

**Article title:** Inpatient Care Costs of COVID-19 in South Africa’s Public Healthcare System

**Journal name:** International Journal of Health Policy and Management (IJHPM)

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### **Supplementary File 3**

#### ***Capital Equipment***

We identified hospital equipment and linen requirements through reviewing clinical management guidelines and published literature.<sup>1-3</sup> These items, quantity per patient, their unit costs and corresponding annualised costs are presented in Table S7. Unit costs for capital equipment were obtained from government commodity tender documents and retail advertisements.<sup>4-10</sup> (Table S7). In general wards, we assumed that nurses would observe and record patients’ vital signs twice per day, and thus 2 vital sign monitoring machines would be shared amongst 50 patients on a ward. We assumed that patients in high care and intensive care would require continuous monitoring. Quantity of linen used per patient per day was obtained through expert consultations (Table S7).

We assumed that each hospital bed would be occupied for two-thirds of the year, in order to apportion daily economic costs to each patient – this assumption does not apply to the financial cost analysis, where the unit price of each equipment was divided by the total number of days in a year (365 days) to estimate daily financial costs. In a scenario analysis, we assessed the impact of this assumption (number of ‘bed days’ per year) on total economic costs, using a lower bound of a one-third occupancy rate and an upper bound of 100% occupancy.

Table S7. Inputs for Capital Equipment Costs (2020 USD)

| (1)<br>Resource input                | Ward/ patient<br>population                  | (2)<br>Quantity, per<br>patient per day | (3)<br>Unit cost | Annualised costs | Economic cost per<br>patient per day<br>[financial cost] | Sources  |
|--------------------------------------|--|---|------------------|------------------|--|--|
| <b>Infusion pump</b>                 | All wards                                    | 1                                       | 897.87           | 116.28           | 0.48 [0.25]  | (1) <sup>11</sup><br>(2) Expert opinion<br>(3) <sup>5</sup>  |
| <b>Patient monitor</b>               | General ward                                 | 0.04 <sup>a</sup>                       | 1 992.70         | 258.06           | 0.03 [0.01]  | (1) <sup>11</sup>  |
|                                      | High care ward                               | 0.083 <sup>b</sup>                      |                  |                  | 0.09 [0.05]  | (2) Expert opinion   |
|                                      | ICU  | 1                                       |                  |                  | 1.06 [0.55]  | (3) <sup>6</sup>   |
| <b>Ventilator</b>                    | ICU: CPAP                                    | 1                                       | 9 660.80         | 1 251.12         | 5.14 [2.65]  | (1) <sup>11</sup>  |
|                                      | ICU: NIV                                     | 1                                       | 12 945.12        | 1 676.45         | 6.89 [3.55]  | (2) Assumption   |
|                                      | ICU: IMV                                     | 1                                       | 26 991.34        | 3 495.50         | 14.37 [7.39]   | (3) <sup>4</sup>   |
| <b>High flow machine</b>             | High care ward                               | 1                                       | 3 716.34         | 487.11           | 2.00 [1.03]  | (1) <sup>11</sup><br>(2) Expert opinion<br>(3) <sup>4</sup>  |
| <b>Oxygen Concentrator</b>           | All patients who receive respiratory support | 1                                       | 2 018.26         | 261.37           | 1.07 [0.55]  | (1) <sup>11</sup><br>(2) Expert opinion<br>(3) <sup>7</sup>  |
| <b>Suction pump</b>                  | ICU  | 1                                       | 210.63           | 27.28            | 0.11 [0.06]  | (1) <sup>11</sup><br>(2) Expert Opinion<br>(3) <sup>8</sup>  |
| <b>Backup oxygen cylinder</b>        | All patients who receive respiratory support | 1                                       | 283.53           | 36.72            | 0.15 [0.08]  | (1) <sup>11</sup><br>(2) Expert Opinion<br>(3) <sup>9</sup>  |
| <b>Ambu-bag (self-inflating bag)</b> | ICU  | 1                                       | 15.72            | 3.63             | 0.01 [0.01]  | (1) <sup>11</sup><br>(2) Expert Opinion<br>(3) <sup>10</sup> |
| <b>Laryngoscope</b>                  | ICU: intubated                               | 0.38 <sup>c</sup>                       | 209.75           | 48.44            | 0.20 [0.11]  | (1) <sup>11</sup>  |

|   | patients only |                |        |       |             | (2) <sup>11,12</sup><br>(3) <sup>13</sup>                   |
|---|---------------|----------------|--------|-------|-------------|---|
| <b>Bed: Manual hospital bed plus mattress</b> | All           | 1              | 620.23 | 80.33 | 0.33 [0.17] | (1) <sup>11</sup><br>(2) Expert Opinion<br>(3) <sup>4</sup> |
| <b>Blanket</b>                                | All           | 1              | 21.24  | 4.91  | 0.02 [0.01] | (1) <sup>1</sup><br>(3) <sup>1</sup>                        |
| <b>Draw sheet</b>                             | All           | 5 <sup>d</sup> | 10.23  | 11.82 | 0.05 [0.03] | (1) <sup>1</sup><br>(3) <sup>1</sup>                        |
| <b>Bed sheet</b>                              | All           | 5 <sup>d</sup> | 10.23  | 11.82 | 0.05 [0.03] | (1) <sup>1</sup><br>(3) <sup>1</sup>                        |
| <b>Mattress Protector</b>                     | All           | 5 <sup>d</sup> | 9.03   | 10.45 | 0.05 [0.03] | (1) <sup>1</sup><br>(3) <sup>1</sup>                        |
| <b>Blanket cover</b>                          | All           | 5 <sup>d</sup> | 10.23  | 11.82 | 0.05 [0.03] | (1) <sup>1</sup><br>(3) <sup>1</sup>                        |
| <b>Patient suits</b>                          | All           | 5 <sup>d</sup> | 19.86  | 22.94 | 0.11 [0.06] | (1) <sup>1</sup><br>(3) <sup>1</sup>                        |
| <b>Pillows</b>                                | All           | 2              | 7.22   | 3.34  | 0.02 [0.01] | (1) <sup>1</sup><br>(3) <sup>3</sup>                        |
| <b>Pillow covers</b>                          | All           | 5 <sup>d</sup> | 3.41   | 3.94  | 0.01 [0.01] | (1) <sup>1</sup><br>(3) <sup>2</sup>                        |

Note: For most inputs, a different source was used for each component of the input. Thus for each row, the number attached to the column header corresponds to each citation in the source column.

<sup>a</sup> 2 monitors shared amongst the ward for nurses to take twice daily vitals

<sup>b</sup> Each patient requires 3 hourly observations for approximately 15 minutes, thus 2/24 hours each day

<sup>c</sup> 3 required for unit, thus divided by number of patients in the unit, and only used once during ICU admission

<sup>d</sup> Multiple required per bed space to rotate for laundry

### ***Human Resources***

Detailed inputs for estimating cost per patient per day for each cadre are displayed in Table S8. Hourly wage of each cadre of staff was estimated using annual salary, number of hours worked per year, overtime and benefits pay. The value of overtime pay was based on expert opinion and was estimated to be 40% the annual salary of junior staff and 20% the annual salary of senior staff. Benefits are included in the annual salary estimates of staff members included in the Occupational-Specific Dispensation (OSD) salary scales. Administrative staff and cleaning staff are not included in the OSD scales, and these staff receive benefits amounting to 37% of their annual salary (expert consultation).

Staff-to-patient ratios for each staff cadre were determined by dividing the estimated number of patients on each ward (50 patients in general wards, 25 patients in high care wards and 12 patients in ICU) by the number of staff expected to cover each ward (Table S8). In the case of nurses, the staff-to-patient ratio was obtained from the Guidelines for Intensive Care in South Africa, and through expert consultation.<sup>14</sup>

In a scenario analysis, staff-to-patient ratio for each cadre was varied by +/-50% to determine the impact of these assumptions on cost per patient day. The ranges of staff-to-patient ratio used in this sensitivity analysis are presented in Table S8.

Table S8. Inputs for Human Resource Costs (2020 USD)

| (1)<br>Type of Human Resource                | Ward                | (2)<br>Staff-to-patient ratio | (3)<br>Annual salary | (4)<br>Overtime | (5)<br>Benefits | (6)<br>Hourly wage | Cost per patient per day | Source  |
|--|---------------------|-------------------------------|----------------------|-----------------|-----------------|--------------------|--------------------------|---|
| <b>Infection prevention control officers</b> | All wards           | 1:100<br>(1:50 – 1:150)       | 24 717.93            | -               | -               | 14.37              | 1.15                     | (1) <sup>15</sup><br>(2) Assumption<br>(3) <sup>16</sup><br>(6) <sup>16</sup> , Expert opinion                      |
| <b>Critical care nurses</b>                  | Intensive care Unit | 1:2<br>(1:1 – 1:3)            | 28 791.00            | -               | 10 652.64       | 16.74              | 200.87                   | (1) <sup>15</sup><br>(2) Assumption<br>(3) <sup>16</sup><br>(5) <sup>16</sup><br>(6) <sup>16</sup> , Expert opinion |
| <b>Professional nurse</b>                    | General ward        | 1: 18<br>(1:9 – 1:27)         | 21 201.65            | -               | -               | 12.33              | 8.22                     | (1) <sup>14</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(6) <sup>16</sup> , Expert opinion                  |
|  | High care ward      | 1:3 (1:1 – 1:5)               |                      |                 |                 |                    | 49.31                    |   |
|  | Intensive care unit | 1:2 (1:1 – 1:3)               |                      |                 |                 |                    | 147.92                   |   |
| <b>Staff nurses</b>                          | General ward        | 1:18 (1:9 – 1:27)             | 13 658.467           | -               | -               | 7.95               | 5.29                     | (1) <sup>14</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(6) <sup>16</sup> , Expert opinion                  |
|  | High care ward      | 1:3 (1:1 – 1:5)               |                      |                 |                 |                    | 31.76                    |   |
|  | Intensive care unit | 1:2 (1:1 – 1:3)               |                      |                 |                 |                    | 95.29                    |   |
| <b>Nursing Assistant</b>                     | General ward        | 1:10 (1:5 – 1:15)             | 10 468.79            | -               | -               | 6.08               | 14.61                    | (1) Expert opinion<br>(2) Expert opinion<br>(3) <sup>16</sup>   |

|  |                                       |                         |            |           |   |       |       |  |
|--|---------------------------------------|-------------------------|------------|-----------|---|-------|-------|--|
|  |                                       |                         |            |           |   |       |       | (6) <sup>16</sup> ,Expert opinion  |
| <b>Consultant<br/>(internal medicine)<br/>a,b</b>      | General ward<br>and high care<br>ward | 1:100<br>(1:50 – 1:150) | 91 676.98  | 18 335.40 | - | 63.96 | 5.12  | (1) <sup>14</sup><br>(2)Expert opinion<br>(3) <sup>16</sup>  |
|  | Intensive care<br>Unit                | 1:12 (1:6 – 1:18)       |            |           |   |       | 3.41  | (4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion   |
| <b>Intensivist – team<br/>leader<sup>a</sup></b>       | Intensive care<br>Unit                | 1:12 (1:6 – 1:18)       | 114 617.63 | 22 923.50 | - | 79.97 | 4.26  | (1) <sup>14</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion |
| <b>Cardiovascular<br/>specialist<sup>a</sup></b>       | Intensive care<br>Unit                | 1:12<br>(1:6 – 1:18)    | 91 676.98  | 18 335.40 | - | 63.96 | 0.56  | (1) <sup>17</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion |
| <b>Pulmonologists</b>                                  | Intensive care<br>unit                | 1:20<br>(1:10 – 1:30)   | 91 676.9   | 18 335.40 | - | 63.96 | 2.13  | (1) <sup>14</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion |
| <b>Internal medicine<br/>physician<br/>(registrar)</b> | General ward                          | 1:25<br>(1:13 – 1:38)   | 50 538.92  | 20 215.58 | - | 41.14 | 13.16 | (1) <sup>14</sup><br>(2) Expert opinion  |
|  | High care ward                        | 1:20<br>(1:10 – 1:30)   |            |           |   |       | 16.45 | (3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion   |
|  | Intensive care<br>unit                | 1:12 (1:6 – 1:18)       |            |           |   |       | 27.42 | (6) <sup>16</sup> ,Expert opinion  |

|   |                     |                                    |           |          |          |       |      |  |
|---|---------------------|------------------------------------|-----------|----------|----------|-------|------|--|
| <b>Administrative staff</b>                     | General ward        | 1:50<br>(1:25 – 1:75)              | 9 490.30  | -        | 3 511.40 | 5.52  | 0.88 | (1) <sup>14</sup><br>(2) <sup>14</sup><br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion  |
|   | High care ward      | 1:20<br>(1:10 – 1:30)              |           |          |          |       | 3.02 |  |
|   | Intensive care unit | 1:12 (1:6 – 1:18)                  |           |          |          |       | 3.68 |  |
| <b>Respiratory physiotherapists<sup>c</sup></b> | High care ward      | 1:20<br>(1:10 – 1:30)              | 24 717.93 | -        | -        | 14.37 | 5.75 | (1) <sup>14</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion |
| <b>Radiographer c</b>                           | High care ward      | 1:100<br>(1:50 – 1:150)            | 24 717.93 | -        | -        | 14.37 | 1.15 | (1) <sup>14</sup><br>(2) <sup>14</sup><br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion  |
|   | Intensive care unit | 1:12<br>(1:6 – 1:18)               |           | 9 887.20 |          | 20.12 | 3.22 |  |
| <b>Social worker</b>                            | High care wards     | 1:100<br>(1:50 - 1:150)            | 23 470    | 9 388.17 | -        | 19.10 | 1.09 | (1) Expert opinion<br>(2) <sup>14</sup><br>(3) <sup>16</sup><br>(4) <sup>16</sup><br>(6) <sup>16</sup> ,                               |
|   | Intensive care unit |                                    |           |          |          |       | 3.06 |  |
| <b>Medical technologists</b>                    | High care ward      | 1:100<br>(1:50 – 1:150)            | 24 717.93 | -        | -        | 14.37 | 1.15 | (1) Expert opinion<br>(2) <sup>14</sup><br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion |
|   | Intensive care unit | 1:50 <sup>c</sup><br>(1:25 – 1:75) |           | 9 887.20 | 20.12    | 3.22  |      |  |

|                            |                     |                      |           |   |          |       |      |  |
|----------------------------|---------------------|----------------------|-----------|---|----------|-------|------|--|
| <b>Nutritionist</b>        | Intensive care unit | 1:50 (1:25 – 1:75)   | 24 717.93 | - | -        | 14.37 | 2.30 | (1) <sup>14</sup><br>(2) Expert opinion<br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion |
| <b>Clinical pharmacist</b> | High Dependency     | 1:100 (1:50 – 1:150) | 58 221.98 | - | -        | 33.85 |      | (1) <sup>14</sup><br>(2) <sup>14</sup><br>(3) <sup>16</sup><br>(4) <sup>16</sup> ,Expert opinion<br>(6) <sup>16</sup> ,Expert opinion  |
|                            | Intensive care unit | 1:50 (1:25 – 1:75)   |           |   |          |       |      |  |
| <b>Cleaning staff</b>      | All wards           | 1:50 (1:25 – 1:75)   | 6 697.94  | - | 2 478.27 | 5.34  | 0.85 | (1) <sup>14</sup><br>(2) <sup>14</sup><br>(3) <sup>16</sup><br>(4) <sup>16</sup><br>(6) <sup>16</sup>                                  |

Note: For most inputs, a different source was used for each component of the input. Thus for each row, the number attached to the column header corresponds to each citation in the source column.

<sup>a</sup> One consultant leading medical team on ICU, with the role shared between Intensivist, anaesthetist consultant and cardiovascular specialist

<sup>b</sup> In the general ward, twenty-four-hour consultant availability, covering HDU and the wards (approximately 100 pts)

<sup>c</sup> Working 8 hours/day full-time, providing on-call cover for 16 hours of the day to ICU only



***Overhead costs***

Table S9 presents the ward overhead costs. These were obtained from the facility fees laid out in the Uniform Patient Fee Schedule (2020). The UPFS reports fees for 3 different levels of health care facilities based on the services these facilities provide (primary, secondary and tertiary health services). We used the median fees of the different healthcare facility levels, for of the 3 types of wards (general ward, HCW and ICU) reported in the UPFS.

*Table S9. Facility fees for each ward (2020 USD)*

|   | <b>General ward</b> | <b>High care ward</b> | <b>Intensive care unit</b> |
|---|---------------------|-----------------------|----------------------------|
| <b>Facility fee per patient per day</b> | 64.57               | 196.55                | 516.36                     |

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