Development of a Mathematical Model to Estimate the Cost-Effectiveness of the Ryan White HIV/AIDS Program

Supplementary Material

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S1. Assign individual-level attributes during the initialization

We created an initial population to represent people with HIV in the U.S. Each agent has six types of individual-level attributes: (1) Whether or not receiving services through the RWHAP, (2) care stage, (3) demographics, (4) risk group characteristics, (5) health state, and (6) need and receipt of services.

1. Whether or not receiving services through the RWHAP

We assigned 63% of person with diagnosed HIV to receive services through the RWHAP based on the following statistics. The CDC estimated that there were 1,122,900 persons with HIV in the United States at the end of 2015. Among these, 14.5 percent are undiagnosed.1 Among people with diagnosed HIV, the HIV/AIDS Bureau (HAB) estimated that approximately 608,000 received services through the RWHAP (or ADAP) in 2015.

2. Care stage

For individuals to receive services through the RWHAP, they have to see a clinician at least once, so they must be in care and treatment (Stage 4), viral suppression (Stage 5), or have left care (Stage 6). We calculated the number of RWHAP clients in care and treatment using the number of individuals who either have clinical outcomes reported in the 2016 RSR or receive one or more of the following services: outpatient ambulatory health services (OAHS) or antiretroviral therapy (ART), other core medical services, or ADAP services. HAB estimated that 82.7 percent of clients with at least one OAHS visit or ART prescription are virally suppressed. To calculate the number of RWHAP clients who have left care in a year, we subtract the number of clients in care and treatment from the total number of clients.

For individual diagnosed with HIV but does not receive services through the RWHAP, he or she can be in diagnosed but never in care (Stage 3), care and treatment (Stage 4), viral suppression (Stage 5), or have left care (Stage 6). For the Stage 4 and 5, we estimated the size of the population in each care stage by subtracting the number of RWHAP clients in a given care stage from the total number of people with HIV in that care stage. HAB estimated that approximately 50,000 people diagnosed with HIV have never been in care (HRSA HIV/AIDS Bureau, personal communication, July 31, 2018). The rest are people who do not receive services through the RWHAP, diagnosed with HIV, and have left care.

3. Demographic and risk group characteristics

We assigned the demographic and risk groups for RWHAP clients using data from the client-level 2016 RSR and ADR data. For people living with HIV who do not receive services through the RWHAP and for HIV-negative population, we used imputation methods to generate the distribution of demographic and risk group characteristics. For each care stage, we applied the conditional probabilities observed for the RWHAP clients at that care stage to the interactions for the total HIV population at that care stage. The approach assumes that the probability of being in a demographic group or risk group is the same in the general population as it is among RWHAP clients. In Table S1 through S9, we present the percentage of people with HIV by demographic and risk group in each of the relevant boxes in Figure 2. We start with the overall HIV population, which was needed for calculating the demographic and risk group characteristics for the other groups in the model. We then show the percentages by the same set of characteristics for the eight terminal nodes in Figure 2.

4. Health state

Rather than obtaining some of this data from the RSR and the remainder from the literature, we used the following approach to maintain alignment between the initialization and other modules. We estimated the distribution of CD4 at the time of acquiring HIV using the mean and standardized deviation (830 cells/μL with a SD of +/- 29 cells/μL) reported by Bofill et al.2 For other care stages, we used model simulation to estimate the distribution of CD4. If HIV is untreated, CD4 cell count will decline at a constant rate per month (4.183 cells/μL per month) until it reaches 200 cells/μL.3 We identified the average time between care stage (for instance, average time from infection to diagnosis, from diagnosis to care and treatment, etc.). For each month people with infection but no treatment will experience the decline of CD4 counts by a constant amount. After executing the program for 100 years, we recorded the CD4 counts for all PLWH by care stage.

We determine a person’s viral load by the length of time since infection. The period immediately after a person acquires HIV is referred to as the *acute phase* of the disease and is characterized by a rapid growth in the viral load. Following the acute phase and without ART, the viral load levels tend to remain near the set-point established early after HIV infection, referred to as the *chronic phase*. Table S9 provides the probability that an individual resides in a viral load strata by disease phase. We calculated the percentage of individuals in each viral load category during their chronic phase based on the following steps: Kitahata et al. provided a median viral load at baseline of 15,848.93 copies/mL and interquartile range (IQR) between 794.3 and 79,432.8 copies/mL for ART-naïve patients with a CD4 count between 351-500 and who initiated ART when their CD4 count was within one of the two thresholds. Kitahata et al. used data from the North America AIDS Cohort Collaboration on Research and Design (NA-ACCORD). We estimated a (best fitting) log-normal distribution based on the median and IQR viral loads from Kitahata et al. We then used the fitted log-normal distribution to calculate the percentage of individuals in each viral load category.

5. Service needs and receipt

We assumed that everyone living with HIV needs OAHS and ART. Receiving OAHS and ART is determined by entering Stage 4 from Stage 3.The need for and receipt of the other three types of services (referred to here as ancillary services) vary by demographic and risk group and only affect transitions after a person enters Stage 4. We used findings from Weiser et al to estimate the proportion of people with HIV who need each type of ancillary service, as well as the proportion of those who receive it.4 We assumed ancillary service need was exogenous to the model and was the same (conditional on demographic and risk group) for people who receive services through the RWHAP and those who do not (Table S10). However, receiving services through the RWHAP affect the receipt of a service he or she needs (Table S11).

S2. Estimation of HIV-negative population at non-negligible risk of acquiring HIV

To identify the HIV-negative population at non-negligible risk of acquiring HIV, we used the same four risk categories for person with HIV in the model: men who have sex with men (MSM), injection drug users (IDU), MSM and IDU (MSM+IDU), and individuals who are neither MSM or IDU but have an elevated risk of acquiring HIV due to unprotected heterosexual contact (heterosexual).We used the size of the first three groups to determine the number of people in the fourth, by using the ratio between these risk categories found in CDC surveillance estimates of the people with HIV. This assumes (1) all people belonging to the MSM, IDU, or MSM+IDU groups who are not living with an HIV infection have a non-negligible chance of acquiring one, and (2) the relative size of each population group with an elevated risk of acquiring HIV among those who are not living with an HIV infection is the same as the relative size of each population group among all people with HIV.

We started with the 2017 American Community Survey (ACS) 1-year estimates to obtain data on the total size of the U.S. population age 13 or older by gender (137,326,946 males and 143,218,434 females). Purcell and colleagues found that 3.9 percent of males age 13 or older in the United States had sex with men during a five-year recall period.5 We estimated that 5,355,751 men age 13 or over are MSM. Lansky and colleagues found that 0.3 percent of people age 13 or older in the United States injected drugs in the past year.6 We estimated the size of the past-year IDU population at 841,636. To avoid double counting the individuals who are both MSM and IDU, we used the estimate from CDC that 5.1 percent of people with HIV belonged to the MSM+IDU group. Finally, the CDC estimates that 73.8 percent of people with HIV belong to either the MSM, IDU, or MSM+IDU group. The remaining 26.2 percent of clients are assigned to the “heterosexual” risk category. We applied the same ratio and estimated the size of the “heterosexual” risk group. Based on calculations described above, we estimate that the size of the HIV-negative population in the United States with a non-negligible chance of acquiring HIV is 6,851,789. The non-negligible risk group represents approximately 2.4 percent of the total U.S. population over the age of 13 (280,545,380) and is approximately 6.1 times the number of the people with HIV in the U.S. (1,122,900). We provide a summary of the results of our calculations in Table S12.

S3. Estimate HIV transmission probabilities through sexual contact by different viral load categories and by different types of sexual contact

HIV transmission probability depends on viral load and sexual contact. To estimate how HIV transmission probability vary by viral load, we acquired estimates of HIV transmission probability for heterosexual contact based on a meta-analysis by Attia et al and two more recent studies (Table S14).7-9

Data on how HIV transmission probability vary by viral load among MSM are sparser. Therefore, to estimate the transmission probability by viral load among MSM, we take the viral-load-stratified transmission probability among the heterosexual contact and apply a ratio of the transmission probability of MSM contact and heterosexual contact. Gopalappa et al reported the transmission probability per sex act for different kinds of sexual contact.10 For example, the average HIV transmission rate per sexual encounter among non-MSMs is 0.0011. The average HIV transmission rate per sexual encounter among MSMs is 0.0050. The ratio of HIV transmission rates between MSM and non-MSM is: 0050/.0011 = 4.57. We then lowered the multiplier to 2.0 during model calibration. Finally, we derived viral load- and risk group-stratified rates by multiplying the overall viral load rates from Attia et al. by 2.0 and assigning these new rates to the MSM group. The probability of transmitting HIV through MSM is listed in Table S14.

S4. Estimate the impact of services on retention in care and viral suppression

Not receiving a service that people with HIV needs will decrease the probability of staying in care. We used results from Messeri et al to estimate the impact of services on retention.11 Let be the monthly probability of remaining in medical care and treatment (Stages 4 and 5) for a person who receives his or her needed services. We set (for a 40 year old with a CD4 count of 400) based on estimates in the literature. Let be the monthly probability of remaining in medical care and treatment (Stages 4 and 5) for a person who needs but does not receive service, therefore . Let be the monthly probability of death; for simplification we set , which is the monthly probability of death for a 40 year old with a CD4 count of 400. Let denote the percentage increase in the monthly probability of transitioning from care and treatment (Stage 4) to left care (Stage 6) for someone needing but not receiving service . This modifier specifies the percentage increase in the transition to out of care. The modifier in the transition probability for someone needing but not receiving services can be represented as:

Table S17 shows Messeri and colleagues’ impact estimates (as odds ratios) for an ancillary service, first, when the service is the only provided service and, second, as well as the isolated contribution of the service when provide in combination with other services. In order to use the estimates reported by Messeri et al, we have to map the estimates of their seven service categories into the estimates of the three service categories we use in the cost-effectiveness model. To replicate the definition of the service categories in our model, we added the estimates for medical case management and case management counselling for MCM in our model (therefore, MCM in the model is defined as receiving both medical case management and case management counselling). We weighted the estimates for mental health services and therapeutic drug treatment for MH/SA in our model. Finally, we weighted the estimates for social case management, transportation, and housing services for all support services in the model. We estimated the weights for the services based on data from the 2016 RSR (Table S18). We show the calculated values of for each combination of services in Table S19.

Not receiving a service that people with HIV needs will decrease the probability of achieving viral suppression. However, there is no data available in the literature. In order to estimate the impact of services on achieving viral suppression, we assumed each ancillary service has the same *relative* impact on viral suppression as it does on care retention, and estimated the value of this multiplier using model calibration technique. We calibrated the model inputs for the impact of services on achieving viral suppression so that the viral suppression rate among RWHAP clients in care and treatment matched the projected viral suppression rate of 89 percent.12-15 Finally, we multiplied the modifiers to the transition inputs for care retention by the estimated multiplier to obtain the modifiers for the transition to viral suppression. The estimated decrease in the probability of transitioning from Stage 4 to Stage 5 due to unmet ancillary service need is presented in Table S20.

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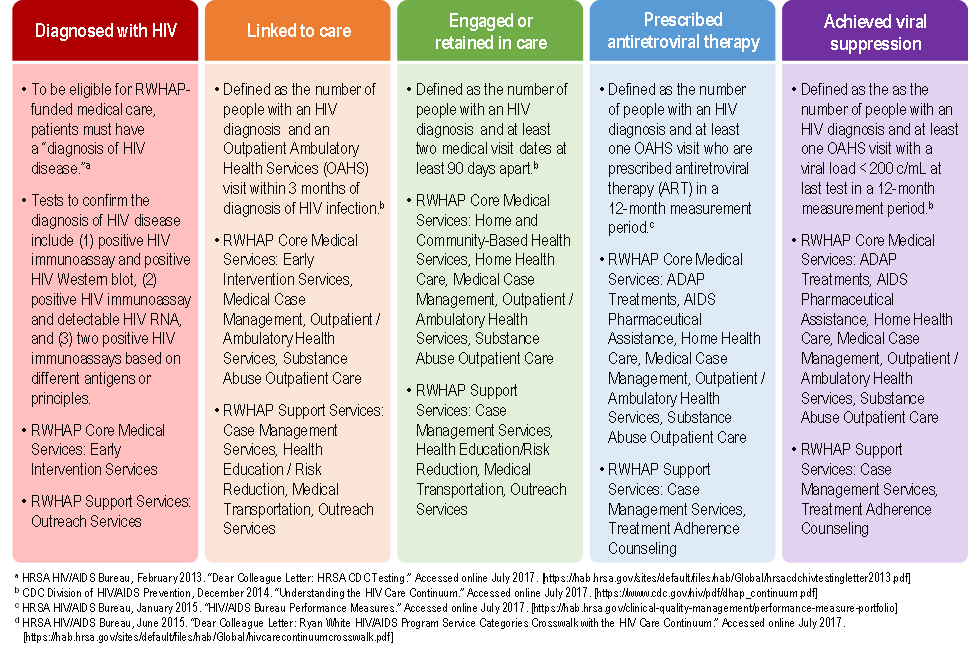
Figure S1. The RWHAP in the context of the HIV care continuum.

Table S1. Percentage of people with HIV in the United States, by demographic and risk group (Box N1)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 1.38 | n.a. | 16.12 | n.a. | 6.13 | n.a. |
| IDU only | 0.13 | 0.08 | 2.04 | 1.36 | 0.85 | 0.57 |
| MSM and IDU | 0.09 | n.a. | 1.44 | n.a. | 0.60 | n.a. |
| Other risk | 0.22 | 0.39 | 2.39 | 5.10 | 0.89 | 2.00 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.78 | n.a. | 8.71 | n.a. | 3.27 | n.a. |
| IDU only | 0.07 | 0.04 | 1.09 | 0.73 | 0.45 | 0.30 |
| MSM and IDU | 0.05 | n.a. | 0.77 | n.a. | 0.32 | n.a. |
| Other risk | 0.12 | 0.22 | 1.30 | 2.75 | 0.48 | 1.07 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 1.07 | n.a. | 13.68 | n.a. | 5.34 | n.a. |
| IDU only | 0.10 | 0.07 | 1.77 | 1.19 | 0.74 | 0.50 |
| MSM and IDU | 0.07 | n.a. | 1.25 | n.a. | 0.52 | n.a. |
| Other risk | 0.17 | 0.31 | 2.02 | 4.37 | 0.78 | 1.75 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Notes: Percentages are based on an estimated **1,122,900** people with HIV in the United States. Percentages might not add to 100 due to rounding. The CDC reports the number of undiagnosed and diagnosed cases for age, race/ethnic, and gender/risk group separately. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

CDC = Centers for Disease Control and Prevention; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program.

n.a. = not applicable

Table S2 Percentage of people with HIV who are undiagnosed, by demographic and risk group (Box P1)

| Race/ethnicity and risk group | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 2.1 | n.a. | 17.6 | n.a. | 3.8 | n.a. |
| IDU only | 0.0 | 0.0 | 0.4 | 0.7 | 1.0 | 0.3 |
| MSM and IDU | 0.0 | n.a. | 0.3 | n.a. | 0.3 | n.a. |
| Other risk | 0.3 | 0.5 | 3.8 | 7.1 | 1.9 | 2.5 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.8 | n.a. | 12.7 | n.a. | 2.4 | n.a. |
| IDU only | 0.0 | 0.0 | 0.6 | 0.3 | 0.4 | 0.1 |
| MSM and IDU | 0.0 | n.a. | 0.4 | n.a. | 0.1 | n.a. |
| Other risk | 0.1 | 0.2 | 2.1 | 2.3 | 0.8 | 0.8 |
| Other race and ethnicity |  |  |  |  |  |  |
| MSM only | 0.6 | n.a. | 17.2 | n.a. | 8.0 | n.a. |
| IDU only | 0.0 | 0.0 | 0.5 | 0.3 | 0.3 | 0.1 |
| MSM and IDU | 0.0 | n.a. | 1.1 | n.a. | 0.4 | n.a. |
| Other risk | 0.1 | 0.1 | 1.2 | 2.0 | 0.6 | 0.7 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages are based on an estimated **162,500** people with HIV who are undiagnosed in the United States. Percentages might not add to 100 due to rounding. The CDC reports the number of undiagnosed cases for age, race/ethnic, and gender/risk group separately. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

CDC = Centers for Disease Control and Prevention; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program.

n.a. = not applicable

Table S3. Percentage of RWHAP clients who are in care and treatment and virally suppressed, by demographic and risk group (Box P2)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 1.5 | n.a. | 14.3 | n.a. | 3.5 | n.a. |
| IDU only | 0.0 | 0.1 | 0.7 | 1.9 | 2.0 | 1.1 |
| MSM and IDU | 0.0 | n.a. | 0.3 | n.a. | 0.3 | n.a. |
| Other risk | 0.1 | 0.4 | 2.5 | 8.3 | 1.4 | 3.2 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.6 | n.a. | 11.5 | n.a. | 2.3 | n.a. |
| IDU only | 0.0 | 0.0 | 1.0 | 0.8 | 0.8 | 0.3 |
| MSM and IDU | 0.0 | n.a. | 0.4 | n.a. | 0.1 | n.a. |
| Other risk | 0.1 | 0.1 | 1.5 | 2.8 | 0.6 | 1.1 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 0.5 | n.a. | 16.0 | n.a. | 8.0 | n.a. |
| IDU only | 0.0 | 0.0 | 1.0 | 1.0 | 0.6 | 0.4 |
| MSM and IDU | 0.0 | n.a. | 1.1 | n.a. | 0.4 | n.a. |
| Other risk | 0.0 | 0.1 | 0.9 | 2.5 | 0.5 | 1.0 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages will be based on **437,189** RWHAP clients in care and treatment who are virally suppressed. Percentages may not add to 100 due to rounding. We excluded those with missing data, those younger than 13 or older than 100, and those reported as transgender. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

ADR = ADAP Data Report; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report;

n.a. = not applicable

Table S4. Percentage of RWHAP clients who are in care and treatment but not virally suppressed, by demographic and risk group (Box P3)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 3.8 | n.a. | 21.3 | n.a. | 2.2 | n.a. |
| IDU only | 0.0 | 0.2 | 1.1 | 2.6 | 1.7 | 0.8 |
| MSM and IDU | 0.0 | n.a. | 0.6 | n.a. | 0.2 | n.a. |
| Other risk | 0.4 | 1.3 | 3.6 | 10.9 | 1.2 | 2.1 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 1.3 | n.a. | 10.3 | n.a. | 1.0 | n.a. |
| IDU only | 0.0 | 0.0 | 1.5 | 0.9 | 0.7 | 0.2 |
| MSM and IDU | 0.0 | n.a. | 0.6 | n.a. | 0.1 | n.a. |
| Other risk | 0.1 | 0.3 | 1.6 | 2.9 | 0.4 | 0.6 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 0.8 | n.a. | 11.6 | n.a. | 2.4 | n.a. |
| IDU only | 0.0 | 0.1 | 1.2 | 1.2 | 0.3 | 0.2 |
| MSM and IDU | 0.1 | n.a. | 1.3 | n.a. | 0.2 | n.a. |
| Other risk | 0.1 | 0.2 | 0.8 | 2.4 | 0.2 | 0.4 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages are based on **91,775** RWHAP clients who are in care and treatment and are not virally suppressed. Percentages might not add to 100 due to rounding. We excluded those with missing data, those younger than 13 or older than 100, and those reported as transgender. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

ADR = ADAP Data Report; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report.

n.a. = not applicable

Table S5. Percentage of people with HIV who received RWHAP services and left care, by demographic and risk group (Box P4)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 1.6 | n.a. | 15.0 | n.a. | 4.2 | n.a. |
| IDU only | 0.0 | 0.1 | 1.3 | 2.2 | 2.7 | 1.3 |
| MSM and IDU | 0.0 | n.a. | 0.5 | n.a. | 0.4 | n.a. |
| Other risk | 0.2 | 0.6 | 3.2 | 8.8 | 1.8 | 3.2 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.6 | n.a. | 8.5 | n.a. | 2.3 | n.a. |
| IDU only | 0.0 | 0.0 | 1.8 | 0.8 | 1.0 | 0.3 |
| MSM and IDU | 0.0 | n.a. | 0.4 | n.a. | 0.1 | n.a. |
| Other risk | 0.1 | 0.1 | 1.4 | 2.1 | 0.6 | 0.9 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 0.4 | n.a. | 13.2 | n.a. | 7.9 | n.a. |
| IDU only | 0.0 | 0.0 | 1.3 | 1.2 | 0.7 | 0.5 |
| MSM and IDU | 0.0 | n.a. | 1.2 | n.a. | 0.5 | n.a. |
| Other risk | 0.0 | 0.1 | 0.9 | 2.6 | 0.5 | 1.0 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages are based on **79,036** RWHAP clients who are in care and treatment and are not virally suppressed. Percentages might not add to 100 due to rounding. We excluded those with missing data, those younger than 13 or older than 100, and those reported as transgender. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

ADR = ADAP Data Report; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report.

n.a. = not applicable

Table S6. Percentage of people with diagnosed HIV who do not receive RWHAP services, are in care and treatment, and are virally suppressed, by demographic and risk group (Box P5)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 1.4 | n.a. | 13.3 | n.a. | 3.2 | n.a. |
| IDU only | 0.0 | 0.0 | 0.7 | 0.7 | 2.0 | 0.4 |
| MSM and IDU | 0.0 | n.a. | 1.9 | n.a. | 1.7 | n.a. |
| Other risk | 0.2 | 0.3 | 2.7 | 5.9 | 1.5 | 2.3 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.5 | n.a. | 10.7 | n.a. | 2.1 | n.a. |
| IDU only | 0.0 | 0.0 | 1.0 | 0.3 | 0.8 | 0.1 |
| MSM and IDU | 0.0 | n.a. | 2.3 | n.a. | 0.7 | n.a. |
| Other risk | 0.1 | 0.1 | 1.6 | 2.0 | 0.6 | 0.8 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 0.5 | n.a. | 14.8 | n.a. | 7.4 | n.a. |
| IDU only | 0.0 | 0.0 | 1.0 | 0.4 | 0.6 | 0.2 |
| MSM and IDU | 0.1 | n.a. | 6.6 | n.a. | 2.4 | n.a. |
| Other risk | 0.0 | 0.1 | 0.9 | 1.8 | 0.5 | 0.7 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages are based on an estimated **137,130** people with HIV who do not receive RWHAP services and are virally suppressed. Percentages may not add to 100 due to rounding. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

ADR = ADAP Data Report; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report;

n.a. = not applicable

Table S7. Percentage of people with diagnosed HIV who do not receive RWHAP services and are in care and treatment, but are not virally suppressed, by demographic and risk group (Box P6)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 2.4 | n.a. | 12.8 | n.a. | 1.2 | n.a. |
| IDU only | 0.0 | 0.2 | 1.4 | 2.6 | 2.9 | 1.1 |
| MSM and IDU | 0.1 | n.a. | 3.1 | n.a. | 1.5 | n.a. |
| Other risk | 0.4 | 1.0 | 4.3 | 11.1 | 1.7 | 3.0 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.8 | n.a. | 5.9 | n.a. | 0.5 | n.a. |
| IDU only | 0.0 | 0.0 | 2.0 | 1.0 | 1.2 | 0.4 |
| MSM and IDU | 0.1 | n.a. | 3.2 | n.a. | 0.4 | n.a. |
| Other risk | 0.1 | 0.2 | 2.0 | 3.3 | 0.6 | 0.9 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 0.5 | n.a. | 6.4 | n.a. | 1.0 | n.a. |
| IDU only | 0.0 | 0.0 | 1.7 | 1.3 | 0.7 | 0.4 |
| MSM and IDU | 0.3 | n.a. | 7.6 | n.a. | 1.5 | n.a. |
| Other risk | 0.1 | 0.2 | 1.1 | 2.8 | 0.4 | 0.8 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages are based on an estimated **38,839** people with diagnosed HIV who did not receive RWHAP services and are in care and treatment, but are not virally suppressed. Percentages might not add to 100 due to rounding. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

ADR = ADAP Data Report; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report.

n.a. = not applicable

Table S8. Percentage of people with HIV with diagnosed HIV who do not receive RWHAP services and left care (Box T7) and those who were never in care, by demographic and risk group (Box P8)

| **Race/ethnicity and risk group** | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 1.7 | n.a. | 14.2 | n.a. | 3.1 | n.a. |
| IDU only | 0.0 | 0.1 | 1.7 | 2.1 | 4.4 | 1.1 |
| MSM and IDU | 0.0 | n.a. | 0.7 | n.a. | 0.5 | n.a. |
| Other risk | 0.2 | 0.4 | 2.8 | 6.4 | 1.5 | 2.2 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 0.6 | n.a. | 10.2 | n.a. | 1.9 | n.a. |
| IDU only | 0.0 | 0.0 | 2.5 | 0.8 | 1.8 | 0.3 |
| MSM and IDU | 0.0 | n.a. | 0.7 | n.a. | 0.2 | n.a. |
| Other risk | 0.1 | 0.2 | 1.5 | 2.0 | 0.6 | 0.8 |
| Other race/ethnicity |  |  |  |  |  |  |
| MSM only | 0.5 | n.a. | 13.8 | n.a. | 6.5 | n.a. |
| IDU only | 0.0 | 0.0 | 2.2 | 1.1 | 1.2 | 0.4 |
| MSM and IDU | 0.0 | n.a. | 2.0 | n.a. | 0.7 | n.a. |
| Other risk | 0.0 | 0.1 | 0.9 | 1.8 | 0.5 | 0.7 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf); RSR 2015; ADR 2015.

Note: Percentages are based on an estimated **126,430** people with HIV did not receive RWHAP services and left treatment and an estimated **50,000** people with diagnosed HIV have never been in care. Percentages may not add to 100 due to rounding. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

ADR = ADAP Data Report; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report.

n.a. = not applicable

Table S9. Percentage of people with HIV by viral load within each disease phase

|  |  |  |  |
| --- | --- | --- | --- |
| **Viral load category** | **Acute  phase** | **Chronic  phase** | **Virally  suppressed** |
| More than 50,000 copies/mL | 100 | 33.0 | 0 |
| 10,000–50,000 copies/mL | 0 | 17.7 | 0 |
| 3,500–9,999 copies mL | 0 | 11.7 | 0 |
| 400–3,499 copies/mL | 0 | 20.1 | 0 |
| Fewer than 400 copies/mL | 0 | 17.5 | 100 |

Source: We approximated the percentage of individuals in each viral load category during their chronic phase based on data from the North America AIDS Cohort Collaboration on Research and Design (NA-ACCORD).

Table S10. The proportion of people with HIV who need medical case management, mental health/substance abuse, and support services, by demographic group, and risk group

| **Race/ethnicity and risk group** | **Medical case management** | | | | | | **Mental health/substance abuse** | | | | | | **Support services** | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| **M** | **F** | **M** | **F** | **M** | **F** | **M** | **F** | **M** | **F** | **M** | **F** | **M** | **F** | **M** | **F** | **M** | **F** |
| Black |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MSM only | 75.4 | n.a. | 65.2 | n.a. | 60.2 | n.a. | 19.4 | n.a. | 18.0 | n.a. | 17.3 | n.a. | 91.7 | n.a. | 91.5 | n.a. | 91.9 | n.a. |
| IDU only | 59.4 | 74.9 | 68.2 | 70.6 | 66.1 | 69.2 | 19.8 | 11.9 | 24.9 | 31.3 | 24.2 | 30.9 | 84.7 | 88.9 | 93.9 | 96.1 | 90.5 | 90.6 |
| MSM and IDU | 65.8 | n.a. | 69.6 | n.a. | 65.3 | n.a. | 24.4 | n.a. | 25.3 | n.a. | 24.4 | n.a. | 78.2 | n.a. | 98.4 | n.a. | 97.8 | n.a. |
| Other risk | 75.9 | 79.3 | 67.2 | 71.1 | 66.3 | 68.3 | 25.3 | 29.2 | 16.3 | 20.5 | 15.5 | 19.9 | 89.3 | 94.6 | 92.0 | 94.4 | 91.8 | 93.8 |
| Hispanic |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MSM only | 75.3 | n.a. | 61.9 | n.a. | 57.7 | n.a. | 22.7 | n.a. | 18.1 | n.a. | 17.9 | n.a. | 88.8 | n.a. | 88.5 | n.a. | 89.9 | n.a. |
| IDU only | 69.6 | 53.5 | 71.8 | 78.1 | 71.2 | 76.5 | 17.9 | 39.7 | 31.3 | 33.2 | 31.5 | 37.0 | 82.6 | 95.3 | 85.3 | 90.5 | 86.3 | 87.4 |
| MSM and IDU | 79.0 | n.a. | 65.0 | n.a. | 62.2 | n.a. | 25.5 | n.a. | 30.4 | n.a. | 27.1 | n.a. | 100 | n.a. | 90.2 | n.a. | 90.7 | n.a. |
| Other risk | 76.0 | 80.3 | 65.3 | 71.6 | 64.3 | 70.2 | 34.5 | 34.5 | 17.5 | 25.0 | 22.1 | 27.4 | 88.2 | 91.1 | 84.9 | 90.1 | 82.0 | 84.9 |
| Other race/ethnicity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MSM only | 77.6 | n.a. | 64.2 | n.a. | 58.4 | n.a. | 22.8 | n.a. | 20.0 | n.a. | 16.4 | n.a. | 87.3 | n.a. | 85.1 | n.a. | 88.3 | n.a. |
| IDU only | 86.8 | 80.3 | 72.3 | 77.5 | 66.7 | 72.1 | 22.5 | 17.4 | 20.8 | 27.1 | 19.8 | 30.7 | 82.4 | 92.6 | 88.5 | 91.6 | 87.8 | 93.8 |
| MSM and IDU | 84.4 | n.a. | 71.0 | n.a. | 66.6 | n.a. | 26.3 | n.a. | 29.8 | n.a. | 26.4 | n.a. | 90.4 | n.a. | 92.6 | n.a. | 93.3 | n.a. |
| Other risk | 73.8 | 78.6 | 66.5 | 73.4 | 63.0 | 67.7 | 23.9 | 25.2 | 16.3 | 21.3 | 13.4 | 19.1 | 86.4 | 88.7 | 85.0 | 92.6 | 85.7 | 90.4 |

Source: RSR 2015; Weiser et al. (2015).

Note: The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

F = Female; IDU = injection drug use; M = male; MSM = men who have sex with men; people with HIV = people living with HIV; RSR = Ryan White HIV/AIDS Program Services Report: n.a. = not applicable

Table S11. Percentage of people with HIV using a given service, by program and service type

|  | **Program** | |
| --- | --- | --- |
| **Service** | **RWHAP** | **Non-RWHAP** |
| Medical case management | 93.5 | 87.7 |
| Mental health/substance abuse | 84.0 | 78.7 |
| Support services | 78.7 | 76.9 |

Source: RSR 2015; Weiser et al. (2015).

Note: The percentage of people with HIV who use each service does not vary by demographic or risk group characteristics.

RWHAP = Ryan White HIV/AIDS Program; RSR = Ryan White HIV/AIDS Program Services Report.

Table S12. Calculations used to identify the number of people in the United States at risk for HIV infection

| **Number** | **Value** | **Source** |
| --- | --- | --- |
| **U.S. population** |  |  |
| Males age 13+ | 137,326,946 | 2017 ACS 1-year estimates |
| Females age 13+ | 143,218,434 | 2017 ACS 1-year estimates |
| **MSM population** |  |  |
| Percent of males age 13+ who are MSM | 3.9 | Purcell et al. |
| Males age 13+ who are MSM | 5,355,751 | ACS and Purcell et al. |
| **IDU population** |  |  |
| Percentage 13+ who are IDU | 0.3 | Lansky et al. |
| Population age 13+ who are IDU | 841,636 | ACS and Lansky et al. |
| **MSM+IDU population** |  |  |
| Combined total of MSM and IDU populations | 6,197,387 | ACS, Lansky et al., Purcell et al. |
| Percent of RSR that is MSM+IDU | 5.1 | 2016 RSR |
| Population age 13+ who are MSM and IDU | 316,067 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| Combined total of MSM and IDU populations, minus those who are both MSM+IDU | 5,881,320 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| MSM and IDU who are HIV infected | 824,700 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| Remaining at-risk MSM and IDU population | 5,056,620 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| **At risk but not MSM or IDU population** |  |  |
| Percent of RSR that is not MSM or IDU | 26.2 | 2016 RSR |
| Percent of RSR that is MSM and/or IDU | 73.8 | 2016 RSR |
| Population age 13+ at-risk but not MSM or IDU | 1,795,169 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| **Total at-risk population** |  |  |
| Total at-risk population | 6,851,789 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| As a percentage of total U.S. population | 2.4 | ACS, Lansky et al., Purcell et al., 2016 RSR |
| Population of people with HIV | 1,122,900 | CDC |
| Times larger than people with HIV population | 6.1 | ACS, Lansky et al., Purcell et al., 2016 RSR, CDC |

Source: 2016 RSR; 2017 American Community Survey 1-year estimates; Lansky et al. 2014; Purcell et al. 2012; Centers for Disease Control and Prevention. Estimated HIV incidence and prevalence in the United States, 2010–2015. HIV Surveillance Supplemental Report 2018;23(No. 1). [http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf). Published March 2018.

CDC = Centers for Disease Control; IDU = injection drug users; MSM = men who have sex with men; RSR = Ryan White HIV/AIDS Program Services Report.

Table S13. Percentage of population at elevated risk for becoming HIV infected, by demographic and risk group

| Race/ethnicity and risk group | **Youth (13–24)** | | **Adult (25–54)** | | **Older adult (55+)** | |
| --- | --- | --- | --- | --- | --- | --- |
| **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Black |  |  |  |  |  |  |
| MSM only | 7.1 | n.a. | 19.5 | n.a. | 2.2 | n.a. |
| IDU only | 0.4 | 0.3 | 1.0 | 0.7 | 0.1 | 0.1 |
| MSM and IDU | 0.3 | n.a. | 0.9 | n.a. | 0.1 | n.a. |
| Other risk | 0.8 | 1.6 | 2.1 | 4.5 | 0.2 | 0.5 |
| Hispanic |  |  |  |  |  |  |
| MSM only | 4.4 | n.a. | 12.0 | n.a. | 1.3 | n.a. |
| IDU only | 0.2 | 0.2 | 0.6 | 0.4 | 0.1 | 0.0 |
| MSM and IDU | 0.2 | n.a. | 0.6 | n.a. | 0.1 | n.a. |
| Other risk | 0.5 | 1.0 | 1.3 | 2.8 | 0.1 | 0.3 |
| Other race and ethnicity |  |  |  |  |  |  |
| MSM only | 5.4 | n.a. | 14.7 | n.a. | 1.6 | n.a. |
| IDU only | 0.3 | 0.2 | 0.7 | 0.5 | 0.1 | 0.1 |
| MSM and IDU | 0.2 | n.a. | 0.7 | n.a. | 0.1 | n.a. |
| Other risk | 0.6 | 1.2 | 1.6 | 3.4 | 0.2 | 0.4 |

Source: [HIV Surveillance Supplemental Report Volume 23, Number 1, March 2018](https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-23-1.pdf).

Note: Percentages are based on an estimated **38,500** people in the United States who became HIV infected in 2015. Percentages might not add to 100 due to rounding. The CDC reports the number of undiagnosed cases for age, race/ethnic, and gender/risk group separately. We imputed cross-tabulations for the undiagnosed population by multiplying the percentages in each age, race/ethnicity, and gender/risk group combination. The imputation methodology assumes that the distributions across groups are independent. The other race/ethnicity group includes the American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, white, and multiple races categories. The other risk group includes hemophilia/coagulation disorder, heterosexual contact, transfusion, blood components or tissue, and perinatal transmission.

CDC = Centers for Disease Control and Prevention; IDU = injection drug use; MSM = men who have sex with men; people with HIV = people living with HIV; RWHAP = Ryan White HIV/AIDS Program.

Table S14. HIV transmission probabilities through sexual contact, by viral load category and type of sexual contact

|  | Probability of transmitting HIV per 100 person-years | |
| --- | --- | --- |
| Viral load category | MSM | Non-MSM |
| More than 50,000 copies/mL | 18.06 | 9.03 |
| 10,000–50,000 copies/mL | 16.24 | 8.12 |
| 3,500–9,999 copies mL | 8.34 | 4.17 |
| 400–3,499 copies/mL | 4.12 | 2.06 |
| 200-399 copies/mL | 0.32 | 0.16 |
| Fewer than 200 copies/mL | 0.00 | 0.00 |

Source: non-MSM values are from (Attia et al, 2009). MSM values are calculated through model calibration.

Table S15. Monthly probability of transitioning from undiagnosed to diagnosed, by gender and risk group

| **Gender** | **Risk group** | **Monthly transition probability** |
| --- | --- | --- |
| Male | MSM only |  |
|  | IDU only |  |
|  | MSM and IDU |  |
|  | Other |  |
| Female | IDU |  |
|  | Other |  |

Source: CDC’s [*Morbidity and Mortality Weekly Report (MMWR),* Weekly / Vol. 66 / No. 47, December 1, 2017](https://www.cdc.gov/mmwr/volumes/66/wr/mm6647e1.htm?s_cid=mm6647e1_w#T1_down) <https://www.cdc.gov/mmwr/volumes/66/wr/pdfs/mm6647-H.pdf>

Table S16 The death rate and the AIDS or death (AIDS/death) rate (per 100 person-years), by current CD4 cell count and age.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Age in years | CD4 count, cells/mL | | | | | | | | Death rate for general population |
| <50 | 50-99 | 100-199 | 200-349 | 350-499 | >500 | All | |
| 15-24 | 34.7 (27/77.9) | 6.1 (2/33.0) | 1.1 (1/91.7) | 0.71 (2/280) | 0.58 (2/343) | 0.65 (5/774) | 2.4 (39/1600) | 0.08 | |
| 25-34 | 47.7 (157/329) | 10.8 (20/185) | 3.7 (16/437) | 1.1 (13/1190) | 0.38 (5/1330) | 0.22 (5/2270) | 3.8 (216/5740) | 0.09 | |
| 35-44 | 58.8 (164/279) | 15.6 (26/167) | 4.5 (15/330) | 0.92 (7/760) | 0.74 (6/809) | 0.85 (10/1170) | 6.5 (228/3517) | 0.18 | |
| 45-54 | 66 (83/126) | 18.8 (14/74.6) | 7.7 (13/168) | 1.8 (6/341) | 1.3 (4/299) | 0.86 (3/347) | 9 (123/1360) | 0.46 | |
| ≥55 | 91.2 (30/32.9) | 21.4 (7/32.7) | 17.6 (14/79.4) | 3.8 (5/132) | 2.5 (2/80.8) | 0.91 (1/110) | 12.6 (59/467) | 1.84 | |

Source: Dunn, D., P.Woodburn, T. Duong, J. Peto, A. Phillips, et al. 2008. “Current CD4 Cell Count and the Short-Term Risk of AIDS and Death before the Availability of Effective Antiretroviral Therapy in HIV-Infected Children and Adults.” Journal of Infectious Diseases, February, 1 (197), pp. 398-404.

Table S17. Mapping between ancillary services defined by Messeri and those used in RWHAP cost-effectiveness model

|  |  |  |
| --- | --- | --- |
| Service category | Odds Ratio | Variable Representation |
| *(Messeri et al, 2002)* |  |  |
| 1. Medical case management |  |  |
| Alone | 2.3\* |  |
| With other services | 1.2 |  |
| 2. Case management counselling |  |  |
| Alone | 2.6\* |  |
| With other services | 1.3 |  |
| 3. Mental health services |  |  |
| Alone | 1.5 |  |
| With other services | 1.2 |  |
| 4. Therapeutic drug treatment |  |  |
| Alone | 1.5 |  |
| With other services | 1.3 |  |
| 5. Case management social services |  |  |
| Alone | 2.9\* |  |
| With other services | 2.0\* |  |
| 6. Transportation |  |  |
| Alone | 1.4 |  |
| With other services | 1.0 |  |
| 7. Housing |  |  |
| Alone | 2.5\* |  |
| With other services | 2.3\* |  |
| *(This study)* |  |  |
| 1. MCM |  |  |
| Alone |  |  |
| With other services |  |  |
| 1. MH/SA |  | |
| Alone |  | |
| With other services |  | |
| 1. Support Services |  |  |
| Alone |  | |
| With other services |  | |

Note: The estimates for MH/SA and Support Services will be based on weights. Table S18 presents the weights for the services based on data from the 2016 RSR.

Table S18. Percent of RWHAP clients using different combinations of services

|  |  |  |
| --- | --- | --- |
| Combinations of service use among RWHAP clients | Percent of clients using each combination of services | Variable representation |
| Combination of MH and SA |  |  |
| 1. MH but not SA | 7.6 |  |
| 1. SA but not MH | 12.6 |  |
| 1. MH and SA | 11.8 |  |
| Combination of nonmedical CM, medical transportation, and housing |  |  |
| 1. Nonmedical CM but neither medical transportation nor housing | 56.9 |  |
| 1. Medical transportation but neither nonmedical CM nor housing | 20.6 |  |
| 1. Housing but neither nonmedical CM nor medical transportation | 4.0 |  |
| 1. Nonmedical CM and medical transportation but not housing | 14.4 |  |
| 1. Nonmedical CM and housing but not medical transportation | 1.7 |  |
| 1. Medical transportation and housing but not nonmedical CM | 1.1 |  |
| 1. Nonmedical CM and medical transportation and housing | 1.4 |  |

Sources: RWHAP Services Report, 2016.

Notes: Percentages may not sum to 100 due to rounding.

Table S19. Increase in probability of transitioning from care and treatment (Stage 4) or viral suppression (Stage 5) to left care (Stage 6) due to unmet need

|  |  |  |
| --- | --- | --- |
| Service category |  | Increase in transition probability |
| 1. MCM | 2.50 | 161.6% |
| 1. MH/SA | 1.62 | 67.2% |
| 1. Support services | 2.65 | 177.6% |
| 1. MCM and MH/SA | 3.87 | 306.4% |
| 1. MCM and support services | 4.55 | 377.2% |
| 1. MH/SA and support services | 3.41 | 259.1% |
| 1. MCM and MH/SA and support services | 5.91 | 518.1% |

Table S20. Decrease in probability of transition from care and treatment (Stage 4) to viral suppression (Stage 5) due to unmet need

|  |  |
| --- | --- |
| Service category | Decrease in transition probability |
| 1. Medical case management | 73.5% |
| 1. Mental health/substance abuse | 47.8% |
| 1. Support services | 76.1% |
| 1. Medical case management + mental health/substance abuse | 89.7% |
| 1. Medical case management + support services | 94.1% |
| 1. Mental health/substance abuse + support services | 85.9% |
| 1. Medical case management + mental health/substance abuse + support services | 99.7% |