**Supplementary Information**

**Reaching UNAIDS 95-95-95 targets worldwide: predicted benefits and treatment costs with generic manufacture**

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**Model Selection**

Model selection of weighted log-linear models was conducted in a stepwise, bi-directional model, with three resulting models considering the associations between: (i) antiretroviral treatment (ART) coverage and HIV death rate; (ii) ART coverage and HIV infection rate; (iii) ART coverage and mother-to-child-transmission (MTCT) rate

The resulting model for HIV death rate (proportion of PLHIV dying annually) was:

( S 1 )

where is the intercept and are the coefficients for independent variables. is the proportion of PLHIV receiving ART in a country, ; is the UNAIDS region as a categorical variable; is the income level; is the proportion of the population living with HIV. The UNAIDS regions are:

* Africa – Eastern and Southern
* Africa – West and Central
* Asia and the Pacific
* Eastern Europe and Central Asia
* Latin America and the Caribbean
* Middle East and North Africa
* Western and Central Europe and North America

The income categories are: high income; middle income; low income.

The model for HIV infection rate (proportion of PLHIV newly infected each year) was:

( S 2 )

The model for HIV MTCT rate (proportion of infants born to HIV positive mothers who contract HIV) was:

( S 3 )

Coefficients, standard errors and p-values for each model are shown in Table S1.

Table S 1. Final model coefficients, standard errors and p-values. Models were selected in a stepwise bi-directional manner. In the case of categorical covariates “UNAIDS region” and “income”, the intercept categories are “Africa – Eastern and Southern” and “High income”.

|  |  |  |  |
| --- | --- | --- | --- |
| **Coefficient** | **Estimate** | **Standard error** | **p-value** |
| **HIV death rate (equation S1)** | | | |
| Intercept | 6.11 x 10-3 | 6.25 x 10-3 | 0.33 |
| log(ART coverage) | -0.02 | 1.61 x 10-3 | < 0.01 |
| UNAIDS region (Africa – West and Central) | 7.72 x 10-3 | 1.84 x 10-3 | < 0.01 |
| UNAIDS region (Asia and Pacific) | 9.44 x 10-3 | 2.66 x 10-3 | < 0.01 |
| UNAIDS region (Eastern Europe and Central Asia) | 1.75 x 10-3 | 4.41 x 10-3 | 0.69 |
| UNAIDS region (Latin America and the Caribbean) | -1.24 x 10-3 | 2.54 x 10-3 | 0.63 |
| UNAIDS region (North Africa & Middle East) | 0.01 | 5.91 x 10-3 | 0.09 |
| UNAIDS region (Western and Central Europe & North America) | -2.57 x 10-3 | 6.75 x 10-3 | 0.70 |
| Income (Low income) | 7.47 x 10-3 | 6.11 x 10-3 | 0.22 |
| Income (Middle income) | 5.12 x 10-3 | 5.99 x 10-3 | 0.39 |
| Adult prevalence | -0.03 | 0.01 | < 0.01 |
| **HIV infection rate (equation S2)** | | | |
| Intercept | 0.01 | 5.23 x 10-3 | 0.01 |
| log(ART coverage) | -0.05 | 4.48 x 10-3 | < 0.01 |
| Income (Low income) | 0.01 | 5.47 x 10-3 | 0.04 |
| Income (Middle income) | 8.96 x 10-3 | 5.49 x 10-3 | 0.44 |
| Adult prevalence | -0.05 | 0.02 | 0.01 |
| **MTCT rate (equation S3)** | | | |
| Intercept | 9.87 x 10-2 | 1.47 x 10-2 | < 0.01 |
| log(ART coverage) | -1.35 x 10-2 | 1.66 x 10-2 | < 0.01 |
| UNAIDS region (Africa – West and Central) | 3.36 x 10-2 | 1.67 x 10-2 | 4.81 x 10-2 |
| UNAIDS region (Asia and Pacific) | -4.63 x 10-2 | 2.49 x 10-2 | 0.07 |
| UNAIDS region (Eastern Europe and Central Asia) | -2.84 x 10-2 | 4.26 x 10-2 | 0.51 |
| UNAIDS region (Latin America and the Caribbean) | -3.62 x 10-2 | 2.92 x 10-2 | 0.22 |
| UNAIDS region (North Africa & Middle East) | 1.86 x 10-2 | 6.04 x 10-2 | 0.76 |
| UNAIDS region (Western and Central Europe & North America) | -8.17 x 10-2 | 3.99 x 10-2 | 0.04 |
| Adult prevalence | -0.58 | 9.84 x 10-2 | < 0.01 |

**Data summary**

A summary of epidemiological data for the 164 countries included in the study is shown in Table S2. The avertable infections, deaths and MTCTs as a result of increased service coverage to 95-95-95 are also shown, as well as the cost to treat at 95-95-95 using generic TDF/3TC/DTG for $59 per person per year.

Table S 2.Epidemiological data and predicted benefits of 95-95-95 for all 164 countries included in the study.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Country | HIV prevalence in adults | PLHIV | ART coverage (all ages) | Cost to treat at 95-95-95 using generic drugs | Deaths avertable with 95-95-95 | Infections avertable with 95-95-95 | MTCTs avertable with 95-95-95 |
| Afghanistan | 0.05% | 11000 | 10% | $ 589,197 | 437 | 1141 | 161 |
| Albania | 0.05% | 1400 | 43% | $ 74,989 | 19 | 49 | 2 |
| Algeria | 0.05% | 22000 | 67% | $ 1,178,394 | 118 | 309 | 17 |
| Angola | 1.80% | 340000 | 27% | $ 18,211,548 | 7407 | 19339 | 3602 |
| Antigua and Barbuda | 1.10% | 1000 | 43% | $ 53,563 | 13 | 35 | 2 |
| Argentina | 0.40% | 140000 | 67% | $ 7,498,873 | 753 | 1966 | 120 |
| Armenia | 0.10% | 3500 | 62% | $ 187,472 | 24 | 62 | 2 |
| Australia | 0.10% | 29000 | 83% | $ 1,553,338 | 44 | 114 | 4 |
| Austria | 0.09% | 6527 | 75% | $ 349,608 | 22 | 57 | 2 |
| Azerbaijan | 0.10% | 9700 | 52% | $ 519,565 | 97 | 252 | 13 |
| Bahamas | 1.80% | 6000 | 52% | $ 321,380 | 60 | 156 | 8 |
| Bangladesh | 0.05% | 14000 | 22% | $ 749,887 | 357 | 931 | 291 |
| Barbados | 1.10% | 2700 | 52% | $ 144,621 | 27 | 70 | 3 |
| Belarus | 0.40% | 28000 | 63% | $ 1,499,775 | 182 | 474 | 21 |
| Belgium | 0.19% | 17744 | 81% | $ 950,429 | 36 | 94 | 4 |
| Belize | 1.90% | 4900 | 28% | $ 262,461 | 104 | 270 | 26 |
| Benin | 1.00% | 75000 | 65% | $ 4,017,253 | 444 | 1160 | 182 |
| Bhutan | 0.30% | 1300 | 37% | $ 69,632 | 21 | 55 | 5 |
| Bolivia | 0.20% | 19000 | 60% | $ 1,017,704 | 140 | 366 | 28 |
| Bosnia and Herzegovina | 0.05% | 500 | 67% | $ 26,782 | 3 | 7 | 1 |
| Botswana | 22.20% | 380000 | 82% | $ 20,354,083 | 658 | 1717 | 157 |
| Brazil | 0.50% | 920000 | 69% | $ 49,278,305 | 4459 | 11642 | 530 |
| Bulgaria | 0.05% | 3300 | 50% | $ 176,759 | 35 | 92 | 3 |
| Burkina Faso | 0.80% | 1.00E+05 | 67% | $ 5,356,338 | 538 | 1404 | 247 |
| Burundi | 1.20% | 85000 | 84% | $ 4,552,887 | 110 | 288 | 61 |
| Cabo Verde | 0.60% | 2500 | 94% | $ 133,908 | -2 | 0 | 0 |
| Cambodia | 0.60% | 73000 | 84% | $ 3,910,126 | 95 | 247 | 21 |
| Cameroon | 3.20% | 510000 | 62% | $ 27,317,321 | 3457 | 9025 | 1433 |
| Canada | 0.17% | 63100 | 70% | $ 3,379,849 | 289 | 756 | 22 |
| Central African Republic | 3.60% | 1.00E+05 | 46% | $ 5,356,338 | 1217 | 3177 | 553 |
| Chad | 1.20% | 120000 | 58% | $ 6,427,605 | 958 | 2501 | 491 |
| Chile | 0.50% | 74000 | 68% | $ 3,963,690 | 378 | 987 | 44 |
| China | 0.04% | 780000 | 63% | $ 41,779,433 | 5061 | 13215 | 277 |
| Colombia | 0.50% | 2.00E+05 | 45% | $ 10,712,675 | 2513 | 6561 | 337 |
| Comoros | 0.05% | 200 | 60% | $ 10,713 | 1 | 4 | 1 |
| Congo | 3.10% | 1.00E+05 | 25% | $ 5,356,338 | 2317 | 6051 | 942 |
| Costa Rica | 0.40% | 14000 | 66% | $ 749,887 | 79 | 207 | 11 |
| Croatia | 0.05% | 1600 | 75% | $ 85,701 | 5 | 14 | 0 |
| CÃ´te d'Ivoire | 2.70% | 430000 | 63% | $ 23,032,251 | 2790 | 7285 | 1173 |
| Cuba | 0.30% | 32000 | 76% | $ 1,714,028 | 99 | 259 | 8 |
| Czechia | 0.05% | 4400 | 60% | $ 235,679 | 32 | 85 | 3 |
| Democratic Republic of the Congo | 0.80% | 520000 | 53% | $ 27,852,955 | 4997 | 13047 | 2005 |
| Denmark | 0.10% | 6200 | 89% | $ 332,093 | 2 | 4 | 0 |
| Djibouti | 0.90% | 6800 | 43% | $ 364,231 | 91 | 238 | 20 |
| Dominica | 0.60% | 500 | 32% | $ 26,782 | 9 | 24 | NA |
| Dominican Republic | 0.90% | 72000 | 48% | $ 3,856,563 | 821 | 2143 | 162 |
| Ecuador | 0.40% | 47000 | 65% | $ 2,517,479 | 278 | 727 | 58 |
| Egypt | 0.05% | 26000 | 32% | $ 1,392,648 | 487 | 1271 | 168 |
| El Salvador | 0.60% | 27000 | 50% | $ 1,446,211 | 288 | 752 | 49 |
| Equatorial Guinea | 7.00% | 65000 | 35% | $ 3,481,619 | 1111 | 2902 | 278 |
| Eritrea | 0.70% | 14000 | 62% | $ 749,887 | 95 | 248 | 63 |
| Estonia | 0.90% | 7400 | 59% | $ 396,369 | 57 | 148 | 7 |
| Eswatini | 27.10% | 2.00E+05 | 95% | $ 10,712,675 | -185 | 0 | 0 |
| Ethiopia | 1.10% | 670000 | 74% | $ 35,887,461 | 2401 | 6269 | 968 |
| Fiji | 0.20% | 1000 | 41% | $ 53,563 | 14 | 37 | 4 |
| Finland | 0.10% | 4000 | 76% | $ 214,254 | 12 | 32 | 1 |
| France | 0.30% | 190000 | 82% | $ 10,177,041 | 329 | 859 | 30 |
| Gabon | 3.60% | 51000 | 51% | $ 2,731,732 | 525 | 1372 | 145 |
| Gambia | 2.00% | 28000 | 29% | $ 1,499,775 | 574 | 1498 | 276 |
| Georgia | 0.30% | 9100 | 56% | $ 487,427 | 78 | 205 | 10 |
| Germany | 0.10% | 87000 | 80% | $ 4,660,014 | 189 | 494 | 11 |
| Ghana | 1.70% | 340000 | 45% | $ 18,211,548 | 4271 | 11153 | 1432 |
| Greece | 0.13% | 14200 | 53% | $ 760,600 | 138 | 360 | 8 |
| Grenada | 0.50% | 500 | 70% | $ 26,782 | 2 | 6 | 0 |
| Guatemala | 0.30% | 36000 | 58% | $ 1,928,282 | 287 | 750 | 80 |
| Guinea | 1.40% | 110000 | 57% | $ 5,891,971 | 912 | 2383 | 421 |
| Guinea-Bissau | 3.40% | 40000 | 41% | $ 2,142,535 | 570 | 1488 | 254 |
| Guyana | 1.40% | 8700 | 69% | $ 466,001 | 42 | 110 | 8 |
| Haiti | 1.90% | 160000 | 71% | $ 8,570,140 | 693 | 1809 | 160 |
| Honduras | 0.40% | 25000 | 48% | $ 1,339,084 | 285 | 744 | 58 |
| Hungary | 0.05% | 3700 | 56% | $ 198,184 | 32 | 83 | 3 |
| Iceland | 0.10% | 500 | 79% | $ 26,782 | 1 | 3 | 0 |
| India | 0.20% | 2100000 | 56% | $ 112,483,088 | 18091 | 47238 | 3309 |
| Indonesia | 0.40% | 640000 | 17% | $ 34,280,560 | 19286 | 50359 | 4384 |
| Iran (Islamic Republic of) | 0.05% | 59000 | 25% | $ 3,160,239 | 1367 | 3570 | 104 |
| Ireland | 0.20% | 7500 | 84% | $ 401,725 | 10 | 25 | 1 |
| Israel | 0.20% | 9000 | 51% | $ 482,070 | 94 | 245 | 26 |
| Italy | 0.30% | 130000 | 90% | $ 6,963,239 | 7 | 17 | 1 |
| Jamaica | 1.40% | 32000 | 44% | $ 1,714,028 | 415 | 1084 | 63 |
| Japan | 0.05% | 30000 | 80% | $ 1,606,901 | 65 | 170 | 8 |
| Jordan | 0.05% | 500 | 84% | $ 26,782 | 1 | 2 | 1 |
| Kazakhstan | 0.20% | 33000 | 52% | $ 1,767,591 | 328 | 858 | 53 |
| Kenya | 4.80% | 1500000 | 74% | $ 80,345,063 | 5375 | 14036 | 2101 |
| Kuwait | 0.05% | 1000 | 62% | $ 53,563 | 7 | 18 | 2 |
| Kyrgyzstan | 0.20% | 10000 | 40% | $ 535,634 | 147 | 384 | 32 |
| Lao People's Democratic Republic | 0.30% | 13000 | 56% | $ 696,324 | 112 | 292 | 34 |
| Latvia | 0.30% | 5600 | 53% | $ 299,955 | 54 | 141 | 4 |
| Lebanon | 0.05% | 2700 | 63% | $ 144,621 | 18 | 46 | 2 |
| Lesotho | 23.10% | 340000 | 65% | $ 18,211,548 | 2014 | 5260 | 619 |
| Liberia | 1.50% | 47000 | 33% | $ 2,517,479 | 854 | 2229 | 336 |
| Libya | 0.20% | 9500 | 34% | $ 508,852 | 167 | 437 | 31 |
| Lithuania | 0.10% | 3400 | 35% | $ 182,115 | 58 | 152 | 4 |
| Luxembourg | 0.30% | 1200 | 77% | $ 64,276 | 3 | 9 | 0 |
| Madagascar | 0.20% | 39000 | 13% | $ 2,088,972 | 1364 | 3562 | 471 |
| Malawi | 9.50% | 1100000 | 79% | $ 58,919,713 | 2644 | 6903 | 1229 |
| Malaysia | 0.40% | 88000 | 50% | $ 4,713,577 | 938 | 2450 | 168 |
| Mali | 1.20% | 140000 | 36% | $ 7,498,873 | 2323 | 6065 | 1206 |
| Mauritania | 0.20% | 5700 | 57% | $ 305,311 | 47 | 123 | 18 |
| Mauritius | 1.00% | 11000 | 25% | $ 589,197 | 255 | 666 | 24 |
| Mexico | 0.20% | 230000 | 70% | $ 12,319,576 | 1055 | 2755 | 157 |
| Mongolia | 0.05% | 1000 | 32% | $ 53,563 | 19 | 49 | 5 |
| Montenegro | 0.05% | 500 | 49% | $ 26,782 | 6 | 14 | 0 |
| Morocco | 0.05% | 21000 | 70% | $ 1,124,831 | 96 | 252 | 11 |
| Mozambique | 12.10% | 2200000 | 60% | $ 117,839,425 | 16213 | 42334 | 7750 |
| Myanmar | 0.60% | 240000 | 76% | $ 12,855,210 | 745 | 1944 | 130 |
| Namibia | 12.70% | 210000 | 85% | $ 11,248,309 | 227 | 593 | 76 |
| Nepal | 0.10% | 30000 | 63% | $ 1,606,901 | 195 | 508 | 28 |
| Netherlands | 0.20% | 24000 | 87% | $ 1,285,521 | 16 | 41 | 2 |
| New Zealand | 0.05% | 3500 | 86% | $ 187,472 | 3 | 8 | 0 |
| Nicaragua | 0.20% | 9600 | 59% | $ 514,208 | 74 | 192 | 13 |
| Niger | 0.30% | 33000 | 61% | $ 1,767,591 | 233 | 609 | 179 |
| Nigeria | 1.30% | 1800000 | 65% | $ 96,414,075 | 10664 | 27845 | 4333 |
| North Macedonia | 0.05% | 500 | 54% | $ 26,782 | 5 | 12 | 1 |
| Norway | 0.10% | 5800 | 82% | $ 310,668 | 10 | 26 | 1 |
| Oman | 0.10% | 2500 | 61% | $ 133,908 | 18 | 46 | 4 |
| Pakistan | 0.10% | 190000 | 12% | $ 10,177,041 | 6920 | 18070 | 1493 |
| Panama | 0.90% | 26000 | 54% | $ 1,392,648 | 241 | 629 | 47 |
| Papua New Guinea | 0.80% | 52000 | 62% | $ 2,785,296 | 352 | 920 | 90 |
| Paraguay | 0.40% | 22000 | 44% | $ 1,178,394 | 285 | 745 | 55 |
| Peru | 0.40% | 87000 | 77% | $ 4,660,014 | 249 | 651 | 52 |
| Philippines | 0.10% | 97000 | 44% | $ 5,195,647 | 1258 | 3285 | 232 |
| Poland | 0.09% | 35000 | 36% | $ 1,874,718 | 587 | 1534 | 41 |
| Portugal | 0.50% | 41000 | 90% | $ 2,196,098 | 2 | 5 | 0 |
| Republic of Moldova | 0.60% | 15000 | 46% | $ 803,451 | 182 | 476 | 21 |
| Romania | 0.10% | 19000 | 68% | $ 1,017,704 | 97 | 254 | 6 |
| Russian Federation | 1.20% | 1363330 | 36% | $ 73,024,556 | 22619 | 59060 | 2578 |
| Rwanda | 2.90% | 230000 | 87% | $ 12,319,576 | 152 | 398 | 52 |
| Saint Kitts and Nevis | 0.50% | 200 | 42% | $ 10,713 | 3 | 7 | NA |
| Saint Lucia | 0.60% | 1000 | 43% | $ 53,563 | 13 | 35 | 2 |
| Saint Vincent and the Grenadines | 1.50% | 1200 | 33% | $ 64,276 | 22 | 57 | 3 |
| Sao Tome and Principe | 0.70% | 1100 | 76% | $ 58,920 | 3 | 9 | 1 |
| Senegal | 0.40% | 41000 | 70% | $ 2,196,098 | 188 | 491 | 82 |
| Serbia | 0.05% | 3200 | 66% | $ 171,403 | 18 | 47 | 2 |
| Sierra Leone | 1.50% | 78000 | 43% | $ 4,177,943 | 1044 | 2726 | 352 |
| Singapore | 0.20% | 7900 | 73% | $ 423,151 | 30 | 79 | 3 |
| Slovakia | 0.05% | 1200 | 54% | $ 64,276 | 11 | 29 | 2 |
| Somalia | 0.10% | 11000 | 33% | $ 589,197 | 200 | 522 | 70 |
| South Africa | 17.30% | 7500000 | 70% | $ 401,725,313 | 34401 | 89824 | 6446 |
| South Sudan | 2.40% | 190000 | 18% | $ 10,177,041 | 5530 | 14439 | 2520 |
| Spain | 0.40% | 150000 | 85% | $ 8,034,506 | 162 | 424 | 12 |
| Sri Lanka | 0.05% | 3600 | 51% | $ 192,828 | 37 | 97 | 12 |
| Sudan | 0.20% | 46000 | 22% | $ 2,463,915 | 1172 | 3061 | 526 |
| Suriname | 1.30% | 5800 | 50% | $ 310,668 | 62 | 161 | 10 |
| Sweden | 0.08% | 7718 | 86% | $ 413,402 | 7 | 19 | 1 |
| Switzerland | 0.20% | 17000 | 90% | $ 910,577 | 1 | 2 | 0 |
| Syrian Arab Republic | 0.05% | 1000 | 41% | $ 53,563 | 14 | 37 | 23 |
| Tajikistan | 0.20% | 14000 | 51% | $ 749,887 | 144 | 377 | 39 |
| Thailand | 0.80% | 470000 | 80% | $ 25,174,786 | 1023 | 2671 | 85 |
| Timor-Leste | 0.20% | 1500 | 36% | $ 80,345 | 25 | 65 | 11 |
| Togo | 2.30% | 120000 | 64% | $ 6,427,605 | 745 | 1944 | 287 |
| Trinidad and Tobago | 0.90% | 11000 | 73% | $ 589,197 | 42 | 110 | 4 |
| Tunisia | 0.05% | 6500 | 20% | $ 348,162 | 177 | 462 | 20 |
| Uganda | 6.10% | 1500000 | 84% | $ 80,345,063 | 1943 | 5074 | 1072 |
| Ukraine | 0.70% | 250000 | 54% | $ 13,390,844 | 2318 | 6052 | 224 |
| United Kingdom | 0.16% | 103800 | 89% | $ 5,559,878 | 26 | 68 | 2 |
| United Republic of Tanzania | 5.10% | 1700000 | 75% | $ 91,057,738 | 5680 | 14832 | 2839 |
| United States | 0.36% | 1173900 | 65% | $ 62,878,046 | 6955 | 18160 | 662 |
| Uruguay | 0.60% | 14000 | 58% | $ 749,887 | 112 | 292 | 17 |
| Uzbekistan | 0.20% | 50000 | 58% | $ 2,678,169 | 399 | 1042 | 75 |
| Venezuela | 0.50% | 110000 | 40% | $ 5,891,971 | 1616 | 4219 | 326 |
| Viet Nam | 0.30% | 230000 | 70% | $ 12,319,576 | 1055 | 2755 | 157 |
| Yemen | 0.05% | 11000 | 24% | $ 589,197 | 263 | 687 | 78 |
| Zambia | 12.10% | 1200000 | 85% | $ 64,276,050 | 1298 | 3390 | 689 |
| Zimbabwe | 13.40% | 1400000 | 85% | $ 74,988,725 | 1515 | 3955 | 580 |