) |
| **Medically Assisted Therapy (MAT), n (%)** | | | |
| No | 0 (0.0%) | 17 (34.0%) | 17 (21.8%) |
| Yes | 6 (21.4%) | 33 (66.0%) | 39 (50.0%) |
| Defaulted | 22 (78.6%) | 0 (0.0%) | 22 (28.2%) |

**Supplementary Table S13.** Characteristics of patients who completed 12-week post-treatment follow-up in the TLC study cohort

| Variable | Not reached SVR (N=21) | Reached SVR (N=57) | Total (N=78) |
|---|---|---|---|
| **Age (years)** | | | |
| Mean (SD) | 38 (6) | 36 (6) | 36 (6) |
| Median (Q1, Q3) | 36 (32, 42) | 35 (30, 40) | 36 (31, 42) |
| Min - Max | 30 - 47 | 25 - 48 | 25 - 48 |
| **Sex, n (%)** | | | |
| Male | 21 (100.0%) | 7 (12.3%) | 28 (35.9%) |
| Female | 0 (0.0%) | 50 (87.7%) | 50 (64.1%) |
| **METAVIR fibrosis stage, n (%)** | | | |
| F0 | 5 (23.8%) | 18 (31.6%) | 23 (29.5%) |
| F1 | 5 (23.8%) | 10 (17.5%) | 15 (19.2%) |
| F2 | 5 (23.8%) | 13 (22.8%) | 18 (23.1%) |
| F3 | 3 (14.3%) | 9 (15.8%) | 12 (15.4%) |
| F4 | 2 (9.5%) | 7 (12.3%) | 9 (11.5%) |
| Missing | 1 (4.8%) | 0 (0.0%) | 1 (1.3%) |
| **APRI score** | | | |
| Mean (SD) | 1 (1) | 1 (1) | 1 (1) |
| Median (Q1, Q3) | 1 (0, 1) | 1 (0, 1) | 1 (0, 1) |
| Min - Max | 0 - 2 | 0 - 5 | 0 - 5 |
| **FIB-4 score** | | | |
| Mean (SD) | 2 (2) | 2 (2) | 2 (2) |
| Median (Q1, Q3) | 1 (1, 2) | 1 (1, 2) | 1 (1, 2) |
| Min - Max | 0 - 6 | 0 - 10 | 0 - 10 |
| **HCV genotype, n (%)** | | | |
| 1a | 0 (0.0%) | 35 (61.4%) | 35 (44.9%) |
| 4a | 0 (0.0%) | 22 (38.6%) | 22 (28.2%) |
| Missing | 21 (100.0%) | 0 (0.0%) | 21 (26.9%) |
| **HCV/HIV co-infection, n (%)** | | | |
| Negative | 6 (28.6%) | 39 (68.4%) | 45 (57.7%) |
| Positive | 15 (71.4%) | 18 (31.6%) | 33 (42.3%) |
| **HBV/HCV co-infection, n (%)** | | | |
| Negative | 21 (100.0%) | 55 (96.5%) | 76 (97.4%) |
| Positive | 0 (0.0%) | 2 (3.5%) | 2 (2.6%) |
| **Anti-retroviral therapy, n (%)** | | | |
| No | 0 (0.0%) | 3 (5.3%) | 3 (3.8%) |
| Yes | 0 (0.0%) | 16 (28.1%) | 16 (20.5%) |

| | | | |
|---|---|---|---|
| Defaulted | 15 (71.4%) | 3 (5.3%) | 18 (23.1%) |
| Missing | 6 (28.6%) | 35 (61.4%) | 41 (52.6%) |
| **Medically Assisted Therapy (MAT), n (%)** | | | |
| No | 0 (0.0%) | 17 (29.8%) | 17 (21.8%) |
| Yes | 0 (0.0%) | 39 (68.4%) | 39 (50.0%) |
| Defaulted | 21 (100.0%) | 1 (1.8%) | 22 (28.2%) |
| **Completed treatment, n (%)** | | | |
| No | 1 (4.8%) | 0 (0.0%) | 1 (1.3%) |
| Yes | 17 (81.0%) | 57 (100.0%) | 74 (94.9%) |
| Missing | 3 (14.3%) | 0 (0.0%) | 3 (3.8%) |
| **Number of missed dosses** | | | |
| Median (Q1, Q3) | 2 (2, 5) | 3 (2, 8) | 3 (2, 7) |
| Min - Max | 1 - 9 | 1 - 42 | 1 - 42 |
| **Total treatment cost ($USD) *** | | | |
| Mean (SD) | 1565 (494) | 1876 (6) | 1792 (287) |
| Median (Q1, Q3) | 1,800 (1,795, 1,802) | 1,878 (1,876, 1,879) | 1,876 (1,804, 1,879) |

APRI= Aspartate aminotransferase-to-Platelet Ratio Index, SVR= Sustained virological response HCV=hepatitis C virus, HBV=hepatitis B virus, FIB-4=Fibrosis-4, TLC=Testing and Linkage to Care. *Total excludes the costs of diagnosis ($2,126)

**Supplementary Table S14.** Staff types and staff times for the different activities in the TLC HCV screening and treatment intervention.

| Activity | Personnel | Activity time (minutes) | | |
|---|---|---|---|---|
| | | Mean | Low | High |
| **Respondent driven sampling (RDS)** | | | | |
| Recruitment of participants | Research assistant | 20 | 15 | 30 |
| Interview of participants | Research assistant | 50 | 45 | 60 |
| **HCV screening** | | | | |
| Pre- Rapid diagnostic test (RDT) counselling | Research assistant | 25 | 20 | 30 |
| Rapid diagnostic test | Research assistant | 15 | 15 | 20 |
| Post-RDT counselling | Research assistant | 20 | 15 | 30 |
| **HCV Confirmatory test** | | | | |
| HCV antibody result consultation | Research assistant | 15 | 15 | 20 |
| Phlebotomy for HCV PCR | Research assistant | 15 | 10 | 20 |
| **HCV PCR test results** | | | | |
| PCR results consultation | Research assistant | 15 | 10 | 20 |
| PCR results counselling | Research assistant | 25 | 20 | 30 |
| Phlebotomy | Research assistant | 10 | 10 | 30 |
| **Pre-treatment assessment** | | | | |
| Pre-treatment evaluation | Research assistant/ Medical doctor? | 25 | 20 | 30 |
| Pre-treatment counselling | Research assistant | 35 | 30 | 45 |
| Phlebotomy | Research assistant | 25 | 10 | 40 |
| **Treatment initiation** | | | | |
| Treatment initiation consultation | Research assistant | 15 | 10 | 20 |
| Treatment initiation consultation | Medical doctor | 15 | 10 | 20 |
| **Pharmacy** | | | | |
| Directly Observed Therapy (DOT) | Pharmacist | 4 | 3 | 5 |
| **Treatment follow-up w4** | | | | |
| Treatment follow-up consultation | Research assistant | 15 | 10 | 20 |
| On treatment counselling | Research assistant | 15 | 10 | 20 |
| Medical consultation - small case management | Medical doctor | 15 | 10 | 20 |
| Phlebotomy | Research assistant | 15 | 10 | 40 |
| **Treatment follow-up w8** | | | | |
| Treatment follow-up consultation | Research assistant | 15 | 10 | 20 |
| On treatment counselling | Research assistant | 15 | 10 | 20 |
| Phlebotomy | Research assistant | 15 | 10 | 30 |
| **End of treatment w12** | | | | |
| End of treatment consultation | Medical doctor | 15 | 10 | 20 |
| End of treatment counselling | Research assistant | 15 | 10 | 20 |
| Phlebotomy | Medical doctor | 25 | 10 | 40 |
| **SVR** | | | | |

| | | | | |
|---|---|---|---|---|
| SVR consultation | Medical doctor | 15 | 10 | 20 |
| Phlebotomy | Medical doctor | 15 | 10 | 20 |
| **SVR result** | | | | |
| SVR results consultation | Medical doctor | 30 | 20 | 40 |
| SVR results counselling | Research assistant | 35 | 30 | 40 |

**Supplementary Table S15.** Activities, resources and estimated unit costs in the TLC HCV screening and treatment intervention.

| Activity | Ingredients | Type | Unit cost | |
|---|---|---|---|---|
| | | | Financial | Economic |
| Recruitment of participants | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Research assistant | Staff time | 1.26 | 1.26 |
| Interview of participants | Research assistant | Staff time | 3.16 | 3.16 |
| Participant pay-out | Cash | Cash | 2.42 | 2.42 |
| Pre-RDT counselling | Research assistant | Staff time | 1.58 | 1.58 |
| Rapid diagnostic test (RDT) | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Research assistant | Staff time | 0.95 | 0.95 |
| Post-RDT counselling | Research assistant | Staff time | 1.26 | 1.26 |
| HCV RDT results consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Research assistant | Staff time | 0.95 | 0.95 |
| Phlebotomy | Research assistant | Staff time | 0.95 | 0.95 |
| PCR results consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Research assistant | Staff time | 0.95 | 0.95 |
| PCR results counselling | Research assistant | Staff time | 1.58 | 1.58 |
| Phlebotomy for baseline tests | Research assistant | Staff time | 0.63 | 0.63 |
| Pre-treatment evaluation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Research assistant | Staff time | 1.58 | 1.58 |
| Pre-treatment counselling | Research assistant | Staff time | 2.21 | 2.21 |
| Treatment initiation consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Medical doctor | Staff time | 0.95 | 0.95 |
| | Research assistant | Staff time | 0.95 | 0.95 |
| Treatment initiation – DAA medicines | Pharmacist | Staff time | 0.25 | 0.25 |
| Directly Observed Therapy (DOT) | Pharmacist | Staff time | 0.25 | 0.25 |
| Treatment follow-up consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Research assistant | Staff time | 0.95 | 0.95 |
| On-treatment counselling | Research assistant | Staff time | 0.95 | 0.95 |
| Phlebotomy | Research assistant | Staff time | 0.95 | 0.95 |
| Medical consultation - small case management | Medical doctor | Staff time | 0.95 | 0.95 |
| End of treatment consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Medical doctor | Staff time | 0.95 | 0.95 |
| End of treatment counselling | Research assistant | Staff time | 0.95 | 0.95 |
| Phlebotomy | Medical doctor | Staff time | 1.58 | 1.58 |
| SVR12 consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Medical doctor | Staff time | 8.52 | 8.52 |
| SVR results consultation | DIC visit | Space/Materials | 50.64 | 50.76 |
| | Medical doctor | Staff time | 1.90 | 1.90 |
| SVR results counselling | Research assistant | Staff time | 2.21 | 2.21 |

**Supplementary Table S16.** Unit costs for visits, laboratory tests, test kits and medicines in the TLC HCV screening and treatment intervention.

| Variable | Resource type | Unit costs | |
|---|---|---|---|
| | | Financial | Economic |
| **Consultations/ visits** | | | |
| Respondent driven sampling (RDS) | Visit | 57.49 | 57.61 |
| HCV Rapid diagnostic test (RDT) | Visit | 54.44 | 54.55 |
| HCV confirmatory test | Visit | 52.54 | 52.65 |
| PCR results | Visit | 53.81 | 53.92 |
| Baseline initial | Visit | 56.02 | 56.13 |
| Baseline subsequent | Visit | 56.02 | 56.13 |
| Initiation | Visit | 52.79 | 52.91 |
| Directly Observed Therapy | Visit | 0.25 | 0.25 |
| Treatment follow-up | Visit | 53.49 | 53.60 |
| Medical small case management | Visit | 0.95 | 0.95 |
| End of treatment | Visit | 54.12 | 54.23 |
| SVR12 | Visit | 97.82 | 98.05 |
| **Laboratory tests** | | | |
| Serum albumin | Laboratory tests | 5.13 | 5.13 |
| Alanine aminotransferase (ALT) | Laboratory tests | 1.94 | 1.94 |
| Aspartate aminotransferase (AST) | Laboratory tests | 1.94 | 1.94 |
| Bilirubin - Total & Direct | Laboratory tests | 2.30 | 2.30 |
| Complete blood count | Laboratory tests | 4.00 | 4.00 |
| Creatinine | Laboratory tests | 1.94 | 1.94 |
| HBsAg | Laboratory tests | 8.00 | 8.00 |
| HCV Genotype | Laboratory tests | 25.00 | 25.00 |
| HCV RNA (Quantitative) | Laboratory tests | 50.51 | 50.51 |
| haemoglobin | Laboratory tests | 1.29 | 1.29 |
| HIV Rapid diagnostic test | Laboratory test | 0.93 | 0.93 |
| Pregnancy Test | Laboratory test | 1.45 | 1.45 |
| Prothrombin /International Normalized Ratio (PT/INR) | Laboratory tests | 7.46 | 7.46 |
| HCV rapid test | Tests | 1.16 | 1.16 |
| Liver function tests (LFTs) | Tests | 11.31 | 11.31 |
| Harvoni (Sofosbuvir/Ledispavir) | DAA medicines | 14.29 | 14.29 |

**Estimation of the costs of diagnosis**

To estimate the costs of diagnosis, we estimated the costs of the screening test for HCV antibodies, and when positive, an HCV-RNA screening test to confirm chronic infection. All these costs include staff time (for phlebotomy, doing the tests and counselling), test kits and overhead costs (**Supplementary Table S12, S13 & S14**). These were summed up to get the total unit costs for a RDT and RNA test (**Supplementary Table S15**). The average cost per diagnosis was then calculated for the observed HCV antibody (7.7%) and chronic prevalence (76.6%) at the clinic including costs for patients who received an HCV antibody and/or HCV-RNA test but were not reactive. The following formulae were applied to arrive at the full cost of HCV case-finding in this cohort.

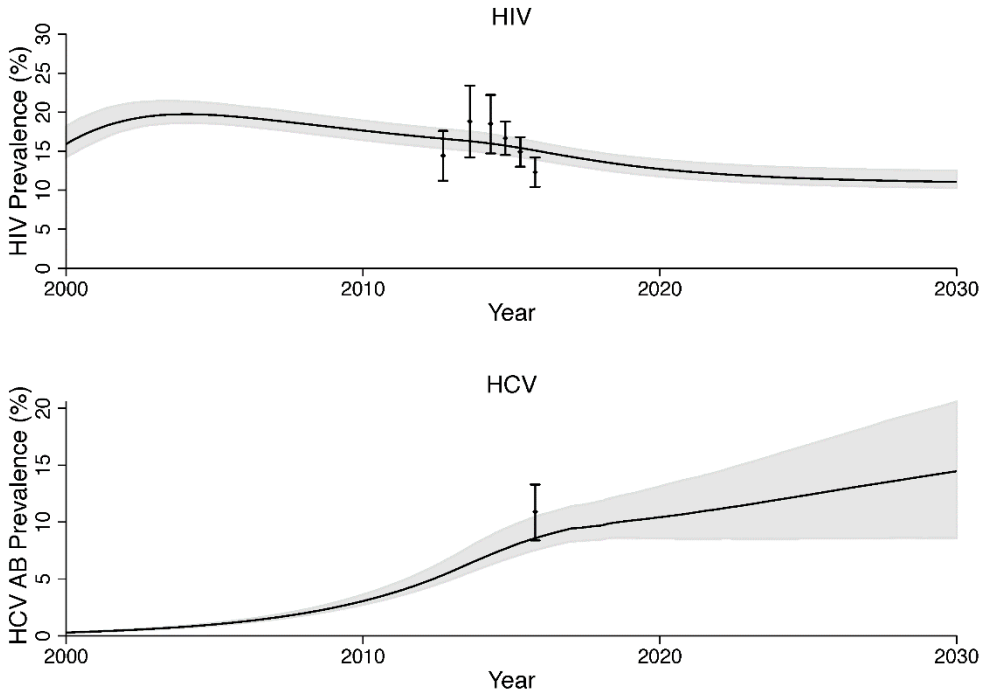
Cost of RDT = cost of Respondent driven sampling (RDS) + cost of RDT clinic visit + cost of HCV RDT kit
Cost of PCR = cost of PCR test visit + cost of PCR result visit + cost of HCV RNA (Quantitative) test

**Table S17.** Total unit costs for screening tests by result ($US) in the TLC HCV screening and treatment intervention.

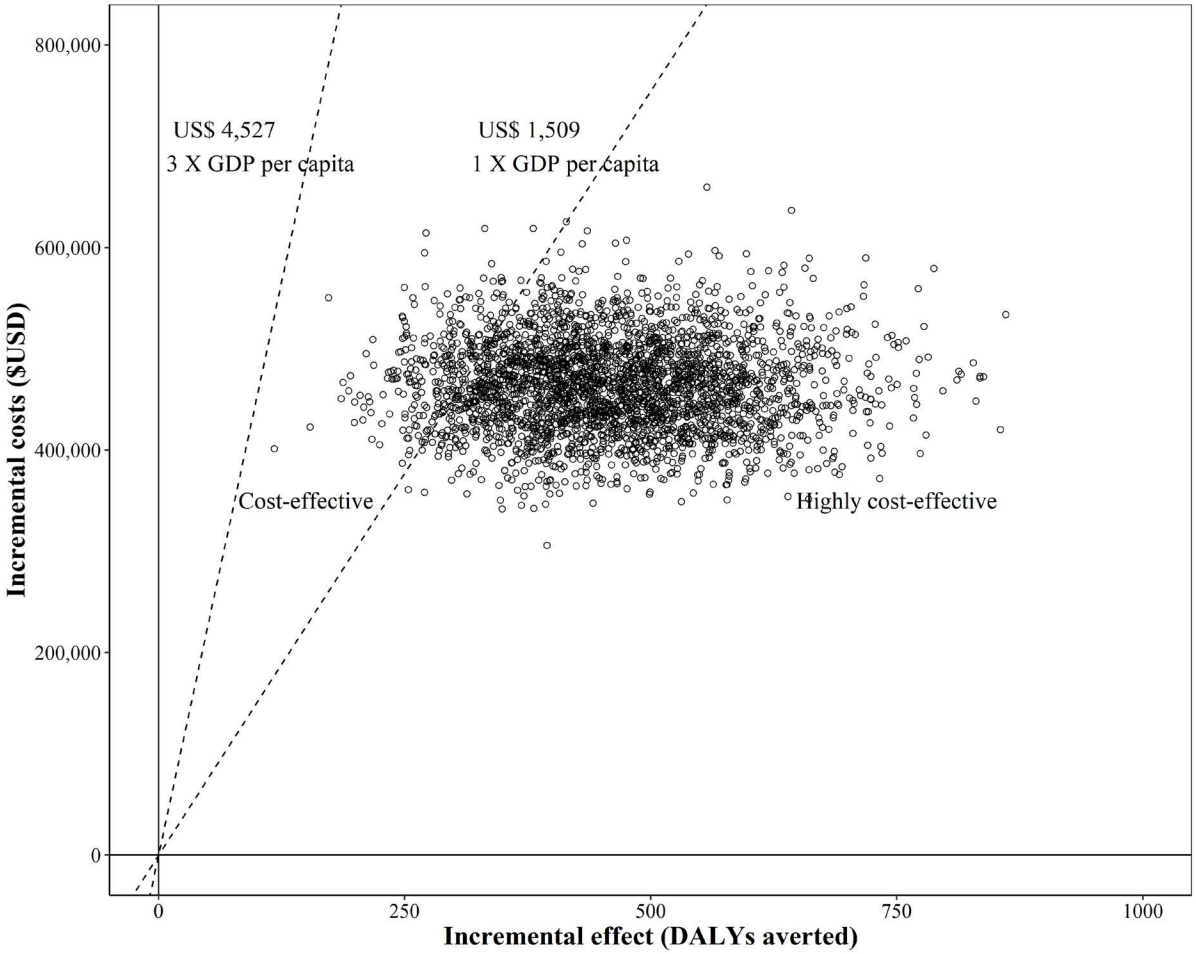
| RDT | PCR |
|---|---|
| 113.13 | 157.08 |

Cost per diagnosis = [Cost of RDT *observed HCV antibody prevalence + Cost of RDT *(1- observed HCV antibody prevalence) + observed HCV antibody prevalence* Cost of PCR * observed chronic HCV prevalence + observed HCV antibody prevalence* cost of PCR *(1- observed chronic HCV prevalence)] / (observed HCV antibody prevalence*observed chronic HCV prevalence) = $2,126

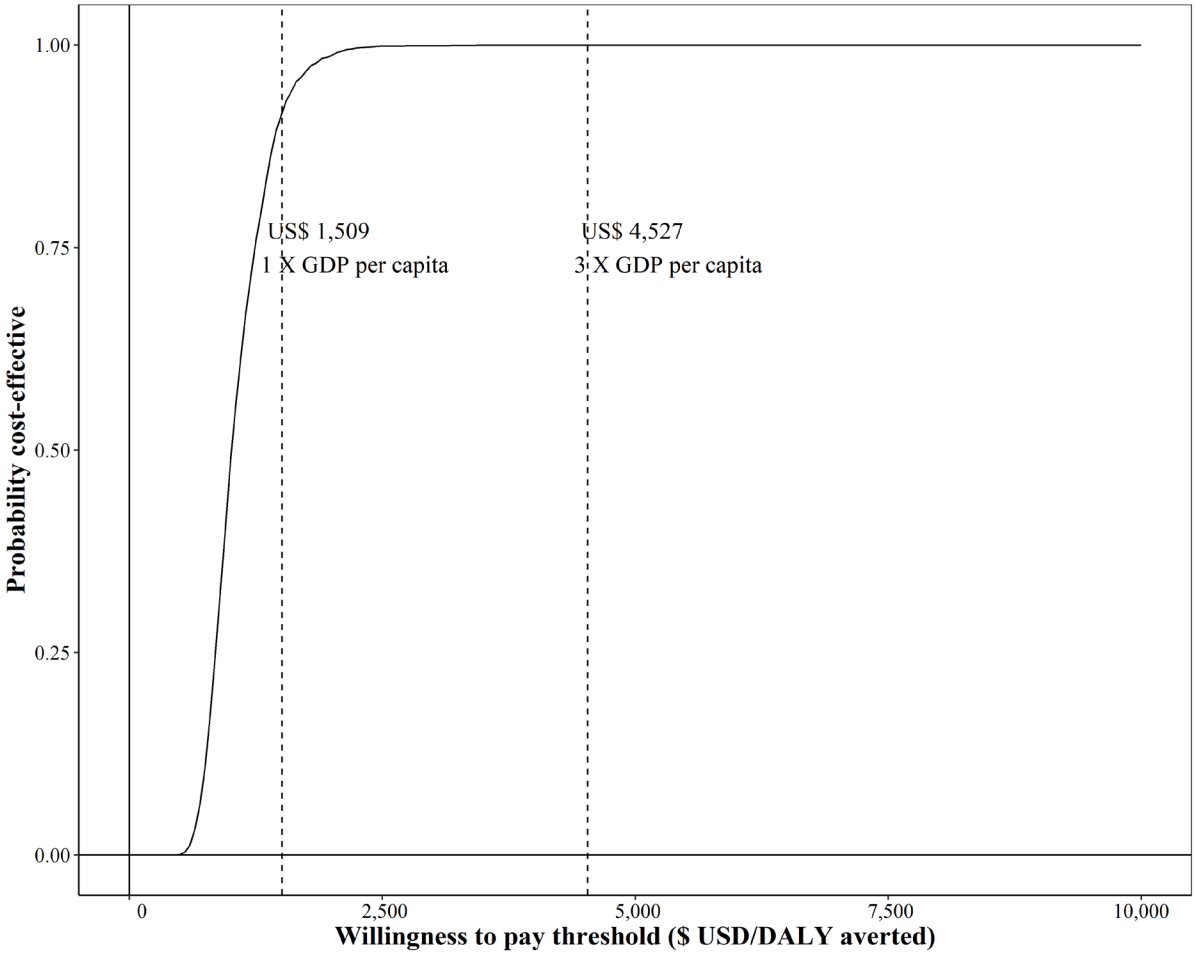
**Supplimentary impact and cost-effectiveness analysis results**



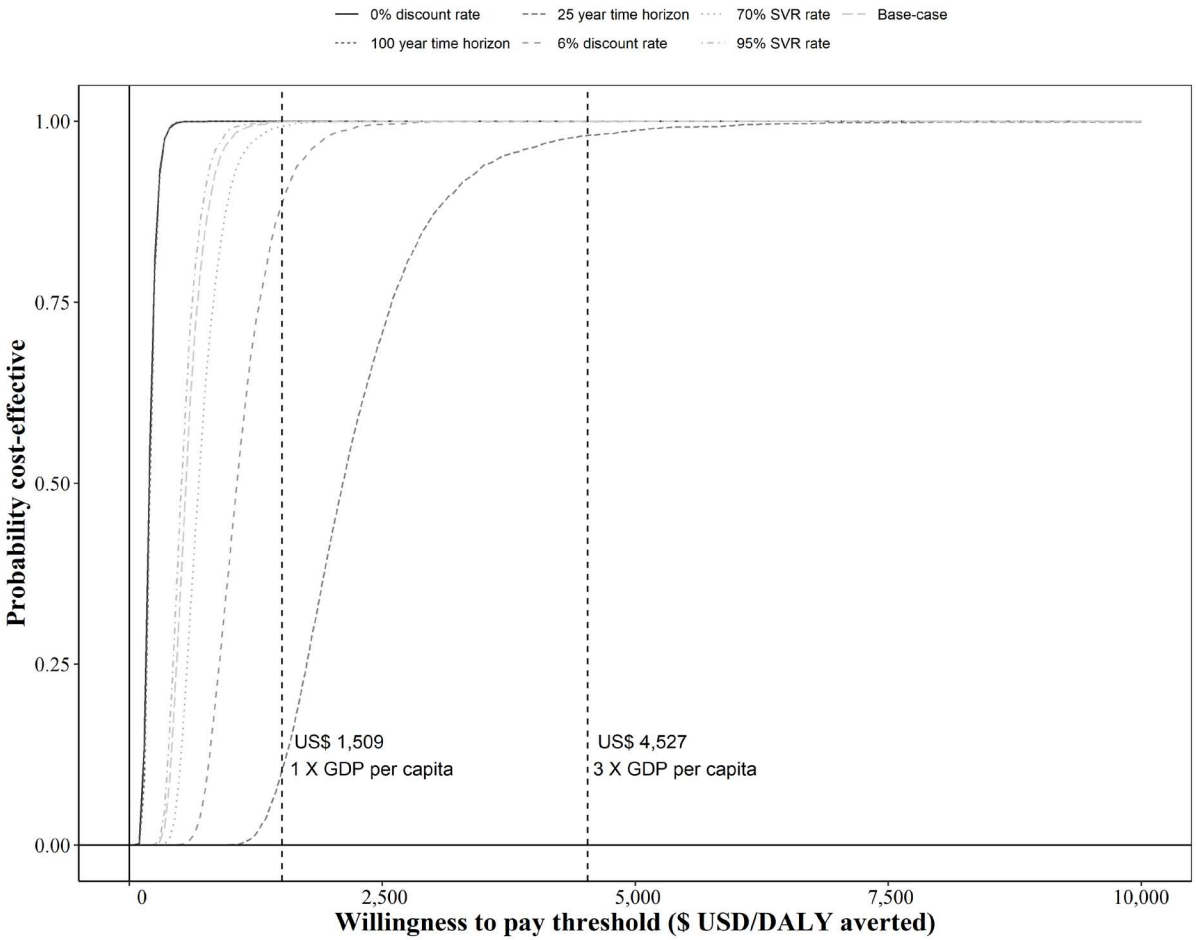

***Supplementary Figure 2.*** *Model projections for HCV and HIV prevalence in Nairobi. HCV=hepatitis C infection, HIV=human immunodeficiency virus*



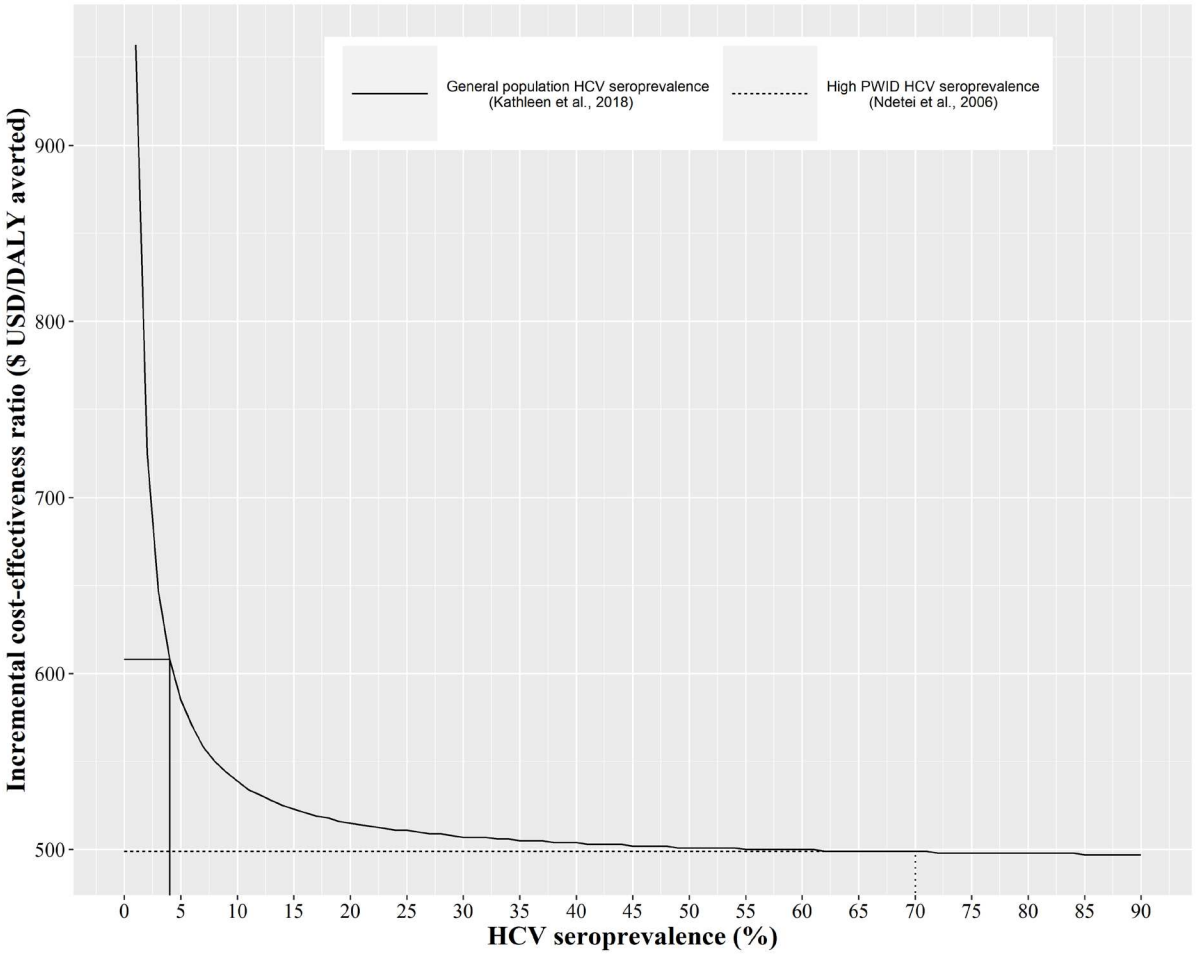

***Supplementary Figure 3.*** *Cost-effectiveness plane showing the incremental costs and disability-adjusted life years averted based on 3000 simulations. DALYs – disability adjusted life years, GDP – gross domestic product.*




***Supplementary Figure 4.*** *Cost-effectiveness acceptability curve for direct-acting antiviral-based HCV treatment in comparison to no treatment. DALY – disability adjusted life year.*




***Supplementary Figure 5.*** *Cost-effectiveness acceptability curves showing the effect of parameter assumptions on the probability of cost-effectiveness for direct-acting antiviral-based HCV treatment in comparison to no treatment. DALY – disability adjusted life year.*




***Supplementary Figure 6.*** *Incremental cost-effectiveness ratio (ICER) for HCV screening and treatment among PWID compared to no screening over a range of HCV seroprevalences. ICER: incremental cost-effectiveness ratio; DALY: disability-adjusted life years; HCV: hepatitis C virus; USD, United States dollar.*

**References**


1. Bouscaillou J, Kikvidze T, Butsashvili M, Labartkava K, Inaridze I, Etienne A, et al. Direct acting antiviral-based treatment of hepatitis C virus infection among people who inject drugs in Georgia: a prospective cohort study. International Journal of Drug Policy. 2018;62:104-11.
2. Akiyama MJ, Cleland CM, Lizcano JA, Cherutich P, Kurth AE. Prevalence, estimated incidence, risk behaviours, and genotypic distribution of hepatitis C virus among people who inject drugs accessing harm-reduction services in Kenya: a retrospective cohort study. Lancet Infect Dis. 2019;19(11):1255-63.
3. National AIDS and STI Control Programme (NASCOP) K. Kenya AIDS Indicator Survey 2012: Final Report. . Nairobi, NASCOP. ; June 2014.
4. Mathers BM, Degenhardt L, Bucello C, Lemon J, Wiessing L, Hickman M. Mortality among people who inject drugs: a systematic review and meta-analysis. Bull World Health Organ. 2013;91(2):102-23.
5. Hollingsworth TD, Anderson RM, Fraser C. HIV-1 transmission, by stage of infection. J Infect Dis. 2008;198(5):687-93.
6. Morgan D, Mahe C, Mayanja B, Okongo JM, Lubega R, Whitworth JA. HIV-1 infection in rural Africa: is there a difference in median time to AIDS and survival compared with that in industrialized countries? AIDS. 2002;16(4):597-603.
7. Low A, Nagot N, Konate I, Meda N, Segondy M, Van de Perre P, et al. Potential impact of existing interventions and of antiretroviral use in female sex workers on transmission of HIV in Burkina Faso: a modeling study. J Acquir Immune Defic Syndr. 2015;68 Suppl 2:S180-8.
8. Platt L, Minozzi S, Reed J, Vickerman P, Hagan H, French C, et al. Needle syringe programmes and opioid substitution therapy for preventing hepatitis C transmission in people who inject drugs. Cochrane Database of Systematic Reviews. 2017(9).
9. MacArthur GJ, Minozzi S, Martin N, Vickerman P, Deren S, Bruneau J, et al. Opiate substitution treatment and HIV transmission in people who inject drugs: systematic review and meta-analysis. BMJ. 2012;345(oct03 3):e5945.
10. Aspinall EJ, Nambiar D, Goldberg DJ, Hickman M, Weir A, Van Velzen E, et al. Are needle and syringe programmes associated with a reduction in HIV transmission among people who inject drugs: a systematic review and meta-analysis. Int J Epidemiol. 2014;43(1):235-48.
11. Quinn TC, Wawer MJ, Sewankambo N, Serwadda D, Li C, Wabwire-Mangen F, et al. Viral load and heterosexual transmission of human immunodeficiency virus type 1. Rakai Project Study Group. N Engl J Med. 2000;342(13):921-9.
12. Unge C, Sodergard B, Ekstrom AM, Carter J, Waweru M, Ilako F, et al. Challenges for Scaling up ART in a Resource-Limited Setting: A Retrospective Study in Kibera, Kenya. Jaids-J Acq Imm Def. 2009;50(4):397-402.
13. Unge C, Sodergard B, Marrone G, Thorson A, Lukhwaro A, Carter J, et al. Long-Term Adherence to Antiretroviral Treatment and Program Drop-Out in a High-Risk Urban Setting in Sub-Saharan Africa: A Prospective Cohort Study. Plos One. 2010;5(10).
14. Zachariah R, Tayler-Smith K, Manzi M, Massaquoi M, Mwagomba B, van Griensven J, et al. Retention and attrition during the preparation phase and after start of antiretroviral treatment in Thyolo, Malawi, and Kibera, Kenya: implications for programmes? T Roy Soc Trop Med H. 2011;105(8):421-30.
15. Ayah R. Scaling up implementation of ART: Organizational culture and early mortality of patients initiated on ART in Nairobi, Kenya. Plos One. 2018;13(1).
16. Larson BA, Bii M, Henly-Thomas S, McCoy K, Sawe F, Shaffer D, et al. ART treatment costs and retention in care in Kenya: a cohort study in three rural outpatient clinics. J Int Aids Soc. 2013;16.

17. European Association for the Study of the Liver. EASL Clinical Practice Guidelines: management of hepatitis C virus infection. Journal of hepatology. 2014;60(2):392-420.
18. Mocroft A, Kirk O, Aldins P, Chies A, Blaxhult A, Chentsova N, et al. Loss to follow-up in an international, multicentre observational study. HIV Med. 2008;9(5):261-9.
19. Low AJ, Mburu G, Welton NJ, May MT, Davies CF, French C, et al. Impact of opioid substitution therapy on antiretroviral therapy outcomes: a systematic review and meta-analysis. Clinical Infectious Diseases. 2016;63(8):1094-104.
20. Fraser H, Mukandavire C, Martin NK, Hickman M, Cohen MS, Miller WC, et al. HIV treatment as prevention among people who inject drugs–a re-evaluation of the evidence. International journal of epidemiology. 2016;46(2):466-78.
21. Micallef JM, Kaldor JM, Dore GJ. Spontaneous viral clearance following acute hepatitis C infection: a systematic review of longitudinal studies. Journal of viral hepatitis. 2006;13(1):34-41.
22. Smith DJ, Jordan AE, Frank M, Hagan H. Spontaneous viral clearance of hepatitis C virus (HCV) infection among people who inject drugs (PWID) and HIV-positive men who have sex with men (HIV+ MSM): a systematic review and meta-analysis. BMC Infect Dis. 2016;16:471.
23. Beckerleg S, Telfer M, Hundt GL. The rise of injecting drug use in East Africa: a case study from Kenya. Harm Reduct J. 2005;2:12.
24. Smith DJ, Combellick J, Jordan AE, Hagan H. Hepatitis C virus (HCV) disease progression in people who inject drugs (PWID): A systematic review and meta-analysis. International Journal of Drug Policy. 2015;26(10):911-21.
25. Thein H-H, Yi Q, Dore GJ, Krahn MD. Natural history of hepatitis C virus infection in HIV-infected individuals and the impact of HIV in the era of highly active antiretroviral therapy: a meta-analysis. Aids. 2008;22(15):1979-91.
26. Shepherd J, Jones J, Hartwell D, Davidson P, Price A, Waugh N. Interferon alfa (pegylated and non-pegylated) and ribavirin for the treatment of mild chronic hepatitis C: a systematic review and economic evaluation. NIHR Health Technology Assessment programme: Executive Summaries: NIHR Journals Library; 2007.
27. Merchante N, Girón-González JA, González-Serrano M, Torre-Cisneros J, García-García JA, Arizcorreta A, et al. Survival and prognostic factors of HIV-infected patients with HCV-related end-stage liver disease. Aids. 2006;20(1):49-57.
28. López-Diéguez M, Montes ML, Pascual-Pareja JF, Quereda C, Von Wichmann MA, Berenguer J, et al. The natural history of liver cirrhosis in HIV–hepatitis C virus-coinfected patients. Aids. 2011;25(7):899-904.
29. van der Meer AJ, Veldt BJ, Feld JJ, Wedemeyer H, Dufour J-F, Lammert F, et al. Association between sustained virological response and all-cause mortality among patients with chronic hepatitis C and advanced hepatic fibrosis. Jama. 2012;308(24):2584-93.
30. Morgan RL, Baack B, Smith BD, Yartel A, Pitasi M, Falck-Ytter Y. Eradication of hepatitis C virus infection and the development of hepatocellular carcinoma: a meta-analysis of observational studies. Annals of internal medicine. 2013;158(5_Part_1):329-37.
31. Salomon JA, Haagsma JA, Davis A, de Noordhout CM, Polinder S, Havelaar AH, et al. Disability weights for the Global Burden of Disease 2013 study. The Lancet Global Health. 2015;3(11):e712-e23.
32. World Health Organization. Guidelines for the screening care and treatment of persons with chronic hepatitis C infection. . Geneva, Swizterland; 2016.
33. AASLD/IDSA HCV Guidance Panel. Hepatitis C guidance: AASLD-IDSA recommendations for testing, managing, and treating adults infected with hepatitis C virus. 2015;62(3):932-54.

34. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. Journal of Biomedical Informatics. 2009;42(2):377-81.