### Table S1. Input parameters for HIV Modes of Transmission among Sudan and Sub-national Regions

| Region                      | Exposure group | Population size | HIV prevalence | STIs prevalence | Number of partners per year | Number of acts of exposure per partner per year | Percentage of acts that are protected | Number of people receiving ART |
|-----------------------------|----------------|-----------------|----------------|-----------------|-----------------------------|---------------------------------------------|-----------------------------------|-------------------------------|
|                             | Value(N)       | Uncertainty Ranges(%) | Justification or Reference | Value(N)       | Uncertainty Ranges(%) | Justification or Reference | Value(N)       | Uncertainty Ranges(%) | Justification or Reference | Value(N)       | Uncertainty Ranges(%) | Justification or Reference |
| National                    |                |                 |                |                 |                |                              |                              |                              |                              |                |                 |                          |
|                            |                |                 |                |                 |                |                              |                              |                              |                              |                |                 |                          |
| PWIDs                       | 986            | 20              | EO\(^1\)       | 6.00            | 50             | EO\(^1\)                     | 10.0            | 50             | EO\(^\)                        | 2             | 50             | EO\(^\)                     | 30             | 50             | EO\(^\)                        | 0.00          | 50             | EO\(^\)                     | 4             | -              | SNAP\(^2\)                    |
| PWIDs’ Partners             | 484            | 20              | EO\(^1\)       | 3.00            | 50             | EO\(^1\)                     | NA             | -             | -                               | 1             | -              | EO\(^\)                     | 30             | 10             | EO\(^\)                        | 0.00          | 20             | EO\(^\)                     | 1             | -              | SNAP\(^2\)                    |
| FSW                         | 212,462        | 20              | PSE\(^3\) 2012 | 1.60            | 20             | IBBSS\(^4\) 2010              | 28.0            | 20             | IBBSS\(^4\) 2010              | 100           | 20             | WBP\(^5\) 2010; EO\(^\)       | 5             | 10             | WBP\(^5\) 2010; EO\(^\)       | 11.00         | 10             | IBBSS\(^4\) 2010              | 189           | -              | SNAP\(^2\)                    |
| FSW’s Clients               | 1,487,235      | 20              | PSE\(^3\) 2012 | 0.90            | 20             | IBBST\(^6\) 2008; EO\(^\)     | 9.3             | 20             | EO\(^\)                        | 10            | 20             | EO\(^\)                        | 8             | 10             | EO\(^\)                        | 10.80         | 10             | EO\(^\)                        | 1059          | -              | SNAP\(^2\)                    |
| Partners of FSW’s clients   | 817,979        | 20              | PSE\(^3\) 2012 | 0.45            | 20             | IBBST\(^6\) 2008; EO\(^\)     | NA             | -             | -                               | 1             | -              | EO\(^\)                        | 70            | 10             | EO\(^\)                        | 1.00          | 5              | EO\(^\)                        | 389           | -              | SNAP\(^2\)                    |
| MSM                         | 131,998        | 20              | PSE\(^3\) 2012 | 2.55            | 20             | IBBSS\(^4\) 2010; Spectrum 2103 | 15.0            | 20             | IBBSS\(^4\) 2010              | 10            | 20             | IBBSS\(^4\) 2010              | 5.2           | 10             | IBBSS\(^4\) 2010              | 19.00         | 10             | IBBSS\(^4\) 2010              | 173           | -              | SNAP\(^2\)                    |
| MSM’s Female partners       | 25,212         | 20              | IBBSS\(^4\) 2010; EO\(^\) | 1.28               | 20             | IBBSS\(^4\) 2010; EO\(^\)     | NA             | -             | -                               | 1             | -              | EO\(^\)                        | 52            | 10             | EO\(^\)                        | 1.00          | 5              | EO\(^\)                        | 70            | -              | SNAP\(^2\)                    |
| (CHS)                       | 2,773,762      | 20              | SCBS\(^7\); EO\(^\) | 0.50            | 20             | ANC\(^8\) 2010; SHHS\(^9\) 2010; EO\(^\) | 6.0            | 20             | BSS University 2010; EO\(^\) | 2.75          | 20             | EO\(^\)                        | 30            | 10             | EO\(^\)                        | 10.00         | 5              | BSS University 2010; EO\(^\) | 712           | -              | SNAP\(^2\)                    |
| CHS’s partners              | 1,070,448      | 20              | SCBS\(^7\); EO\(^\) | 0.25            | 20             | ANC\(^8\) 2010; SHHS\(^9\) 2010; EO\(^\) | NA             | -             | -                               | 1             | -              | EO\(^\)                        | 70            | 10             | EO\(^\)                        | 1.00          | 5              | EO\(^\)                        | 133           | -              | SNAP\(^2\)                    |
| Stable heterosexual couples | 5,081,011      | 20              | SCBS\(^7\); EO\(^\) | 0.15            | 20             | ANC\(^8\) 2010; SHHS\(^9\) 2010; EO\(^\) | 5.0            | 20             | -                               | 1             | -              | EO\(^\)                        | 70            | 10             | EO\(^\)                        | 1.00          | 5              | EO\(^\)                        | 461           | -              | SNAP\(^2\)                    |
| No risk | 6,480,312 | 20 | SCBS\(^2\); EO\(^1\) | 0.01 | 0 | ANC\(^3\) 2010; SHHS\(^3\) 2010; EO\(^3\) | 2.0 | 0 | EO\(^3\) | 0 | - | EO\(^3\) | 0 | 0 | EO\(^3\) | 0.00 | - | EO\(^3\) | 39 | - | SNAP\(^2\) |
| Medical injections | 18,081,889 | - | EO\(^1\) | 0.01 | - | EO\(^1\) | NA | - | - | 1 | 10 | - | 1 | - | - | 95.00 | - | EO\(^1\) | - | - | - |
| Blood transfusions | 291,920 | - | EO\(^1\) | 0.01 | 10 | EO\(^1\) | NA | - | - | 1 | - | - | 1 | - | - | 100.00 | - | EO\(^1\) | - | - | - |

### Sub-national

| PWIDs' Partners | 150 | 20 | EO\(^1\) | 3.00 | 50 | EO\(^1\) | NA | - | - | 1 | - | - | EO\(^3\) | 30 | 10 | EO\(^3\) | 0.00 | 20 | EO\(^1\) | 0 | - | SNAP\(^2\) |
| FSW | 46,112 | 20 | PSE\(^3\); 2012 | 0.80 | 20 | IBBSS\(^4\); 2010 | 26.0 | 20 | IBBSS\(^4\); 2010 | 100 | 20 | WBP\(^2\); 2010; EO\(^1\) | 5 | 10 | WBP\(^2\); 2010; EO\(^1\) | 8.20 | 10 | IBBS S\(^2\); 2010 | 16 | - | SNAP\(^2\) |
| FSW’s Clients | 322,781 | 20 | PSE\(^3\); 2012; EO\(^1\) | 0.45 | 20 | IBBST\(^4\); 2008; EO\(^1\) | 9.0 | 20 | EO\(^1\) | 10 | 20 | EO\(^3\) | 8 | 10 | EO\(^3\) | 8.00 | 10 | EO\(^1\) | 88 | - | SNAP\(^2\) |
| Partners of FSW’s clients | 177,529 | 20 | PSE\(^3\); 2012; EO\(^1\) | 0.22 | 20 | IBBST\(^4\); 2008; EO\(^1\) | NA | - | - | 1 | - | - | EO\(^3\) | 70 | 10 | EO\(^3\) | 2.00 | 5 | EO\(^1\) | 32 | - | SNAP\(^2\) |
| MSM | 20,836 | 20 | PSE\(^3\); 2012; mapping 2012 | 2.50 | 20 | IBBSS\(^4\); 2010; Spectrum 2103 | 15.8 | 20 | IBBSS\(^4\); 2010 | 10 | 20 | IBBSS\(^4\); 2010 | 5 | 20 | IBBSS S\(^2\); 2010 | 5.80 | 10 | IBBS S\(^2\); 2010 | 14 | - | SNAP\(^2\) |
| MSM’s Female partners | 1,042 | 20 | IBBSS\(^4\); 2010; EO\(^1\) | 1.25 | 20 | IBBSS\(^4\); 2010; EO\(^1\) | NA | - | - | 1 | - | - | EO\(^3\) | 52 | 10 | EO\(^3\) | 2.00 | 5 | EO\(^1\) | 6 | - | SNAP\(^2\) |
| (CHS) | 482,463 | 20 | SCBS\(^2\); EO\(^1\) | 0.40 | 20 | ANC\(^3\) 2010; SHHS\(^3\) 2010; EO\(^3\) | 6.0 | 20 | BSS University 2010; EO\(^1\) | 2.75 | 20 | EO\(^3\) | 30 | 10 | EO\(^3\) | 10.00 | 5 | BSS University 2010; EO\(^1\) | 59 | - | SNAP\(^2\) |
| CHS’s partners | 186,439 | 20 | SCBS\(^2\); EO\(^1\) | 0.26 | 20 | ANC\(^3\) 2010; SHHS\(^3\) 2010; EO\(^3\) | NA | - | - | 1 | - | - | EO\(^3\) | 70 | 10 | EO\(^3\) | 2.00 | 5 | EO\(^1\) | 11 | - | SNAP\(^2\) |
| Stable heterosexual 1 couples | 969,367 | 20 | SCBS\(^2\); EO\(^1\) | 0.13 | 20 | ANC\(^3\) 2010; SHHS\(^3\) 2010; EO\(^3\) | 5.0 | 20 | - | 1 | - | - | EO\(^3\) | 70 | 10 | EO\(^3\) | 2.00 | 5 | EO\(^1\) | 38 | - | SNAP\(^2\) |
| No risk | 1,208,805 | 20 | SCBS\(^2\); EO\(^1\) | 0.01 | 0 | ANC\(^3\) 2010; SHHS\(^3\) 2010; EO\(^3\) | 2.0 | 0 | EO\(^1\) | 0 | - | EO\(^3\) | 0 | 0 | EO\(^3\) | 0.00 | - | EO\(^1\) | 3 | - | SNAP\(^2\) |
| Medical injections | 3,415,669 | - | EO\(^1\) | 0.01 | - | EO\(^3\) | NA | - | - | 1 | 10 | - | 1 | - | - | 95.00 | - | EO\(^3\) | - | - | - |
| Blood transfusions | PWIDs | PWIDs’ Partners | FSW | FSW’s Clients | Partners of FSW’s clients | MSM | MSM’s Female partners | (CHS) | CHS’s partners | Stable heterosexual couples | No risk | Medical injections | Blood transfusions | PWIDs | PWIDs’ Partners |
|--------------------|-------|----------------|------|---------------|--------------------------|-----|-----------------------|------|----------------|--------------------------|---------|----------------|----------------|-------|----------------|
| 59,837             | 35    | 16             | 31,441 | 220,086      | 121,047                 | 30,917 | 2,164                 | 390,390 | 151,527        | 721,435                 | 947,023 | 2,620,066      | 28,553 | 301    | 149          |
| EO                 | 30    | 20             | PSE3  | PSE3 2012;    | PSE3 2012; mapping      | 0.60  | 0.30                  | 0.31  | 0.01            | 0.00            | 0.01    | 0.01          | 0.01    | 0.00   | 0.00         |
| 0.01              | 10    | 20             | 6.20  | 3.20          | 1.25                     | 3.80  | 1.80                  | 0.60  | 0.30            | 0.31            | 0.01    |              | 0.01    |              |              |
| 1                 | 2     | 1              | 25.0  | 8.0           | 1.25                     | 24.6  | 1.80                  | 6.0   | 0.30            | 5.0             | 2.0     | 1.00          | 100.00  | 1.00   | 0.00         |
| 2                 | 10    | 20             | 100.00| 10            | 10                        | 10    | 20                    | 30    | 10             | 20             | 0.00    | 100.00        | 50      | 50     | 0.00         |
| 1                 | 5     | 10             | WBP3  | 5             | 1                         | WBP3  | 5                     | 10    | 5              | 1.80           | 10      | 100.00        | 0.00    | 20     | 0.00         |
| 1                 | 10    | 20             | IBBSS | 10            | 1                         | IBBSS | 5                     | 10    | 20             | 8.50           | 10      | 40            | 5       | 20     | 1            |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 2.00           | 5       | 82            | EO      | 15     | 8            |
| 1                 | 1     | 2              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 2.00           | 100.00  | 149           | EO      | 28     | 8            |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 2.00           | 5       | 97            | EO      | 8      | 8            |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       | 8             | EO      | 1      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| 1                 | 1     | 1              | 1     | 1             | 1                         | 1     | 1                     | 1     | 1              | 0.00           | -       |              | EO      | -      |              |
| Category | Clients | Frequency | Gender | Type | Percentage | Partnerships | Type | Percentage | Type | Percentage | Type | Percentage | Type | Percentage |
|----------|---------|-----------|--------|------|------------|-------------|------|------------|------|------------|------|------------|------|------------|
| FSW      | 37,575  | 20        |        |      | 0.95       | 20          |      | 17.0       | 20  | 100        | 5    | 10         | 18.60| 10         |
|          | FSW+    | 263,026   | 20     |      | 0.50       | 20          |      | 8.0        | 20  | 10         | 8    | 10         | 18.00| 10         |
|          | FSW’s   | 144,664   | 20     |      | 0.25       | 20          |      | NA         | 1   | 70         | 7    | 2.00       |     | 208        |
| MSM      | 28,916  | 20        |        |      | 0.60       | 20          |      | 10.0       | 20  | 10         | 5.2  | 10         | 6.00| 10         |
| MSM’s    | 1,533   | 20        |        |      | 0.30       | 20          |      | NA         | 1   | 70         | 7    | 2.00       |     | 37         |
| (CHS)    | 506,447 | 20        |        |      | 0.20       | 20          |      | 6.0        | 20  | 10         | 10.0 | 5         |     | 380        |
| CHS’s    | 196,044 | 20        |        |      | 0.18       | 20          |      | NA         | 1   | 70         | 7    | 2.00       |     | 71         |
| Stable   | 918,466 | 20        |        |      | 0.10       | 20          |      | 5.0        | 20  | 10         | 5.0  | 5         |     | 246        |
| Hetero   | 1,166,298| 20        |        |      | 0.01      | 20          |      | 2.0        | 0   | 0          | 0    | 0         |     | 21         |
| Medical  | 3,267,398| 20        |        |      | 0.01      | 20          |      | NA         | 1   | 10         | 0    | 0         |     | 95.00      |
| Blood    | 216,244 | 20        |        |      | 0.01      | 10          |      | NA         | 1   | 0         | 0    | 0         |     | 0          |
| PWIDs    | 283     | 20        |        |      | 0.60      | 50          |      | 0.0        | 50  | 0          | 0.0  | 50        |     | 0          |
| PWIDs’   | 139     | 20        |        |      | 3.00      | 50          |      | NA         | 1   | 10         | 0.0  | 0         |     | 0          |
| FSW+     | 31,376  | 20        |        |      | 1.20      | 20          |      | 25.0       | 20  | 10         | 5    | 10         |     | 20.00      |
| FSW’s    | 219,630 | 20        |        |      | 0.70      | 20          |      | 15.0       | 20  | 8          | 10   | 5         |     | 115        |

SNAP: Sexual and Reproductive Health Assistance Program.
| Partners of FSW’s clients | 120,796 | 20 | PSE (2012; EO) | 0.35 | 20 | IBBSS (2008; EO) | NA | - | 1 | - | EO (70 | 10 | EO (10 | 2.00 | 5 | EO | 42 | - | SNAP² |
|---------------------------|---------|----|----------------|------|-----|-----------------|-----|---|---|---|-----|-----|-----|------|----|-----|-------|------|----|-----|
| MSM | 24,403 | 20 | PSE (2012; mapping 2012) | 1.90 | 20 | IBBSS (2010; Spectrum 2103) | 11.0 | 20 | IBBSS (2010 | 10 | 20 | IBBSS (2010 | 5.2 | 10 | IBBS (2010 | 3.00 | 10 | IBBS (2010 | 20 | - | SNAP² |
| MSM’s Female partners | 488 | 20 | IBBSS (2010; EO) | 1.00 | 20 | IBBSS (2010; EO) | NA | - | 1 | - | EO (52 | 10 | EO (2.00 | 5 | EO | 8 | - | SNAP² |
| (CHS) | 540,359 | 20 | SCBS (EO) | 0.30 | 20 | ANC (2010; SHHS 2010; EO) | 6.0 | 20 | BSS University (2010; EO) | 2.75 | 20 | EO (30 | 10 | EO | 10.00 | 5 | BSS University (2010; EO) | 77 | - | SNAP² |
| CHS’s partners | 209,171 | 20 | SCBS (EO) | 0.20 | 20 | ANC (2010; SHHS 2010; EO) | NA | - | 1 | - | EO (70 | 10 | EO | 2.00 | 5 | EO | 14 | - | SNAP² |
| Stable heterosexual couples | 1,074,966 | 20 | SCBS (EO) | 0.13 | 20 | ANC (2010; SHHS 2010; EO) | 5.0 | 20 | - | 1 | - | EO (70 | 10 | EO | 2.00 | 5 | EO | 50 | - | SNAP² |
| No risk | 1,264,615 | 20 | SCBS (EO) | 0.01 | 0 | ANC (2010; SHHS 2010; EO) | 2.0 | 0 | EO | 0 | 0 | EO | 0.00 | - | EO | 4 | - | SNAP² |
| Medical injections | 3,486,188 | - | EO (EO) | 0.01 | - | EO (EO) | NA | - | 1 | 10 | - | - | 95.00 | - | EO | - | - | - |
| Blood transfusions | 55,775 | - | EO (EO) | 0.01 | 10 | EO (EO) | NA | - | 1 | - | - | - | 100.00 | - | EO | - | - | - |
| PWIDs | 103 | 20 | EO (EO) | 6.00 | 50 | EO (EO) | 0.0 | 50 | EO | 2 | 50 | EO | 0.00 | 50 | EO | 0 | - | SNAP² |
| PWIDs’ Partners | 51 | 20 | EO (EO) | 3.00 | 50 | EO (EO) | NA | - | 1 | - | EO (EO) | 30 | 10 | EO | 0.00 | 20 | EO | 0 | - | SNAP² |
| FSW | 12,418 | 20 | PSE (2012; EO) | 5.50 | 20 | IBBSS (2010 | 27.4 | 20 | IBBSS (2010 | 100 | 20 | WBP (2010; EO) | 5 | 10 | WBP (2010; EO) | 2.70 | 10 | IBBS (2010 | 5 | - | SNAP² |
| FSW Clients | 86,929 | 20 | PSE (2012; EO) | 3.00 | 20 | IBBST (2008; EO) | 9.0 | 20 | EO | 10 | 20 | EO | 8 | 10 | EO | 16.22 | 10 | EO | 30 | - | SNAP² |
| Partners of FSW’s clients | 47,811 | 20 | PSE (2012; EO) | 1.50 | 20 | IBBST (2008; EO) | NA | - | 1 | - | EO | 70 | 10 | EO | 5.95 | 5 | EO | 11 | - | SNAP² |
| MSM | 9,393 | 20 | PSE (2012; mapping 2012) | 2.50 | 20 | IBBSS (2010; Spectrum 2103) | 7.0 | 20 | IBBSS (2010 | 10 | 20 | IBBSS (2010 | 5.2 | 10 | IBBS (2010 | 2.70 | 10 | IBBS (2010 | 5 | - | SNAP² |
| Category                          | Sample Size | Source | Methodology | Stages | Sample Size | Source | Methodology | Stages | Sample Size | Source | Methodology | Stages | Sample Size | Source | Methodology | Stages | Sample Size | Source | Methodology |
|---------------------------------|-------------|--------|-------------|---------|-------------|--------|-------------|---------|-------------|--------|-------------|---------|-------------|--------|-------------|---------|-------------|--------|-------------|
| MSM’s Female partners          | 1,315       | IBBSS  | 2010; EO   | 1.25   | 20          | IBBSS  | 2010; EO   | 1.25   | 20          | IBBSS  | 2010; EO   | 1.25   | 20          | IBBSS  | 2010; EO   | 1.25   | 20          | IBBSS  | 2010; EO   |
| (CHS)                           | 159,423     | SCBS   | 2010; EO   | 0.30   | 20          | ANC    | 2010; SHHS | 0.30   | 20          | ANC    | 2010; SHHS | 0.30   | 20          | ANC    | 2010; SHHS | 0.30   | 20          | ANC    | 2010; SHHS |
| CHS’s partners                  | 61,084      | SCBS   | 2010; EO   | 0.15   | 20          | ANC    | 2010; SHHS | 0.15   | 20          | ANC    | 2010; SHHS | 0.15   | 20          | ANC    | 2010; SHHS | 0.15   | 20          | ANC    | 2010; SHHS |
| Stable heterosexual couples     | 301,333     | SCBS   | 2010; EO   | 0.05   | 20          | ANC    | 2010; SHHS | 0.05   | 20          | ANC    | 2010; SHHS | 0.05   | 20          | ANC    | 2010; SHHS | 0.05   | 20          | ANC    | 2010; SHHS |
| No risk                         | 377,861     | SCBS   | 2010; EO   | 0.01   | 0           | ANC    | 2010; SHHS | 0.01   | 0           | ANC    | 2010; SHHS | 0.01   | 0           | ANC    | 2010; SHHS | 0.01   | 0           | ANC    | 2010; SHHS |
| Medical injections              | 1,061,407   | -      | EO         | 0.01   | -           | EO     | 2010; EO   | 0.01   | -           | EO     | 2010; EO   | 0.01   | -           | EO     | 2010; EO   | 0.01   | -           | EO     | 2010; EO   |
| Blood transfusions              | 15,369      | -      | EO         | 0.01   | 10          | EO     | 2010; EO   | 0.01   | 10          | EO     | 2010; EO   | 0.01   | 10          | EO     | 2010; EO   | 0.01   | 10          | EO     | 2010; EO   |

1 EO: Expert Opinion
2 SNAP: Synonymous Non-synonymous Analysis Program.
3 PSE: Population Size Estimation; capture re capture method
4 IBBSS: Integrated Bio-Behavioral Surveillance Survey
5 WBP: World Bank Publications. Available from: https://openknowledge.worldbank.org/handle/10986/2457 License: CC BY 3.0 IGO."
6 IBBST: Integrated Bio-Behavioral Survey among Truck Driver
7 SCBS: Sudan Central Bureau of Statistics
8 ANC: Antenatal Clinic
9 SHHS: Sudan House Hold Survey
10 RDS: Respondent Driven Sampling
Table S2. Data Availability and Quality across all population groups

| Population group                        | Average Score of data quality* |
|----------------------------------------|-------------------------------|
| Injecting drug users                   | 1.0                           |
| Partners of injecting drug users       | 1.0                           |
| Men having sex with men                | 2.8                           |
| Partners of MSM                        | 1.8                           |
| Female sex workers                     | 2.8                           |
| Clients of female sex workers          | 1.5                           |
| Partners of clients of female sex workers | 1.4                      |
| Casual heterosexual sex                | 2.0                           |
| Partners of those engaging in casual sex | 1.0                      |
| Stable heterosexual sex                | 1.3                           |
| No risk populations                    | 1.3                           |
| Medical injections                     | 1.0                           |
| Blood Transfusions                     | 1.0                           |
| **Average Score of quality of all data** | **1.6**                    |
| **Data availability score**            | 55%                           |

* 0=none; 1=poor; 2=limited; 3=good
Figure S1. EPi Review Checklist.

![EPi Review Checklist Table]

- Relevant
- Population size
- HIV prevalence
- STI prevalence
- Sexual /IDU Behaviour
  - Partner per year
  - Acts / partner / year
- Condom use / Sterile (IDU) equipment
- ART provision

| Category                  | Relevant | Population size | HIV prevalence | STI prevalence | Sexual / IDU Behaviour | Condom use / Sterile (IDU) equipment | ART provision |
|---------------------------|----------|------------------|----------------|------------------|------------------------|--------------------------------------|---------------|
| IDU                       | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| MSM                       | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| Female sex workers        | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| Clients of sex workers    | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| Casual sex                | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| Stable heterosexual relationship | Yes   | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| Transgender               | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |
| Other populations         | Yes      | Yes              | Yes            | Yes              | Yes                    | Yes                                  | Reset         |

Data availability score: 55%
Table S3. Expected Number, Percentage, and Incidence rate of New HIV infections per 1000,000 by Exposure Groups in Sub-National models in 2014

| Exposure group                  | Population size | Number of new HIV infections | Share in national new HIV infections (as % with 95% CI) | Incidence rate per 1000,000 |
|---------------------------------|-----------------|------------------------------|-------------------------------------------------------|-----------------------------|
| Central                         |                 |                              |                                                       |                             |
| PWID                            | 302             | 9                            | 0.93(0.33-2.09)                                       | 2,913                       |
| Partners of PWID                | 150             | 0.26                         | 0.07(0.03-0.11)                                       | 172                         |
| FSW                             | 46,112          | 113                          | 12.88(8.59-18.72)                                     | 244                         |
| Clients of FSW's clients        | 322,781         | 129                          | 13.26(8.77-18.94)                                     | 40                          |
| Partners of FSW’s clients       | 177,529         | 62                            | 7.06(4.85-10.21)                                     | 35                          |
| MSM                             | 20,836          | 340                          | 38.67(27.74-50.66)                                     | 1,632                       |
| Female partners of MSM          | 1,042           | 2                             | 0.27(0.20-0.37)                                       | 171                         |
| CHS                             | 482,463         | 95                           | 10.93(7.25-15.78)                                     | 20                          |
| partners of CHS                 | 186,439         | 42                            | 4.81(3.39-7.10)                                       | 23                          |
| Stable heterosexual couples     | 969,367         | 69                            | 9.98(5.80-16.31)                                     | 7                           |
| No risk                         | 5               | 0                            | 0.00                                                   | 0                           |
| Medical injections              | 3,415,669       | 1                             | 0.02(0.02-0.03)                                       | 0                           |
| Blood transfusions              | 59,837          | 0                            | 0.00                                                   | 0                           |
| Total adult population          | 3,415,825       | 861                          | 100                                                   | 98                          |
| Eastern                         |                 |                              |                                                       |                             |
| PWID                            | 35              | 1                            | 0.02(0.005-0.071)                                     | 1,894                       |
| Partners of PWID                | 16              | 0.01                         | 0.001(0.000-0.003)                                     | 93                          |
| FSW                             | 31,441          | 513                          | 19.53(14.02-26.43)                                    | 1,632                       |
| Clients of FSW                 | 220,086         | 660                          | 23.31(16.36-31.50)                                    | 300                         |
| Partners of FSW’s clients       | 121,047         | 121                          | 11.79(8.32-16.92)                                     | 246                         |
| MSM                             | 30,917          | 798                          | 32.56(21.98-45.71)                                    | 2,580                       |
| Female partners of MSM          | 2,164           | 7                            | 0.35(0.25-0.49)                                       | 301                         |
| CHS                             | 390,390         | 113                          | 4.55(2.95-7.08)                                       | 29                          |
| partners of CHS                 | 151,527         | 49                           | 2.04(1.38-2.85)                                       | 33                          |
| Stable heterosexual couples     | 721,435         | 121                          | 4.58(1.55-9.93)                                       | 17                          |
| No risk                         | 947,023         | 0                            | 0.00                                                   | 0                           |
| Medical injections              | 6               | 2                            | 0.02(0.01-0.02)                                       | 0                           |
| Blood transfusions              | 28,553          | 0                            | 0.00                                                   | 0                           |
| Total adult population          | 2,616,085       | 2,562                        | 100                                                   | 98                          |
| Khartoum                        |                 |                              |                                                       |                             |
| PWID                            | 301             | 8                            | 2.26(0.74-5.57)                                       | 2,690                       |
| Partners of PWID                | 149             | 0.23                         | 0.16(0.07-0.28)                                       | 154                         |
| FSW                             | 37,575          | 55                            | 16.00(10.17-23.57)                                    | 147                         |
| Clients of FSW                 | 263,026         | 72                            | 19.62(12.32-29.13)                                    | 27                          |
| Partners of FSW’s clients       | 144,664         | 35                            | 10.20(6.36-15.45)                                    | 24                          |
| MSM                             | 28,916          | 56                            | 17.54(7.78-29.07)                                    | 194                         |
| Female partners of MSM          | 1,533           | 0.20                         | 0.12(0.06-0.19)                                       | 19                          |
| CHS                             | 506,447         | 33                            | 10.03(5.69-16.10)                                    | 7                           |
| partners of CHS                 | 196,044         | 15                            | 4.44(2.76-6.82)                                       | 8                           |
| Stable heterosexual couples     | 918,466         | 39                            | 17.78(10.18-28.30)                                    | 4                           |
| Category                     | No risk | Medical injections | Blood transfusions | Total adult population |
|------------------------------|---------|--------------------|--------------------|------------------------|
|                              |         |                    |                    |                        |
| PWID                         | 1,666,29| 3,267,39           | 216,244            | 3,263,41               |
| Partners of PWID             | 0       | 0.04 (0.03-0.05)   | 0                  | 0                      |
| FSW                          | 0       | 0.00               | 0                  | 0                      |
| Clients of FSW               | 0       | 0.00               | 0                  | 0                      |
| Partners of FSW’s clients    | 0       | 0.00               | 0                  | 0                      |
| MSM                          | 0       | 0.00               | 0                  | 0                      |
| Female partners of MSM       | 0       | 0.00               | 0                  | 0                      |
| CHS                          | 0       | 0.00               | 0                  | 0                      |
| Stable heterosexual couples  | 0       | 0.00               | 0                  | 0                      |
| No risk                      | 0       | 0.00               | 0                  | 0                      |
| Medical injections           | 0       | 0.00               | 0                  | 0                      |
| Blood transfusions           | 0       | 0.00               | 0                  | 0                      |
| Total adult population       | 1,666,29| 3,267,39           | 216,244            | 3,263,41               |

**Kordufan**

| Category                     | No risk | Medical injections | Blood transfusions | Total adult population |
|------------------------------|---------|--------------------|--------------------|------------------------|
|                              | 1,666,29| 3,267,39           | 216,244            | 3,263,41               |
| Partners of PWID             | 0       | 0.04 (0.03-0.05)   | 0                  | 0                      |
| FSW                          | 0       | 0.00               | 0                  | 0                      |
| Clients of FSW               | 0       | 0.00               | 0                  | 0                      |
| Partners of FSW’s clients    | 0       | 0.00               | 0                  | 0                      |
| MSM                          | 0       | 0.00               | 0                  | 0                      |
| Female partners of MSM       | 0       | 0.00               | 0                  | 0                      |
| CHS                          | 0       | 0.00               | 0                  | 0                      |
| Stable heterosexual couples  | 0       | 0.00               | 0                  | 0                      |
| No risk                      | 0       | 0.00               | 0                  | 0                      |
| Medical injections           | 0       | 0.00               | 0                  | 0                      |
| Blood transfusions           | 0       | 0.00               | 0                  | 0                      |
| Total adult population       | 1,666,29| 3,267,39           | 216,244            | 3,263,41               |

**Abbreviations:** PWID (People who inject drugs); FSW (Female sex workers); MSM (Men who have sex with men); CHS (Casual heterosexual sex)
**Figure S2.** Regions with the highest and lowest percentage of new HIV cases in based on exposure groups.