# Sample model outputs with explanations

CG 19th June 2022 for Berlin meeting; UPDATED 29/06/22

Below is a snapshot of output with variables explained and a few notes. All data are reported for the timestep/day. Data shown are for one particular day in a test run.

**General indicators:**

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| # | Indicator | Data | Indicator meaning |
| 1 | Confirmed cases | 51095.48196 | Clinically confirmed cases |
| 2 | Total in hospital | 6438.840001 | Total number of patients in hospital in all wards and waiting for wards |
| 3 | Hospital admissions | 1927.45359 | People being admitted to hospital, a proportion of (both detected and undetected) infected people |
| 4 | Hospital discharges | 999.6324612 | Patients being discharged from hospital |
| 5 | ICU admissions | 38.44842128 | Patients being admitted to ICU |
| 6 | ICU discharges | 17.71942031 | Patients being transferred from ICU to ward |
| 7 | Deaths in hospital | 171.8353549 | Patient deaths in wards, ICU or overflows |

**Ward beds and nurses:**

A staffed ward bed is available when there is both a physical bed available and a nurse. The input parameter *nurse\_per\_bed* determines how many nurses are needed for each physical bed.

*Note: The data show that the shortfall in staffed beds at this point in time is caused by the lack of available nurses, not beds (see gap variables highlighted).*

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| # | Indicator | Data | Indicator meaning |
| 8 | Beds | 10000 | Physical ward beds in stock |
| 9 | Occupied ward beds | 4186.942246 | Total ward beds occupied by patients |
| 10 | Physical ward beds available | 5813.057754 | Physical ward beds currently unoccupied |
| 11 | Expected beds freed | 699.2455555 | Average expected staffed beds freed by ward discharges, deaths and transfers to ICU. |
| 12 | Patients Waiting for Ward Bed | 1497.897722 | Patients waiting for a ward bed |
| 13 | In Ward Overflow | 27.00395345 | Patients who could not get a ward bed and are being cared for outside wards, e.g. in emergency department or on trolleys |
| 14 | Physical ward beds needed | 1524.901675 | Number of physical ward beds needed to meet demand at this time - takes into account patients waiting for a bed and in overflow |
| 15 | Physical ward beds gap | 0 | Gap in physical hospital beds, comparing beds available plus expected beds freed with beds needed (value greater than zero only when demand exceeds supply) |
| 16 | Max available nurses | 1000 | Total general ward nurses employed and available for care of pandemic patients, assuming none are absent |
| 17 | Absent Nurses | 35.24175048 | Nurses absent due to infection (if staff absenteeism option is set) |
| 18 | Nurses | 964.7582495 | Total general ward nurses employed and available for care of pandemic patients, minus absent nurses |
| 19 | Occupied nurses | 837.3884492 | Total general nurses occupied with caring for patients in wards, calculated on the basis of number of occupied beds and nurse-to-patient ratio |
| 20 | Available nurses | 127.3698003 | Nurses not occupied with patients nor absent |
| 21 | Expected nurses freed | 139.8491111 | Nurses freed as expected staffed beds are freed by ward discharges, deaths and transfers to ICU |
| 22 | Total nurses needed for incoming patients | 304.980335 | Number of ward nurses needed to meet demand (for patients waiting for ward and in ward overflow) at the normal nurse-to-patient ratio |
| 23 | Nurses gap | 37.76142359 | Gap in nurses, comparing nurses available plus expected nurses freed with nurses needed (value greater than zero only when demand exceeds supply) |
| 24 | Extra staff needed for overflow patients |  | Overflow patients have separate unspecified staff (simplifying assumption) |
| 25 | Staffed ward beds available | 636.8490016 | The number of physical ward beds supported by available nurses |
| 26 | Staffed ward beds needed | 1524.901675 | The number of staffed ward beds needed to meet current demand (includes patients waiting for ward and in ward overflow) |
| 27 | Staffed ward beds gap | 188.807118 | The gap in staffed ward beds, comparing available staffed beds plus expected beds freed with patients waiting for a bed plus patients in ward overflow |
| 28 | Ward admissions | 1336.094557 | Patients being admitted to ward beds (maximum is staffed wards available plus expected beds freed) |
| 29 | Moving to ward overflow | 161.8031645 | Patients waiting for a ward bed who cannot get access to one (does not include patients currently in overflow) |

**ICU beds and ICU nurses:**

A staffed, equipped ICU bed is available when there is a physical ICU available, an ICU nurse, and usually a ventilator. Two input parameters are used to calculate availability and demand: the *ICU\_nurse\_per\_bed* ratio and *fraction\_ICU\_patients\_requiring\_ventilator*.

*Note: The data show that the shortfall in staffed ICU beds at this point in time is caused by a lack of both available ICU nurses and ICU beds (see gap variables highlighted). There is no gap in ventilators (next table).*

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| # | Indicator | Data | Indicator meaning |
| 30 | ICU Beds | 400 | Physical ICU beds in stock |
| 31 | Occupied ICU beds | 389.8272469 | Total ICU beds occupied by patients |
| 32 | Physical ICU beds available | 10.17275308 | Physical ICU beds currently unoccupied |
| 33 | Expected ICU beds freed | 38.44842128 | Average expected staffed ICU beds freed by transfers to wards and deaths in ICU |
| 34 | Patients Waiting for ICU | 197.0034265 | Patients waiting for an ICU bed |
| 35 | In ICU Overflow | 140.1654064 | Patients who could not get an ICU bed and are being cared for outside ICU, ideally in an enhanced ward bed with extra equipment or staffing, but may not be possible |
| 36 | Physical ICU beds needed | 337.168833 | Number of physical ICU beds needed to meet demand at this time - takes into account patients waiting for an ICU bed and patients in ICU overflow |
| 37 | Physical ICU beds gap | 288.5476586 | Gap in physical ICU beds, comparing ICU beds available plus expected ICU beds freed with ICU beds needed (value greater than zero only when demand exceeds supply) |
| 38 | Max available ICU nurses | 200 | Total ICU nurses employed and available for care of pandemic patients, assuming none are absent |
| 39 | Absent ICU Nurses | 7.048350096 | ICU nurses absent due to infection (if staff absenteeism option is set) |
| 40 | ICU Nurses | 192.9516499 | Total ICU ward nurses employed and available for care of pandemic patients, minus absent ICU nurses |
| 41 | Occupied ICU nurses | 192.9516499 | Total ICU nurses occupied with caring for patients in ICU wards, calculated on the basis of number of occupied ICU beds and ICU nurse-to-patient ratio |
| 42 | Available ICU nurses | 0 | ICU nurses not occupied with patients nor absent |
| 43 | Expected ICU nurses freed | 19.22421064 | ICU nurses freed as expected ICU beds are freed by transfers to wards and deaths in ICU |
| 44 | Total ICU nurses needed for incoming patients | 168.5844165 | Number of ICU nurses needed to meet demand (for patients waiting for ICU and in ICU overflow) at the normal ICU nurse-to-patient ratio |
| 45 | ICU nurses gap | 149.3602058 | Gap in ICU nurses, comparing ICU nurses available plus expected ICU nurses freed with ICU nurses needed (value greater than zero only when demand exceeds supply) |
| 46 | Staffed equipped ICU beds available | 0 | The number of ICU ward beds supported by available ICU nurses and ventilators |
| 47 | Staffed equipped ICU beds needed | 337.168833 | The number of staffed ICU beds needed to meet current demand (includes patients waiting for ICU and in ICU overflow) |
| 48 | Staffed equipped ICU beds gap | 298.7204117 | The gap in staffed ICU beds, comparing available staffed ICU beds plus expected ICU beds freed with patients waiting for ICU plus patients in ICU overflow |
| 49 | Moving to ICU overflow | 158.5550052 | Patients waiting for an ICU bed who cannot get access to one (does not include patients currently in ICU overflow) |
| 50 | At risk of dying from lack of ICU | 126.1488658 | Patients at risk of dying because they cannot access an ICU bed |

**Ventilators:**

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| # | Indicator | Data | Indicator meaning |
| 51 | Ventilators in stock | 800 | Mechanical ventilators in stock |
| 52 | Ventilators in use | 218.3032583 | Mechanical ventilators currently in use |
| 53 | Ventilators available | 581.6967417 | Ventilators not currently in use |
| 54 | Expected ventilators freed | 21.53111591 | Ventilators freed as expected ICU beds are freed by transfers to wards and deaths in ICU |
| 55 | Ventilators needed for incoming ICU patients | 188.8145465 | Mechanical ventilators needed, according to current demand for ICU (patients requiring ICU and in overflow, not those currently in ICU) |
| 56 | Gap in ventilators | 0 | Gap in ventilators, comparing ventilators available plus expected ventilators freed with ventilators needed (value greater than zero only when demand exceeds supply) |

**PPE:**

PPE is required by both ward nurses and ICU nurses, and its lack constrains their availability to treat patients.

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| # | Indicator | Data | Indicator meaning |
| 57 | PPE | 4126.409934 | Personal protective equipment in stock (masks, gloves, aprons etc). Units are PPE sets. |
| 59 | PPE needed | 5151.700495 | PPE sets needed by staff caring for patients currently in hospital |
| 50 | PPE gap | 1025.290561 | Gap in PPE (value greater than zero only when demand exceeds supply) |
| 60 | total PPE used | 44638.44969 | Cumulative total of PPE sets used over the simulated time period up to this point in time |
| 61 | Interrupted PPE supply | 0 | Whether PPE supply is interrupted (1 for yes, 0 for no). Occurs between a preset start and end time when option to simulate interrupted supply is set. |

**Totals:**

These are cumulative – see **final end of run figures** for the totals.

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| # | Indicator | Data | Indicator meaning |
| 62 | Total needed ICU |  | Total of all patients who needed ICU during current run (from admissions and transfers from ward and overflow) |
| 63 | Total ICU admissions |  | Total number of patients who were admitted to ICU |
| 64 | Total needed Ward Bed |  | Total of all patients who needed a ward bed during current run (from admissions and transfers from ICU) |
| 65 | Total Ward admissions |  | Total number of patients who were admitted to wards (from admissions and transfers from ICU) |
| 66 | Potential deaths due to lack of ICU |  | Patients who died requiring an ICU bed when no ICU bed was available to them |
| 67 | Total deaths |  | Total deaths in hospital; includes potential deaths due to lack of ICU |

**Peak values:**

Calculations of peak daily demand for ICU and ward are made by treating all resources as unlimited, allowing admission of all patients needing ICU or a ward beds without the complication of overflows. The required peak capacity of beds, nurses, ventilators and PPE can be calculated from these peak daily figures. See **final end of run figures** for the peak values.

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| # | Indicator | Data | Indicator meaning |
| 68 | Peak ICU demand |  | If all patients requiring ICU could be admitted (unlimited resources), then this would be the peak ICU occupancy (demand) to plan for |
| 69 | Peak demand ICU beds |  | If all patients requiring ICU could be admitted (unlimited resources), then this would be the peak number of ICU beds required |
| 70 | Peak demand ICU nurses |  | If all patients requiring ICU could be admitted (unlimited resources), then this would be the peak number of ICU nurses required |
| 71 | Peak demand ventilators |  | If all patients requiring ICU could be admitted (unlimited resources), then this would be the peak number of ventilators required |
| 72 | Peak ward demand |  | If all patients requiring a ward bed could be admitted (unlimited resources), then this would be the peak ward occupancy (demand) to plan for |
| 73 | Peak demand ward beds |  | If all patients requiring ward beds could be admitted (unlimited resources), then this would be the peak number of ward beds required |
| 74 | Peak demand nurses |  | If all patients requiring ward beds could be admitted (unlimited resources), then this would be the peak number of nurses required |
| 75 | Peak demand PPE |  | If all patients requiring ward and ICU beds could be admitted (unlimited resources), then this would be the peak number of PPE sets required for ward and ICU nurses |

**Active surge strategies:**

A value of 0 means the strategy is not activated, 1 means it has been activated for that timestep/day

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| # | Indicator | Data | Indicator meaning |
| 76 | Activate surge strategy 1 | 0 | Surge strategy 1 is to reduce the ICU nurse-to-patient ratio (for all patients) when ICU nurses are lacking. It will be activated when resources are low, and if the strategy is enabled. |
| 77 | Activate surge strategy 2 | 0 | Surge strategy 1 is to reduce the ward nurse-to-patient ratio (for all patients) when ward nurses are lacking. It will be activated when resources are low, and if the strategy is enabled. |
| 78 | Activate surge strategy 3 | 0 | Surge strategy 3 is to reduce the PPE sets used per staff per shift and will be activated when PPE stock is not enough to supply staff needed to meet demand, and if the strategy is enabled. |
| 79 | Activate surge strategy 4 | 0 | Surge strategy 4 is to increase bed capacity. It will be activated when no beds are available, and if the strategy is enabled. |