# Appendix 2 – Phase 1 results tables and figures

# Appendix 2 Table 1: Bibliometric data

Country

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  |  | pubs. | cit. | pubs. | pubs. | Coll. | Coll. | Coll. | author |
| Algeria | 159,049 | 40,606 | 8,043 | 57,188 | 6,473 | 28,931 | 437 | 1,138 | 52.7 | 10.1 | 34.4 | 2.7 |
| Angola | 95,335 | 28,813 | 446 | 4,827 | 120 | 489 | 21 | 85 | 92.5 | 0.3 | 7.2 | 0.0 |
| Benin | 8,583 | 10,872 | 2,427 | 22,042 | 1,166 | 7,435 | 161 | 290 | 80.7 | 1.0 | 17.8 | 0.6 |
| Botswana | 15,581 | 2,250 | 1,766 | 28,298 | 756 | 4,583 | 113 | 245 | 79.7 | 3.5 | 12.9 | 3.8 |
| Burkina Faso | 11,693 | 18,646 | 3,104 | 36,231 | 1,336 | 8,663 | 216 | 388 | 84.5 | 0.8 | 14.2 | 0.4 |
| Burundi | 3,007 | 10,524 | 243 | 2,250 | 67 | 311 | 6 | 40 | 87.4 | 0.0 | 11.4 | 1.2 |
| Cameroon | 32,218 | 23,439 | 5,973 | 69,384 | 3,356 | 21,499 | 376 | 814 | 73.7 | 7.5 | 17.0 | 1.8 |
| Cape Verde | 1,617 | 540 | 124 | 1,052 | 19 | 52 | 6 | 20 | 94.4 | 1.1 | 3.3 | 1.1 |
| Central African Republic | 1,756 | 4,595 | 333 | 4,490 | 137 | 797 | 19 | 40 | 77.7 | 1.0 | 15.8 | 5.4 |
| Chad | 9,601 | 14,453 | 203 | 2,105 | 55 | 357 | 15 | 41 | 94.8 | 0.0 | 5.2 | 0.0 |
| Comoros | 617 | 796 | 61 | 419 | 13 | 33 | 2 | 7 | 77.8 | 2.8 | 19.4 | 0.0 |
| Democratic Republic of the Congo | 35,382 | 78,736 | 1,535 | 26,099 | 609 | 3,330 | 64 | 261 | 86.2 | 0.5 | 12.2 | 1.2 |
| Djibouti | 1,727 | 942 | 61 | 419 | 30 | 166 | 2 | 7 | 77.8 | 2.8 | 19.4 | 0.0 |
| Egypt | 332,791 | 95,689 | 60,693 | - | - | - | 2,481 | 8,206 | 46.4 | 14.1 | 32.7 | 6.9 |
| Equatorial Guinea | 10,685 | 1,221 | 114 | 1,714 | 12 | 43 | 6 | 12 | 100.0 | 0.0 | 0.0 | 0.0 |
| Eritrea | 2,608 | 4,475 | 154 | 1,252 | 54 | 176 | 15 | 18 | 83.3 | 0.0 | 14.6 | 2.1 |
| Ethiopia | 72,374 | 102,403 | 9,926 | 95,131 | 6,630 | 43,786 | 398 | 1,768 | 57.1 | 6.5 | 32.2 | 4.2 |
| Gabon | 14,214 | 1,980 | 1,203 | 20,122 | 446 | 6,199 | 84 | 141 | 89.5 | 0.0 | 9.3 | 1.1 |
| Gambia | 965 | 2,039 | 1,175 | 32,033 | 363 | 6,243 | 92 | 156 | 95.7 | 0.3 | 2.0 | 2.0 |
| Ghana | 42,690 | 28,207 | 7,005 | 96,341 | 3,681 | 19,958 | 307 | 1,118 | 68.7 | 5.1 | 22.6 | 3.6 |
| Guinea | 8,200 | 12,396 | 1,547 | 28,939 | 418 | 3,416 | 126 | 231 | 91.2 | 0.2 | 6.4 | 2.2 |
| Guinea-Bissau | 1,165 | 1,816 | 333 | 5,016 | 111 | 1,963 | 18 | 48 | 99.1 | 0.5 | 0.0 | 0.5 |
| Ivory Coast | 36,373 | 23,696 | 2,622 | 31,674 | 1,573 | 5,637 | 251 | 284 | 67.8 | 1.1 | 30.4 | 0.7 |

GDP

Pop.

Pubs. Cit.

F-a

F-a

2008

2017

Int.

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Inst.

Single

**Table 1:** Bibliometric data

Country

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  |  | pubs. | cit. | pubs. | pubs. | Coll. | Coll. | Coll. | author |
| Kenya | 70,529 | 48,462 | 14,286 | 243,026 | 6,071 | 61,021 | 943 | 1,909 | 83.2 | 5.6 | 9.0 | 2.2 |
| Lesotho | 2,291 | 2,204 | 186 | 2,581 | 64 | 478 | 14 | 22 | 88.6 | 0.0 | 9.5 | 1.9 |
| Liberia | 2,101 | 4,614 | 258 | 3,733 | 45 | 296 | 7 | 57 | 92.8 | 1.4 | 3.4 | 2.4 |
| Libya | 34,699 | 6,293 | 1,513 | 14,307 | 735 | 3,379 | 77 | 151 | 81.3 | 0.2 | 14.9 | 3.5 |
| Madagascar | 10,001 | 24,895 | 1,999 | 23,688 | 680 | 4,113 | 157 | 264 | 86.2 | 0.3 | 12.5 | 0.9 |
| Malawi | 5,433 | 18,092 | 3,442 | 56,398 | 1,204 | 13,344 | 228 | 540 | 90.5 | 1.1 | 6.0 | 2.3 |
| Mali | 14,035 | 17,995 | 1,691 | 26,428 | 495 | 4,014 | 114 | 244 | 89.9 | 0.3 | 9.4 | 0.4 |
| Mauritania | 4,739 | 4,301 | 227 | 1,719 | 83 | 400 | 13 | 32 | 90.9 | 0.0 | 8.4 | 0.7 |
| Mauritius | 12,168 | 1,263 | 737 | 8,004 | 404 | 2,294 | 37 | 104 | 65.3 | 0.2 | 30.4 | 4.0 |
| Morocco | 103,606 | 35,277 | 12,051 | 80,662 | 9,514 | 32,877 | 744 | 1,537 | 36.8 | 14.2 | 47.3 | 1.8 |
| Mozambique | 11,015 | 28,829 | 1,731 | 39,885 | 542 | 5,014 | 81 | 290 | 93.4 | 1.2 | 3.8 | 1.6 |
| Namibia | 10,948 | 2,480 | 1,026 | 10,156 | 337 | 1,386 | 44 | 154 | 83.9 | 0.4 | 8.3 | 7.4 |
| Niger | 7,528 | 20,673 | 804 | 9,075 | 278 | 1,808 | 56 | 99 | 84.7 | 1.3 | 12.4 | 1.7 |
| Nigeria | 404,653 | 185,990 | 31,023 | 205,135 | 25,853 | 109,386 | 2,443 | 3,369 | 36.3 | 14.1 | 45.1 | 4.5 |
| Republic of the Congo | 7,834 | 5,126 | 921 | 11,026 | 351 | 1,496 | 50 | 102 | 80.9 | 0.3 | 17.1 | 1.6 |
| Rwanda | 8,376 | 11,918 | 1,519 | 23,953 | 538 | 4,022 | 50 | 245 | 90.1 | 0.5 | 7.1 | 2.4 |
| Sao Tome and Principe | 343 | 200 | 25 | 335 | 4 | 56 | 0 | 7 | 100.0 | 0.0 | 0.0 | 0.0 |
| Senegal | 14,684 | 15,412 | 3,667 | 37,424 | 1,759 | 10,138 | 234 | 473 | 73.1 | 4.5 | 21.1 | 1.3 |
| Seychelles | 1,427 | 95 | 339 | 5,631 | 57 | 567 | 31 | 44 | 83.0 | 0.5 | 4.5 | 2.0 |
| Sierra Leone | 3,737 | 7,396 | 530 | 7,489 | 102 | 975 | 15 | 114 | 94.5 | 0.2 | 4.2 | 1.0 |
| Somalia | 6,217 | 14,318 | 73 | 685 | 24 | 74 | 3 | 21 | 96.2 | 0.0 | 1.9 | 1.9 |
| South Africa | 295,456 | 56,015 | 63,171 | - | - | - | 4,210 | 8,325 | 57.2 | 10.6 | 26.3 | 5.9 |
| South Sudan | 9,015 | 12,231 | 80 | 587 | 19 | 102 | 4 | 20 | 83.6 | 4.5 | 11.9 | 0.0 |

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Single

**Table 1:** Bibliometric data

Country

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | GDP (million) | (thousand) |  |  | pubs. | cit. | pubs. | pubs. | Coll. | Coll. | Coll. | author |
| Sudan | 95,584 | 39,579 | 3,620 | 46,793 | 1,949 | 10,599 | 214 | 442 | 76.2 | 0.1 | 20.1 | 3.6 |
| Swaziland | 3,721 | 1,343 | 542 | 5,871 | 199 | 1,727 | 31 | 92 | 86.8 | 0.7 | 7.9 | 4.6 |
| Tanzania | 47,340 | 55,572 | 7,716 | 119,936 | 3,167 | 26,771 | 429 | 1,061 | 83.2 | 1.4 | 13.3 | 2.0 |
| Togo | 4,400 | 7,606 | 924 | 6,331 | 562 | 1,739 | 51 | 107 | 65.2 | 0.0 | 34.5 | 0.3 |
| Tunisia | 42,063 | 11,403 | 20,532 | 182,898 | 17,138 | 117,263 | 1,592 | 2,373 | 47.6 | 7.8 | 43.5 | 1.1 |
| Uganda | 24,079 | 41,488 | 8,250 | 145,435 | 3,496 | 34,353 | 441 | 1,171 | 85.6 | 2.2 | 10.8 | 1.5 |
| Zambia | 21,064 | 16,591 | 2,758 | 49,329 | 861 | 8,047 | 218 | 446 | 90.8 | 2.2 | 5.5 | 1.5 |
| Zimbabwe | 16,620 | 16,150 | 3,005 | 45,515 | 1,320 | 9,604 | 205 | 469 | 75.2 | 1.8 | 19.6 | 3.4 |

Pop.

Pubs. Cit.

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2008

2017

Int.

Nat.

Inst.

Single

Cit., citations; coll., collaboration; F-A, first-author; GDP, gross domestic product; inst., institutional; int., international; nat., national; pop., population; pubs., publications Collaboration figures are from SciVal and reflect outputs published in 2013-2017. All other data cover outputs published in 2008-2017.

# Appendix 2 Table 2: Clinical trial infrastructures and intellectual property rights

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| GDP  Country | | Pop. | Trials | Trials | Trials | Patent | Patent apps |
|  | (million) | (thousand) | (ICTRP) | per 1 mill. | (ct.gov) | apps | per 1 mill. |
| Algeria | 159,049 | 40,606 | 165 | 4.06 | 95 | 106 | 2.61 |
| Angola | 95,335 | 28,813 | 16 | 0.56 | 3 | - | - |
| Benin | 8,583 | 10,872 | 54 | 4.97 | 38 | - | - |
| Botswana | 15,581 | 2,250 | 93 | 41.33 | 64 | 1 | 0.44 |
| Burkina Faso | 11,693 | 18,646 | 186 | 9.98 | 126 | 2 | 0.11 |
| Burundi | 3,007 | 10,524 | 19 | 1.81 | 11 | - | - |
| Cameroon | 32,218 | 23,439 | 113 | 4.82 | 68 | - | - |
| Cape Verde | 1,617 | 540 | 0 | 0.00 | 0 | - | - |
| Central African Republic | 1,756 | 4,595 | 13 | 2.83 | 6 | - | - |
| Chad | 9,601 | 14,453 | 12 | 0.83 | 7 | - | - |
| Comoros | 617 | 796 | 3 | 3.77 | 1 | - | - |
| Democratic Republic of the Congo | 35,382 | 78,736 | 87 | 1.10 | 55 | - | - |
| Djibouti | 1,727 | 942 | 4 | 4.24 | 1 | 1 | 1.06 |
| Egypt | 332,791 | 95,689 | 3,711 | 38.78 | 2,409 | 918 | 9.59 |
| Equatorial Guinea | 10,685 | 1,221 | 6 | 4.91 | 3 | - | - |
| Eritrea | 2,608 | 4,475 | 6 | 1.34 | 0 | - | - |
| Ethiopia | 72,374 | 102,403 | 188 | 1.84 | 124 | 12 | 0.12 |
| Gabon | 14,214 | 1,980 | 63 | 31.82 | 44 | - | - |
| Gambia | 965 | 2,039 | 119 | 58.38 | 67 | - | - |
| Ghana | 42,690 | 28,207 | 238 | 8.44 | 137 | 14 | 0.50 |
| Guinea | 8,200 | 12,396 | 31 | 2.50 | 20 | - | - |
| Guinea-Bissau | 1,165 | 1,816 | 62 | 34.15 | 51 | - | - |
| Ivory Coast | 36,373 | 23,696 | 72 | 3.04 | 39 | 26 | 1.10 |

**Table 2:** Clinical trial infrastructures and intellectual property rights

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| GDP  Country | | Pop. | Trials | Trials | Trials | Patent | Patent apps |
|  | (million) | (thousand) | (ICTRP) | per 1 mill. | (ct.gov) | apps | per 1 mill. |
| Kenya | 70,529 | 48,462 | 639 | 13.19 | 417 | 144 | 2.97 |
| Lesotho | 2,291 | 2,204 | 22 | 9.98 | 16 | - | - |
| Liberia | 2,101 | 4,614 | 25 | 5.42 | 16 | - | - |
| Libya | 34,699 | 6,293 | 19 | 3.02 | 6 | - | - |
| Madagascar | 10,001 | 24,895 | 27 | 1.08 | 15 | 6 | 0.24 |
| Malawi | 5,433 | 18,092 | 317 | 17.52 | 201 | 3 | 0.17 |
| Mali | 14,035 | 17,995 | 170 | 9.45 | 128 | - | - |
| Mauritania | 4,739 | 4,301 | 10 | 2.33 | 1 | - | - |
| Mauritius | 12,168 | 1,263 | 34 | 26.91 | 20 | 2 | 1.58 |
| Morocco | 103,606 | 35,277 | 191 | 5.41 | 96 | 237 | 6.72 |
| Mozambique | 11,015 | 28,829 | 97 | 3.36 | 68 | 15 | 0.52 |
| Namibia | 10,948 | 2,480 | 7 | 2.82 | 3 | - | - |
| Niger | 7,528 | 20,673 | 34 | 1.64 | 26 | - | - |
| Nigeria | 404,653 | 185,990 | 342 | 1.84 | 139 | 50 | 0.27 |
| Republic of the Congo | 7,834 | 5,126 | 52 | 10.14 | 37 | - | - |
| Rwanda | 8,376 | 11,918 | 97 | 8.14 | 71 | 2 | 0.17 |
| Sao Tome and Principe | 343 | 200 | 2 | 10.00 | 0 | - | - |
| Senegal | 14,684 | 15,412 | 103 | 6.68 | 75 | - | - |
| Seychelles | 1,427 | 95 | 3 | 31.69 | 1 | - | - |
| Sierra Leone | 3,737 | 7,396 | 39 | 5.27 | 17 | - | - |
| Somalia | 6,217 | 14,318 | 14 | 0.98 | 0 | - | - |
| South Africa | 295,456 | 56,015 | 4,341 | 77.50 | 2,505 | 2,783 | 49.68 |
| South Sudan | 9,015 | 12,231 | 2 | 0.16 | 0 | - | - |

**Table 2:** Clinical trial infrastructures and intellectual property rights

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| GDP  Country | | Pop. | Trials | Trials | Trials | Patent | Patent apps |
|  | (million) | (thousand) | (ICTRP) | per 1 mill. | (ct.gov) | apps | per 1 mill. |
| Sudan | 95,584 | 39,579 | 71 | 1.79 | 34 | 284 | 7.18 |
| Swaziland | 3,721 | 1,343 | 22 | 16.38 | 13 | - | - |
| Tanzania | 47,340 | 55,572 | 433 | 7.79 | 290 | 1 | 0.02 |
| Togo | 4,400 | 7,606 | 16 | 2.10 | 8 | - | - |
| Tunisia | 42,063 | 11,403 | 426 | 37.36 | 255 | 235 | 20.61 |
| Uganda | 24,079 | 41,488 | 651 | 15.69 | 447 | 16 | 0.39 |
| Zambia | 21,064 | 16,591 | 262 | 15.79 | 171 | 14 | 0.84 |
| Zimbabwe | 16,620 | 16,150 | 190 | 11.76 | 111 | 8 | 0.50 |

Apps, applications; GDP, gross domestic product; ICTRP, International Clinical Trials Registry Platform.

# Appendix 2 Table 3: R&D personnel

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| GDP  Country | | Pop. | R&D staff | Researchers | Researchers | Researchers |
|  | (million) | (thousand) | per mill. | per mill. | (% M&HS) | (% PhD) |
| Algeria | 159,049 | 40,606 | 220.23 | 168.02 | 6.87 | 16.22 |
| Angola | 95,335 | 28,813 | 84.15 | 47.48 |  | 20.09 |
| Benin | 8,583 | 10,872 | - | - | - | - |
| Botswana | 15,581 | 2,250 | 570.35 | 179.47 | 18.31 | 29.37 |
| Burkina Faso | 11,693 | 18,646 | 131.33 | 47.58 | 46.37 | 41.85 |
| Burundi | 3,007 | 10,524 | - | - | - | - |
| Cameroon | 32,218 | 23,439 | - | - | - | - |
| Cape Verde | 1,617 | 540 | 72.83 | 49.21 | 0.00 | 72.00 |
| Central African Republic | 1,756 | 4,595 | - | - | - | - |
| Chad | 9,601 | 14,453 | 75.90 | 58.33 | 6.49 | 29.72 |
| Comoros | 617 | 796 | - | - | - | - |
| Democratic Republic of the Congo | 35,382 | 78,736 | 19.45 | 7.23 | 7.68 | 11.95 |
| Djibouti | 1,727 | 942 | - | - | - | - |
| Egypt | 332,791 | 95,689 | 1,208.51 | 680.30 | 29.80 | 55.86 |
| Equatorial Guinea | 10,685 | 1,221 | - | - | - | - |
| Eritrea | 2,608 | 4,475 | - | - | - | - |
| Ethiopia | 72,374 | 102,403 | 121.21 | 44.97 | 12.98 | 16.66 |
| Gabon | 14,214 | 1,980 | - | - | - | - |
| Gambia | 965 | 2,039 | 603.31 | 33.56 | 40.96 | 55.63 |
| Ghana | 42,690 | 28,207 | 122.57 | 38.37 | 14.40 | 34.39 |
| Guinea | 8,200 | 12,396 | - | - | - | - |
| Guinea-Bissau | 1,165 | 1,816 | - | - | - | - |
| Ivory Coast | 36,373 | 23,696 | - | 69.21 | - | - |

**Table 3:** R&D personnel

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Country GDP | | Pop. | R&D staff | Researchers | Researchers | Researchers |
|  | (million) | (thousand) | per mill. | per mill. | (% M&HS) | (% PhD) |
| Kenya | 70,529 | 48,462 | 1,029.40 | 225.03 | 25.82 | 6.07 |
| Lesotho | 2,291 | 2,204 | 32.90 | 22.83 | 0.00 | 28.06 |
| Liberia | 2,101 | 4,614 | - | - | - | - |
| Libya | 34,699 | 6,293 | - | - | - | - |
| Madagascar | 10,001 | 24,895 | 113.00 | 24.70 | 13.17 | 46.99 |
| Malawi | 5,433 | 18,092 | 113.44 | 48.27 | 18.99 | 9.89 |
| Mali | 14,035 | 17,995 | 73.45 | 30.79 | 11.25 | 61.79 |
| Mauritania | 4,739 | 4,301 | - | - | - | - |
| Mauritius | 12,168 | 1,263 | 500.18 | 181.83 | 6.59 | 27.58 |
| Morocco | 103,606 | 35,277 | 1,149.30 | 1,068.96 | 9.22 | 16.24 |
| Mozambique | 11,015 | 28,829 | 82.83 | 41.48 | 11.65 | 13.99 |
| Namibia | 10,948 | 2,480 | 235.68 | 143.32 | 3.47 | 21.76 |
| Niger | 7,528 | 20,673 | 43.69 | 7.42 | - | - |
| Nigeria | 404,653 | 185,990 | 77.38 | 38.77 | - | 34.11 |
| Republic of the Congo | 7,834 | 5,126 | 67.27 | 31.54 | - | - |
| Rwanda | 8,376 | 11,918 | - | 12.35 | - | 37.66 |
| Sao Tome and Principe | 343 | 200 | - | - | - | - |
| Senegal | 14,684 | 15,412 | 622.86 | 549.32 | 14.07 | 38.68 |
| Seychelles | 1,427 | 95 | 2,028.31 | 146.49 |  | 15.38 |
| Sierra Leone | 3,737 | 7,396 | - | - | - | - |
| Somalia | 6,217 | 14,318 | - | - | - | - |
| South Africa | 295,456 | 56,015 | 742.51 | 473.12 |  | 35.22 |
| South Sudan | 9,015 | 12,231 | - | - | - | - |

**Table 3:** R&D personnel

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Country GDP | | Pop. | R&D staff | Researchers | Researchers | Researchers |
|  | |  |  |  |  |  |
|  | (million) | (thousand) | per mill. | per mill. | (% M&HS) | (% PhD) |
| Sudan | 95,584 | 39,579 | - | - | - | - |
| Swaziland | 3,721 | 1,343 | 308.97 | 119.14 | 33.93 | 24.98 |
| Tanzania | 47,340 | 55,572 | 38.84 | 18.34 | - | 32.78 |
| Togo | 4,400 | 7,606 | 42.42 | 31.77 | 16.11 | 68.88 |
| Tunisia | 42,063 | 11,403 | 2,068.71 | 1,964.97 | - | 35.07 |
| Uganda | 24,079 | 41,488 | 41.54 | 26.47 | 19.55 | 30.51 |
| Zambia | 21,064 | 16,591 | 162.81 | 40.97 | - | - |
| Zimbabwe | 16,620 | 16,150 | 118.34 | 88.72 | 0.23 | 13.45 |

GDP, gross domestic product; M&HS, medical and health sciences; mill., million; pop., population; PhD, doctor of philosophy; R&D, research and development. All data are from 2016 or most recent year available.

# Appendix 2 Table 4: R&D expenditure

Country

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  | (% GDP) | per capita | (M&HS) | per researcher | (M&HS %) |
| Algeria | 159,049 | 40,606 | 241,204.78 | 0.07 | 7.25 | - | 43.13 | - |
| Angola | 95,335 | 28,813 | - | - | - | - | - | - |
| Benin | 8,583 | 10,872 | - | - | - | - | - | - |
| Botswana | 15,581 | 2,250 | 184,247.17 | 0.54 | 86.56 | 23,143.69 | 482.32 | 30.04 |
| Burkina Faso | 11,693 | 18,646 | 65,025.67 | 0.22 | 3.70 | 2,910.88 | - | 4.48 |
| Burundi | 3,007 | 10,524 | 8,460.33 | 0.12 | 0.94 | - | - | - |
| Cameroon | 32,218 | 23,439 | - | - | - | - | - | - |
| Cape Verde | 1,617 | 540 | 2,211.43 | 0.07 | 4.35 |  | 88.46 | - |
| Central African Republic | 1,756 | 4,595 | - | - | - | - | - | - |
| Chad | 9,601 | 14,453 | 91,046.10 | 0.32 | 6.30 | 14,722.82 | 108.00 | 16.17 |
| Comoros | 617 | 796 | - | - | - | - | - | - |
| Democratic Republic of the Congo | 35,382 | 78,736 | 10,234.03 | 0.02 | 0.13 | - | 18.58 | - |
| Djibouti | 1,727 | 942 | - | - | - | - | - | - |
| Egypt | 332,791 | 95,689 | 7,562,293.01 | 0.71 | 79.03 | - | 116.17 | - |
| Equatorial Guinea | 10,685 | 1,221 | - | - | - | - | - | - |
| Eritrea | 2,608 | 4,475 | - | - | - | - | - | - |
| Ethiopia | 72,374 | 102,403 | 787,274.45 | 0.60 | 8.30 | 34,522.66 | 184.52 | 15.50 |
| Gabon | 14,214 | 1,980 | 131,865.44 | 0.58 | 83.10 | - | - | - |
| Gambia | 965 | 2,039 | 3,543.77 | 0.13 | 2.03 | - | 60.47 | - |
| Ghana | 42,690 | 28,207 | 276,671.79 | 0.38 | 11.29 | - | 294.14 | - |
| Guinea | 8,200 | 12,396 | - | - | - | - | - | - |
| Guinea-Bissau | 1,165 | 1,816 | - | - | - | - | - | - |
| Ivory Coast | 36,373 | 23,696 | - | - | - | - | - | - |

GDP

Pop.

GERD

GERD

GERD

GERD

GERD

GERD

**Table 4:** R&D expenditure

Country

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  | (% GDP) | per capita | (M&HS) | per researcher | (M&HS %) |
| Kenya | 70,529 | 48,462 | 788,176.89 | 0.79 | 19.06 | 216,530.58 | 84.70 | 27.47 |
| Lesotho | 2,291 | 2,204 | 3,018.33 | 0.05 | 1.39 | 0.00 | 60.79 | 0.00 |
| Liberia | 2,101 | 4,614 | - | - | - | - | - | - |
| Libya | 34,699 | 6,293 | - | - | - | - | - | - |
| Madagascar | 10,001 | 24,895 | 5,626.29 | 0.01 | 0.23 | 768.68 | 9.15 | 13.66 |
| Malawi | 5,433 | 18,092 |  |  |  |  |  |  |
| Mali | 14,035 | 17,995 | 112,531.28 | 0.31 | 6.44 | 9,256.23 | 209.22 | 8.23 |
| Mauritania | 4,739 | 4,301 | - | - | - | - | - | - |
| Mauritius | 12,168 | 1,263 | 38,856.48 | 0.18 | 31.00 | 1,714.62 | 170.50 | 4.41 |
| Morocco | 103,606 | 35,277 | 1,483,610.29 | 0.71 | 45.78 |  | 63.73 |  |
| Mozambique | 11,015 | 28,829 | 112,790.11 | 0.34 | 4.03 | 32,234.22 | 97.08 | 28.58 |
| Namibia | 10,948 | 2,480 | 81,658.45 | 0.34 | 34.44 | 1,585.30 | 240.31 | 1.94 |
| Niger | 7,528 | 20,673 | - | - | - | - | - | - |
| Nigeria | 404,653 | 185,990 | 1,374,848.32 | 0.22 | 9.39 | 142,133.56 | 242.20 | 10.34 |
| Republic of the Congo | 7,834 | 5,126 | - | - | - | - | - | - |
| Rwanda | 8,376 | 11,918 | - | - | - | - | - | - |
| Sao Tome and Principe | 343 | 200 | - | - | - | - | - | - |
| Senegal | 14,684 | 15,412 | 275,579.68 | 0.75 | 18.40 | - | 33.50 | - |
| Seychelles | 1,427 | 95 | 5,961.26 | 0.22 | 63.26 | - | 305.37 | - |
| Sierra Leone | 3,737 | 7,396 | - | - | - | - | - | - |
| Somalia | 6,217 | 14,318 | - | - | - | - | - | - |
| South Africa | 295,456 | 56,015 | 5,823,288.67 | 0.80 | 105.32 | 905,563.36 | 222.61 | 18.19 |
| South Sudan | 9,015 | 12,231 | - | - | - | - | - | - |

GDP

Pop.

GERD

GERD

GERD

GERD

GERD

GERD

**Table 4:** R&D expenditure

Country

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  | (% GDP) | per capita | (M&HS) | per researcher | (M&HS %) |
| Sudan | 95,584 | 39,579 | 281,296.26 | 0.30 | 9.10 | - | - | - |
| Swaziland | 3,721 | 1,343 | 29,493.90 | 0.27 | 22.36 | 8,923.15 | 187.68 | 30.25 |
| Tanzania | 47,340 | 55,572 | 623,754.21 | 0.53 | 12.32 | - | 671.75 | - |
| Togo | 4,400 | 7,606 | 27,209.82 | 0.27 | 3.76 | 4,317.74 | 100.19 | 15.87 |
| Tunisia | 42,063 | 11,403 | 794,749.43 | 0.60 | 69.70 | - | 35.47 | - |
| Uganda | 24,079 | 41,488 | 114,149.62 | 0.17 | 2.94 | 14,811.03 | 111.06 | 12.98 |
| Zambia | 21,064 | 16,591 | 100,756.29 | 0.28 | 7.70 | - | 187.98 | - |
| Zimbabwe | 16,620 | 16,150 | - | - | - | - | - | - |

GDP

Pop.

GERD

GERD

GERD

GERD

GERD

GERD

GERD, gross expenditure on research and development; GDP, gross domestic product; M&HS, medical and health sciences; pop., population; PhD, doctor of philosophy; R&D, research and development.

All data are from 2016 or most recent year available.

# Appendix 2 Table 5: Regulatory capacities

Country

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  | | | | | | | |
| Algeria | 159,049 | 40,606 | 1 | 0 | 2 | 0 | - | Y | 1 | |
| Angola | 95,335 | 28,813 | - | - | - | - | Y | - | 0 | |
| Benin | 8,583 | 10,872 | 0 | 1 | 0 | 0 | - | Y | 3 | |
| Botswana | 15,581 | 2,250 | 3 | 2 | 1 | 5 | - | Y | 4 | |
| Burkina Faso | 11,693 | 18,646 | 1 | 0 | 2 | 0 | - | Y | 4 | |
| Burundi | 3,007 | 10,524 | - | - | - | - | Y | - | 0 | |
| Cameroon | 32,218 | 23,439 | 1 | 0 | 1 | 1 | Y | - | 8 | |
| Cape Verde | 1,617 | 540 | - | - | - | - | Y | Y | 0 | |
| Central African Republic | 1,756 | 4,595 | - | - | - | - | - | - | 1 | |
| Chad | 9,601 | 14,453 | - | - | - | - | - | - | 0 | |
| Comoros | 617 | 796 | - | - | - | - | - | - | 0 | |
| Democratic Republic of the Congo | 35,382 | 78,736 | 0 | 1 | 0 | 0 | - | Y | 4 | |
| Djibouti | 1,727 | 942 | - | - | - | - | - | - | 0 | |
| Egypt | 332,791 | 95,689 | 2 | 1 | 1 | 0 | - | Y | | 23 |
| Equatorial Guinea | 10,685 | 1,221 | - | - | - | - | - | - | 0 | |
| Eritrea | 2,608 | 4,475 | - | - | - | - | - | - | 0 | |
| Ethiopia | 72,374 | 102,403 | 3 | 1 | 1 | 2 | Y | Y | 7 | |
| Gabon | 14,214 | 1,980 | - | - | - | - | - | Y | 1 | |
| Gambia | 965 | 2,039 | 1 | 0 | 0 | 1 | - | Y | 1 | |
| Ghana | 42,690 | 28,207 | 1 | 1 | 1 | 4 | Y | Y | 3 | |
| Guinea | 8,200 | 12,396 | 2 | 2 | 1 | 1 | Y | - | 0 | |
| Guinea-Bissau | 1,165 | 1,816 | - | - | - | - | Y | - | 0 | |
| Ivory Coast | 36,373 | 23,696 | 1 | 0 | 1 | 0 | Y | Y | 1 | |

GDP

Pop.

Organizations Legislation Regulations Guidelines NPHI NEC IRBs

**Table 5:** Regulatory capacities

Country

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  | | | | | | |
| Kenya | 70,529 | 48,462 | 4 | 3 | 2 | 2 | Y | - | 4 |
| Lesotho | 2,291 | 2,204 | - | - | - | - | - | - | 1 |
| Liberia | 2,101 | 4,614 | 2 | 0 | 2 | 1 | Y | - | 2 |
| Libya | 34,699 | 6,293 | - | - | - | - | Y | - | 1 |
| Madagascar | 10,001 | 24,895 | 0 | 1 | 0 | 0 | Y | Y | 2 |
| Malawi | 5,433 | 18,092 | 8 | 5 | 2 | 8 | Y | Y | 2 |
| Mali | 14,035 | 17,995 | 1 | 1 | 0 | 0 | - | Y | 1 |
| Mauritania | 4,739 | 4,301 | - | - | - | - | - | - | 0 |
| Mauritius | 12,168 | 1,263 | - | - | - | - | - | Y | 2 |
| Morocco | 103,606 | 35,277 | - | - | - | - | Y | - | 2 |
| Mozambique | 11,015 | 28,829 | 0 | 0 | 0 | 1 | Y | - | 0 |
| Namibia | 10,948 | 2,480 | - | - | - | - | - | - | 1 |
| Niger | 7,528 | 20,673 | - | - | - | - | - | - | 1 |
| Nigeria | 404,653 | 185,990 | 5 | 2 | 0 | 6 | Y | Y | 26 |
| Republic of the Congo | 7,834 | 5,126 | - | - | - | - | - | Y | 2 |
| Rwanda | 8,376 | 11,918 | 1 | 0 | 0 | 1 | Y | Y | 3 |
| Sao Tome and Principe | 343 | 200 | - | - | - | - | Y | - | 0 |
| Senegal | 14,684 | 15,412 | 1 | 1 | 0 | 0 | - | Y | 2 |
| Seychelles | 1,427 | 95 | - | - | - | - | - | - | 0 |
| Sierra Leone | 3,737 | 7,396 | 3 | 0 | 3 | 3 | Y | - | 0 |
| Somalia | 6,217 | 14,318 | - | - | - | - | Y | - | 0 |
| South Africa | 295,456 | 56,015 | 11 | 5 | 7 | 9 | Y | Y | 30 |
| South Sudan | 9,015 | 12,231 | - | - | - | - | - | - | 0 |

GDP

Pop.

Organizations Legislation Regulations Guidelines NPHI NEC IRBs

**Table 5:** Regulatory capacities

Country

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (million) | (thousand) |  | | | | | | |
| Sudan | 95,584 | 39,579 | 5 | 3 | 0 | 4 | Y | Y | 7 |
| Swaziland | 3,721 | 1,343 | - | - | - | - | - | - | 0 |
| Tanzania | 47,340 | 55,572 | 5 | 5 | 3 | 3 | Y | - | 5 |
| Togo | 4,400 | 7,606 | 2 | 0 | 1 | 2 | Y | Y | 1 |
| Tunisia | 42,063 | 11,403 | - | - | - | - | - | Y | 2 |
| Uganda | 24,079 | 41,488 | 2 | 2 | 0 | 1 | Y | Y | 9 |
| Zambia | 21,064 | 16,591 | 2 | 3 | 0 | 1 | Y | - | 3 |
| Zimbabwe | 16,620 | 16,150 | 5 | 6 | 3 | 4 | - | - | 3 |

GDP

Pop.

Organizations Legislation Regulations Guidelines NPHI NEC IRBs

GDP, gross domestic product; IRB, institutional review board; NEC, national ethics committee NPHI, national public health institute; pop., population.

# Appendix 2 Table 6: Funding

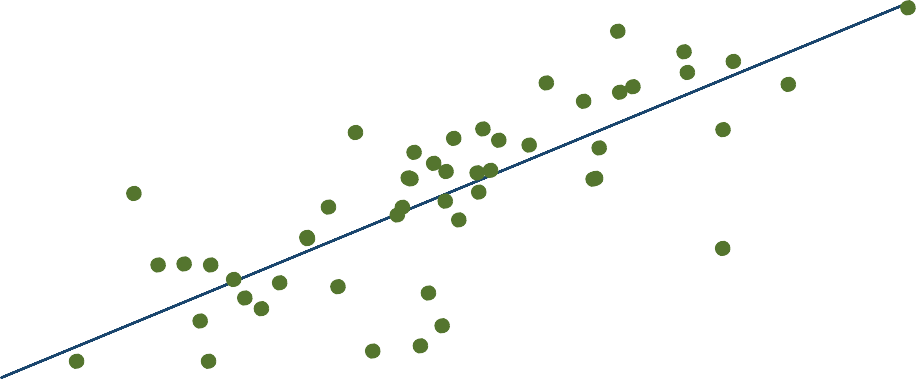
|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | WT | MRC | NIH | CIHR | NHMRC | INSERM | DFG | HHMI |  | EC | CDMRP |
| Algeria | - | - |  | - | - | - | - | - |  | 1,568,955.24 | - |
| Benin | - | - | 1,446,653.00 | - | - | - | - | - |  | - | - |
| Botswana | 184,186.00 | - | 7,356,998.00 | - | - | - | - | - |  | - | - |
| Burkina Faso | 39,300.00 | - |  | - | - | - | - | - |  | - | - |
| Cameroon | 133,593.80 | - |  | - | - | - | - | - | 222 | 2,315,190.99 | - |
| Ivory Coast | 9,177,381.85 | - |  | - | - | - | - | - |  | - | - |
| Democratic Republic of the Congo | 0.00 | - | 451,242.00 | - | - | - | - | - |  | - | - |
| Egypt | 0.00 | - | 384,112.00 | - | - | - | - | - |  | 5,710,715.90 | - |
| Ethiopia | 0.00 | 156,726.38 | 4,045,740.00 | - | - | - | - | - |  | - | - |
| Gambia | 2,201,155.01 | 93,350,867.24 | 220,300.00 | - | - | - | - | - |  | - | - |
| Ghana | 6,802,150.11 | - | 19,915,940.00 | - | - | - | - | - |  | 17,641.05 | - |
| Kenya | 120,959,548.23 | 762,618.20 | 23,965,606.00 | - | - | - | - | - |  | 2,532,293.26 | - |
| Libya | - | - | - | - | - | - | - | - |  | 694,291.15 |  |
| Madagascar | 0.00 | - | 269,867.00 | - | - | - | - | - |  | - | - |
| Malawi | 8,620,144.53 | - | 3,239,240.00 | - | - | - | - | - |  | - | - |
| Mali | 1,317,039.94 | - | 7,315,257.00 | - | - | - | - | - |  | - | - |
| Morocco | - | - | - | - | - | - | - | - | - | 3,357,582.35 |  |
| Mozambique | 0.00 | - | 14,014,017.00 | - | - | - | - | - |  | - | - |
| Namibia | 0.00 | - |  | - | - | - | - | - |  | - | - |
| Nigeria | 1,002,984.47 | - | 34,273,898.00 | - | - | - | - | - |  | 17,641.05 | - |
| Rwanda | 0.00 | - | 1,539,861.00 | - | - | - | - | - |  | - | - |
| Senegal | 1,373,601.81 | 1,720,283.81 | - | - | - | - | - | - |  | 21,006.48  2,513,725 | - |
| South Africa | 77,994,865.15 | 13,302,915.07 | 388,950,849.00 | - | - | - | - | - |  | 2,513,725.77 | - |
| Sudan | 0.00 | - | - | - | - | - | - | - |  | - | - |
| Tanzania | 16,673,318.44 | - | 4,764,355.00 | - | - | - | - | - |  | - | - |
| Tunisia | 0.00 | - | 2,178,511.00 | - | - | - | - | - |  | 7,307,461.63 | - |
| Uganda | 17,943,085.72 | 40,607,133.72 | 35,999,665.00 | - | - | - | - | - |  | 17,641.05 | - |

**Table 6:** Funding

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | WT | MRC | NIH | CIHR | NHMRC | INSERM | DFG | HHMI | EC | CDMRP |
| Zambia | 15,720.00 | - | 13,073,179.00 | - | - | - | - | - | - | - |
| Zimbabwe | 1,389,486.87 | - | 21,663,497.00 | - | - | - | - | - | - | - |

CIHR, Canadian Institutes of Health Research; CDMRP, Congressional Directed Medical Research Programs (Department of Defence); DFG, German Research Foundation (Deutsche Forschungsgemeinschaft); EC, European Commission; HHMI, Howard Hughes Medical Institute; INSERM, Institut national de la santé et de la recherche médicale; MRC, Medical Research Council; NHMRC, National health and Medical Research Council; NIH, National Institutes of Health; WT, Wellcome Trust

\*Cells for CIHR, NHMRC, INSERM, HHMI, CDMRP, DFG are empty because data did not meet inclusion criteria. We excluded funding for research projects in which the principal investigators were based at non-African institutions, even if these projects included collaborators, field sites, or locations of research in Africa.



6

8

10

gdp\_ln

12

14

95% CI

pub\_ln

Fitted values

2

4

6

8

10

12

**Appendix 2 Figure 1. The relationship between gross domestic product and publications**

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 8.** Regression summary for gross domestic product and number of publications

(1)

pub\_ln

gdp\_ln 0.934∗∗∗

(10.52)

Constant −1.630

(−1.93)

Observations 54

*R*2 0.680

Adjusted *R*2 0.674

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

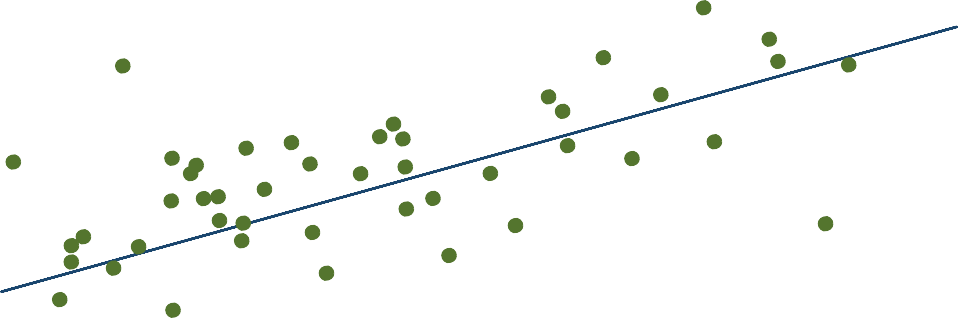
−12

−10

−8

−6

**Appendix 2 Figure 2. The relationship between gross domestic product per capita and publications per capita**



6

7

8

gdp\_cap\_ln

9

10

95% CI

pub\_cap\_ln

Fitted values

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 9.** Regression summary for gross domestic product per capita and the number of publications per capita

(1)

pub\_cap\_ln

gdp\_cap\_ln 0.771∗∗∗

(5.56)

Constant −14.42∗∗∗

(−14.39)

Observations 54

*R*2 0.373

Adjusted *R*2 0.361

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

0

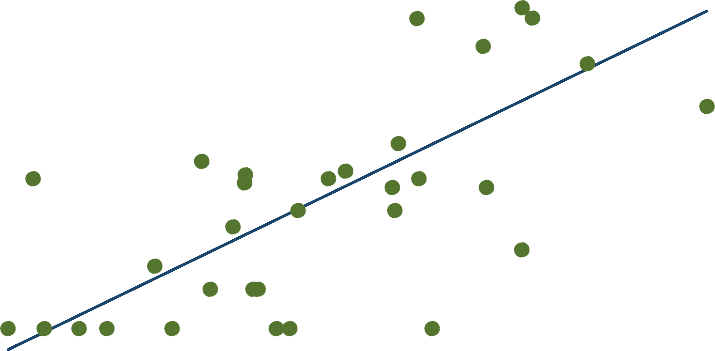
2

4

6

8

Appendix 2 Figure 3. The relationship between gross domestic product and patent applications



6

8

10

gdp\_ln

12

14

95% CI

patent\_ln

Fitted values

−2

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 10.** Regression summary for gross domestic product and patent applications

(1)

patent\_ln

gdp\_ln 1.093∗∗∗

(6.27)

Constant −8.519∗∗∗

(−4.83)

Observations 34

*R*2 0.551

Adjusted *R*2 0.537

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

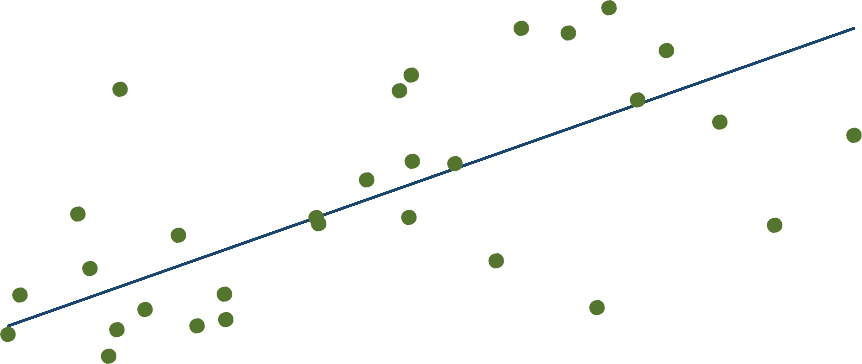
−2

0

2

4

**Appendix 2 Figure 4. The relationship between gross domestic product per capita and patent applications per capita**



6

7

8

gdp\_cap\_ln

9

10

95% CI

patent\_mill\_ln

Fitted values

−4

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 11.** Regression summary for gross domestic product per capita and patent applications per capita

(1)

patent\_mill\_ln

gdp\_cap\_ln 1.196∗∗∗

(4.65)

Constant −8.996∗∗∗

(−4.81)

Observations 34

*R*2 0.403

Adjusted *R*2 0.384

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

8

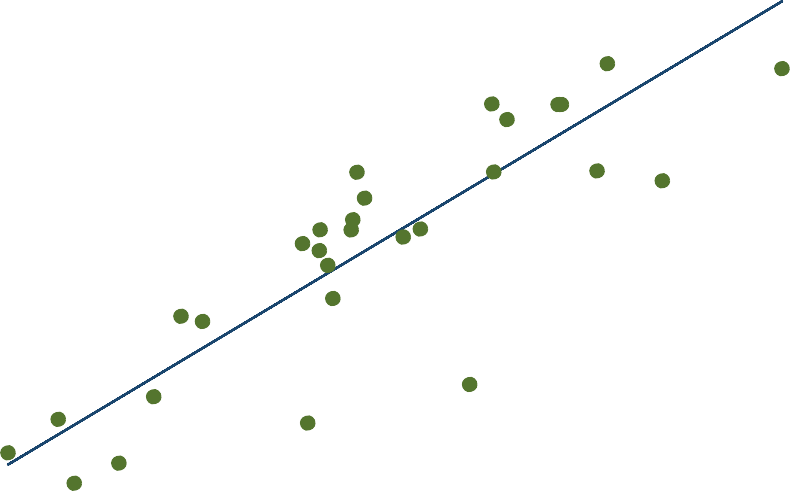
10

12

14

16

Appendix 2 Figure 5. The relationship between gross domestic product and GERD



6

8

10

gdp\_ln

12

14

95% CI

gerd\_ln

Fitted values

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 12.** Regression summary for gross domestic product and GERD

(1)

gerd\_ln

gdp\_ln 1.190∗∗∗

(10.38)

Constant −0.188

(−0.16)

Observations 31

*R*2 0.788

Adjusted *R*2 0.781

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

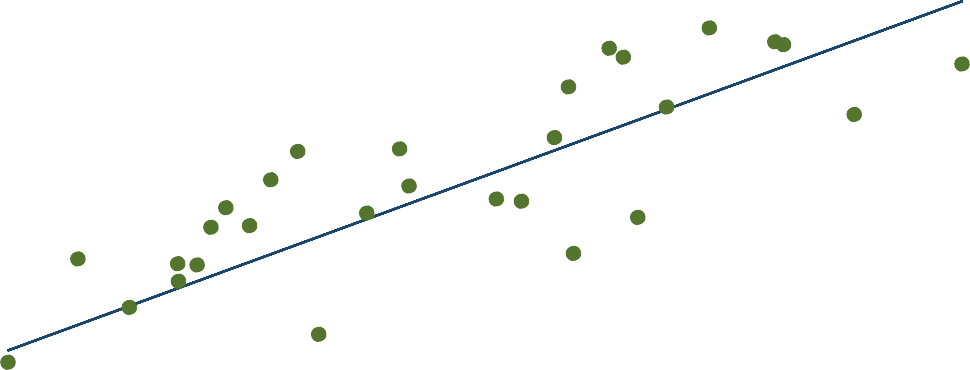
0

2

4

6

**Appendix 2 Figure 6. The relationship between gross domestic product per capita and GERD per capita**



6

7

8

gdp\_cap\_ln

9

10

95% CI

gerd\_cap\_ln

Fitted values

−2

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 13.** Regression summary for gross domestic product per capita and GERD per capita

(1)

gerd\_cap\_ln

gdp\_cap\_ln 1.244∗∗∗

(7.17)

Constant −6.935∗∗∗

(−5.37)

Observations 31

*R*2 0.639

Adjusted *R*2 0.627

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

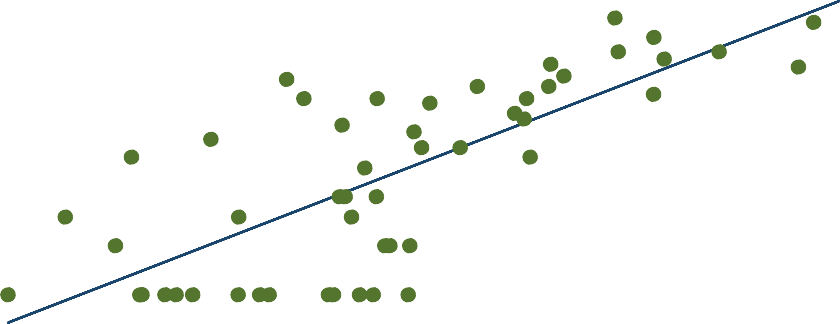
0

2

4

6

**Appendix 2 Figure 7. The relationship between gross domestic product and universities**



6

8

10

gdp\_ln

12

14

95% CI

univ\_ln

Fitted values

−2

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 14.** Regression summary for gross domestic product and universities

(1)

univ\_ln

gdp\_ln 0.700∗∗∗

(8.55)

Constant −4.893∗∗∗

(−6.22)

Observations 52

*R*2 0.594

Adjusted *R*2 0.586

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

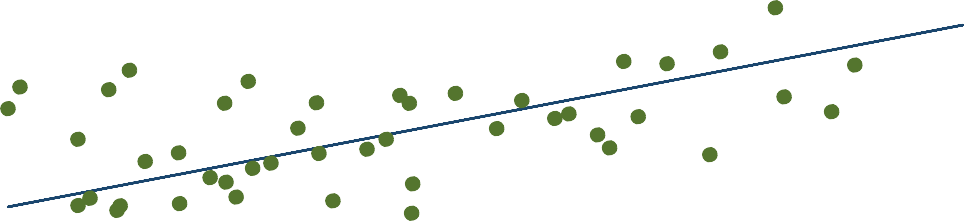
−2

0

2

4

**Appendix 2 Figure 8. The relationship between gross domestic product per capita and universities per capita**



6

7

8

gdp\_cap\_ln

9

10

95% CI

univ\_mill\_ln

Fitted values

−4

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 15.** Regression summary for gross domestic product per capita and universities per capita

(1)

univ\_mill\_ln

gdp\_cap\_ln 0.648∗∗∗

(5.06)

Constant −5.207∗∗∗

(−5.62)

Observations 52

*R*2 0.339

Adjusted *R*2 0.326

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

0

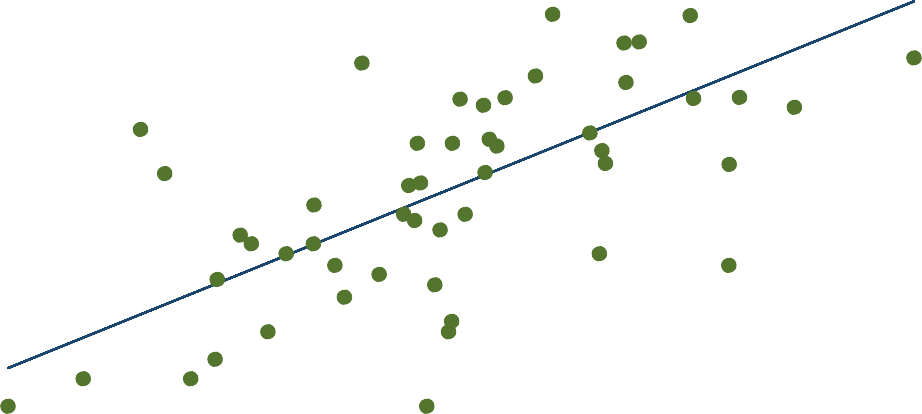
2

4

6

8

**Appendix 2 Figure 9. The relationship between gross domestic product and clinical trials**



6

8

10

gdp\_ln

12

14

95% CI

ictrp\_ln

Fitted values

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 16.** Regression summary for gross domestic product and clinical trials

(1)

ictrp\_ln

gdp\_ln 0.765∗∗∗

(7.03)

Constant −3.212∗∗

(−3.09)

Observations 53

*R*2 0.492

Adjusted *R*2 0.482

*t* statistics in parentheses

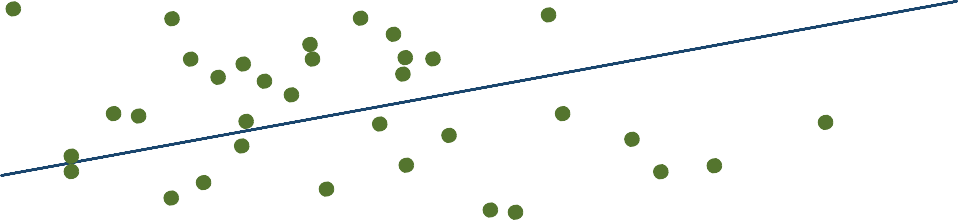
∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001

0

2

4

**Appendix 2 Figure 10. The relationship between gross domestic product per capita and clinical trials per capita**



6

7

8

gdp\_cap\_ln

9

10

95% CI

ictrp\_mill\_ln

Fitted values

−2

**Note**: Both variables are expressed as natural logs.

**Appendix 2 Table 17.** Regression summary for gross domestic product per capita and clinical trials per capita

(1)

ictrp\_mill\_ln

gdp\_cap\_ln 0.492∗∗

(2.98)

Constant −1.789

(-1.50)

Observations 53

*R*2 0.149

Adjusted *R*2 0.132

*t* statistics in parentheses

∗ *p* < 0.05, ∗∗ *p* < 0.01, ∗∗∗ *p* < 0.001