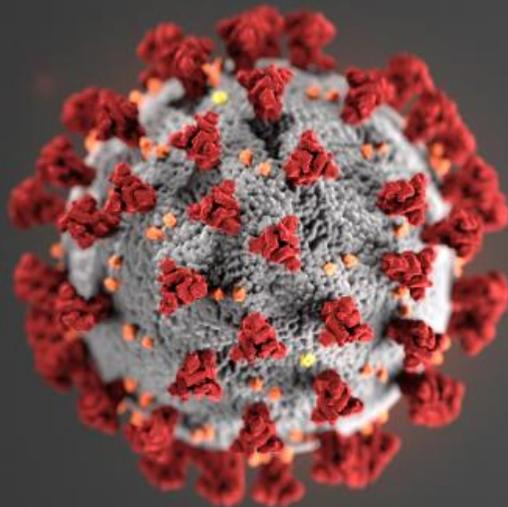




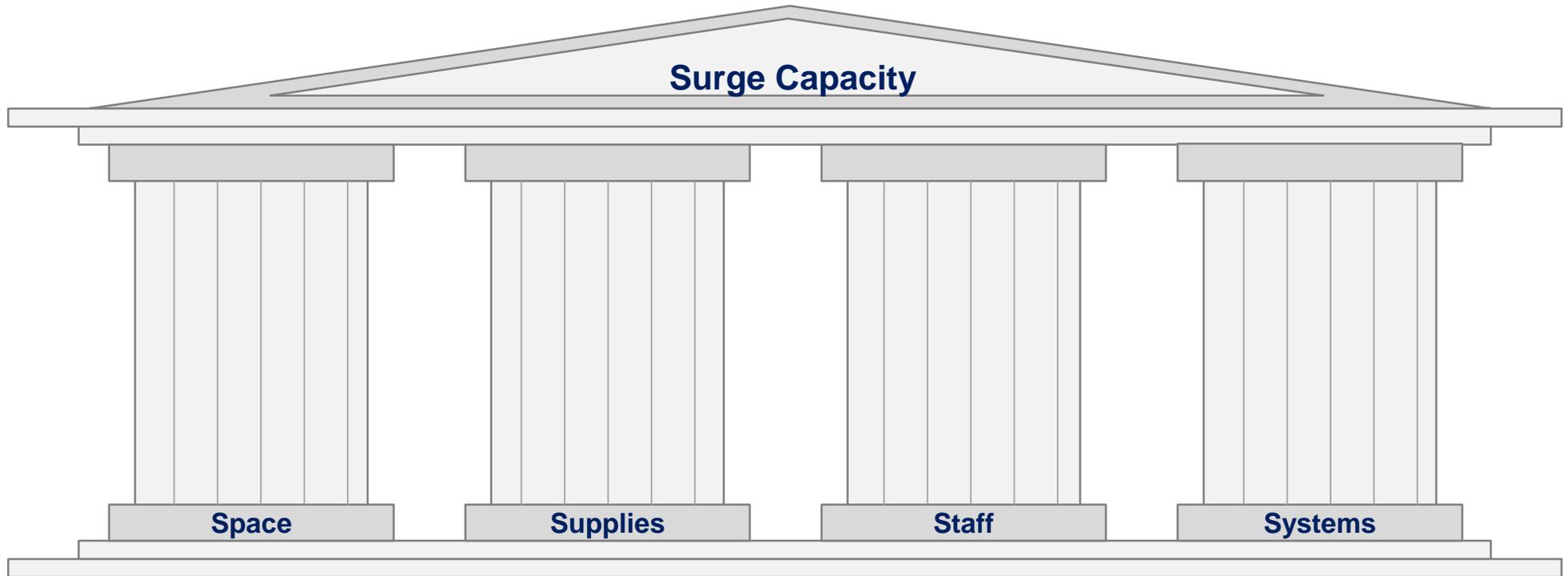
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Surge capacity – preparing for and coping with peaks: practical guidance

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Governments should consider the **four underpinning components** as they prepare for a peak in demand for Covid-19 treatment.



Each of these resources need to work in tandem for an effective surge response in acute and intensive care wards. Failure to adequately prepare one component for the surge will have knock-on consequences for the entire response.

Health systems have been adapting to cope with additional pressure of Covid-19. But, as the number of infections reaches a peak, **resources may be stretched to their limits.**



Use of supplies and staff broadly consistent with usual, daily practices	Not consistent with usual, daily practices but with minimal impact on patient care	Doing the best you can with what you have under significant pressure
<div style="display: flex; justify-content: space-between; width: 100%;"> Conventional Capacity Contingency Capacity Crisis Capacity </div>		
<ul style="list-style-type: none"> • Small surges in demand. • Space adapted for Covid-19 triage and cohorting. • Some modifications to staffing. <ul style="list-style-type: none"> • Supplies utilised with additional caution. • Baseline standard of care. 	<ul style="list-style-type: none"> • Space is repurposed for Covid-19 treatment. • Staff is augmented and/or responsibilities changed. • Attempts to conserve, adapt and substitute supplies where possible. • Functionally equivalent standard of care to baseline. 	<ul style="list-style-type: none"> • Full range of hospital space utilised, including non-clinical spaces. • Staff at full capacity, many working beyond their usual specialisms, hierarchies and outside of ideal staff-patient ratios. • Critical supplies lacking. • Significant difference in the standard of care.

A range of strategies, including substitution, adaptation, conservation, reuse and reallocation may be used to cope with surges. The strategies that have the least impact on clinical care should be used first: strategies with a greater impact on standard of care should be considered only when other strategies have not been sufficient in addressing the resource shortage.

Sources: [National Academies](#), [Canadian Association of Emergency Physicians](#)

Governments should **map their existing capacity**, use modelling techniques to **project the amount of capacity likely to be needed** in hospital care and **take steps to bridge the gap**.



Assess current capacity

- Total number of hospital beds, of which:**
- Number of severe case beds (oxygen therapy)
 - Number of critical case beds (inc. mechanical ventilation)

- Total number of doctors/nurses, of which:**
- Number with working in/experience of ICU
 - Number of professionals in other specialisms with training transferrable in intensive care (e.g. intubation, proning)

Consider options to help **bridge the gap**:



Increase supply

Order new equipment. Source reasonable alternatives. Expand healthcare workforce.



Conserve and optimise use

Postpone non-urgent procedures and discharge patients who can be managed at home. Move patients, equipment and staff between hospitals. Train/repurpose staff for ICU.

Predict required capacity (including probable timing of peaks and location of pressure)

- Proportion of population who will be infected, considering:**
- Reproductive rate
 - Adherence to isolation, social distancing, shielding guidelines

- Expected/observed severity of cases, including:**
- Proportion of cases requiring hospitalisation, of which
 - Proportion of cases requiring intensive care, of which
 - Proportion requiring mechanical ventilation and/or extracorporeal membrane oxygenation, considering demographics of population, including:
 - Proportion of population aged 55+
 - Proportion of population with pre-existing conditions

- Expected/observed duration of treatment, including:**
- Average length of stay in hospital
 - Average length of stay in intensive care
 - Average duration of mechanical ventilation

Consider options for the **cliff edge**, when the limits of capacity and capability have been reached:



Use alternatives

For example: reusing PPE, large increase in patient-to-provider ratio.



Prioritise resources

Decide how to allocate resources to achieve greatest good for greatest number of people.

Prepare your crisis response centre to **monitor and rapidly respond** to the pressures of the surge.



1

Use modelling to predict likely location of surges and institute a programme to loan equipment/move consumables between hospitals and regions to help meet demand.

- Review real-time data to allow rapid mobilisation to support hospitals near or at capacity. Circumstances can change quickly and decision making must be dynamic.
- Model best, worse and most likely scenarios. Once peak has been reached, use models to plan exit strategy and continuously monitor new data to detect a second peak.
- Ensure equipment is appropriately tagged to enable tracking and retrieval.
- Track shipment of supplies to enable diversion to other locations if necessary.



Establishment of **critical care task force in Lombardy** to develop governance guidelines for emergency response and coordinate allocation of resources among patients/transferral between hospitals regionally.



Delhi hospitals were overwhelmed in June, but by late July government said 78% of beds were vacant as a result of combination of declining cases and added capacity. Capacity was maintained as **Delhi expected new surges as residents of other states sought treatment in the capital.**



As the epicentre of the outbreak moved out of Cape Town, the **capacity of field hospitals were reduced so that oxygen concentrators could be sent to other parts of the country,** including Gauteng province and rural areas of Eastern Cape.

2

Emphasise equity and engage hospitals on criteria for allocating scarce resources.

- Hospitals need robust criteria admitting patients to and continuing intensive care should a severe resource shortage occur. Resources should be preferentially allocated to patients likely to derive the greatest incremental benefit, based on clinically-relevant information.
- First come, first served allocation should not be used as it can exacerbate inequalities related to seeking and accessing treatment.



Delhi launched an **app including details of current bed capacity in each hospital** to support patients in seeking treatment. But residents complained of inaccurate details, the need to visit multiple hospitals to find urgent treatment and the preferential allocation of beds for those of high social or economic status.



In recognition of an imbalance between the clinical needs of the population and availability of intensive care, despite government efforts to increase resources, the Italian Society of Anaesthesiology, Analgesia, Resuscitation and Intensive Care published **recommendations on clinical ethics in the allocation of care among patients.**

Governments should seek to **reduce demand for routine, non-urgent care** during the surge while **ensuring they do not depress demand or defer treatment for urgent non-Covid-19 concerns.**



- 1 Identify and postpone non-essential, elective appointments to free up staff time, patient beds and reduce risk of transmission.**
- Calculate the medical risks that a delay will entail. Plans for case triage should avoid blanket policies and instead rely on data and expert opinion.
 - Clearly communicate with patients and implement an interim management plan (e.g. for pain).
 - Duration of delay should be informed by modelling and services should resume as soon as possible to limit the size of the backlog.



The American College of Surgeons has published **guidance for triage of non-emergency surgical procedures**, including a scale to help assess whether treatment can be safely postponed.



Secretary General of Kenya's Association of Private Hospitals says **record declines in health facility attendance in Nairobi** caused by 'coronaphobia' – especially among those with compromised immune systems who are failing to seek urgent treatment.

- 2 Optimise use of isolation and treatment centres.**
- Patients with no or mild symptoms should be asked to isolate at home or an isolation centre to conserve hospital beds.
 - Where isolation centres are at capacity, spaces should be allocated to patients less able to isolate properly and safely at home or with risk factors that make deterioration more likely.
 - Patients with moderate symptoms should present for treatment as soon as possible so that their condition can be stabilised before more intensive care may be required.



When hospitals in Madagascar neared capacity, **admission guidelines were changed** so only patients with severe symptoms who required oxygen therapy were admitted.



In anticipation of a surge, Kenya **discharged patients with mild and asymptomatic symptoms** and implemented home-based isolation and care guidelines to free up space for those who needed in-patient treatment.



Hospitals must maintain capacity to treat urgent conditions and emergencies and **governments should develop public communication campaigns** to ensure patients who need urgent care and expectant mothers who need to deliver at a facility still attend a healthcare facility.

A surge in patients will require hospital facilities to adapt by **increasing capacity in both standard Covid-19 care and intensive care**. Hospitals should evaluate their options through desktop planning.



1 Assess the capabilities of current hospital facilities. Focus first on areas immediately adjacent to current ICU and confirmed Covid-19 wards for spillover. Prioritise spaces that can be converted with minimum modifications:

- Other clinical areas: outpatient procedure spaces, examination labs, pre-op and anaesthesia recovery rooms.
- Non-clinical areas: visitor waiting rooms, conference space, hallways, tents erected in outdoor space.

2 Where surges are anticipated in major population centres, governments might consider:

- Coordinating at the metropolitan level to send patients directly to hospitals or treatment centres with capacity to treat them (e.g. via phone triage)
- Establishing field hospitals and makeshift treatment centres in mothballed buildings or public facilities.



Wherever possible, ICU/high acuity patients should be managed in pre-existing clinical areas with built-in equipment/headwalls. Where additional ICU space is needed, consider remodelling/reclassifying non-Covid-19 and non-urgent wards for ICU purposes and moving patients currently in those wards into newly converted clinical or non-clinical areas.

Adapted, surge capacity spaces for confirmed and suspected Covid-19 patients must still permit **robust infection control** – enclosed as much as possible, with appropriate cohorting of patients, PPE donning and doffing zones, wash basins for hand hygiene, self-enclosed with necessary required patient facilities such as toilets and showers. Consider implications that adapting spaces may have for **thoroughfare and transfer of patients**.



Conversion of Cape Town International Convention Centre into a field hospital to provide 850 additional beds. Additional temporary hospitals opened in townships to provide 616 additional beds.



Alarobia Professional Technical High School and the Mahamasina Sports Complex transformed into makeshift treatment centres with additional 1,000 oxygen concentrators.

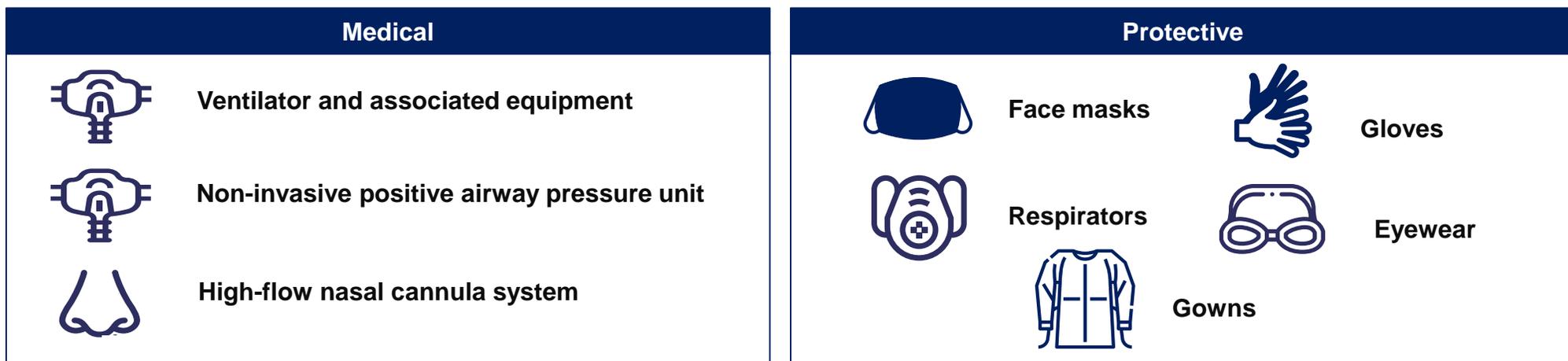


Provides 500 railway coaches and requisitions 25 hotels for patients with mild to moderate symptoms.



The World Health Organization has issued guidance on appropriate conditions for isolation and treatment centres.

Governments must increase supply of **both medical and protective equipment** in anticipation of a surge.



1

Explore the full range of options for procuring additional equipment regionally and internationally, including:

- [Covid-19 Partners Platform](#)
- [African Medical Supplies Platform](#)
- [African Pandemic Responses Alliance](#)
- [Connecting the Dots Initiative](#)

2

Facilitate manufacturing repurposing, for example:

- Assess and facilitate input financing or working capital required by the companies, e.g. via dedicated credit lines.
- Facilitate discussion and support negotiations with global suppliers of raw materials – primarily via the WHO and its partners.
- Implement streamlined and accelerated certification processes.
- Facilitate purchasing intents and agreements necessary for investments needed to scale-up production.
- Support fundraising efforts with investors and DFIs to ramp-up production.

Supply of **medical oxygen** should be increased and patients with the most severe symptoms will drive demand for **mechanical ventilators**.



1

Oxygen therapy is central to the care of Covid-19 patients with moderate symptoms. High-flow nasal oxygen and non-invasive ventilation may reduce need for mechanical ventilation. Hospitals should:

- Ensure oxygen plants are at maximum production capacity.
- Investigate opportunities to obtain and vaporize liquid oxygen into gas, either with existing installations or as component on smaller/portable tanks.
- Prioritise bedside concentrators as complementary approach while waiting for higher-flow solutions to be delivered – key sustainable solution recommended by the Director-General due to low cost.
- Consider ordering and storing cylinders for high pressure supply, in adapted spaces that lack head-walls and in facilities where power is intermittent.
- Ensure access to pulse oximeters and adequate training on supplying oxygen for staff.

Consider engineering limitations associated with increased, simultaneous use of gas through headwalls (e.g. low air pressure, leakage, freezing of tanks, power outages).



Use portable options where necessary, accessible and cost effective. Ensure adequate ventilation to mitigate combustion risk.



Hospitals in Johannesburg reportedly requested donations of oxygen concentrator equipment from the public who may have unnecessarily purchased supplies for use at home.



England has lowered oxygen saturation targets for all patients except for those where higher or lower ranges are medically necessary and encouraged using the lowest flow rate possible to achieve the target.



In South Africa, PATH has developed an Oxygen Delivery Toolkit including case management guidelines and forecasting tools as part of its Covid-19 Respiratory Care Response Coordination project.



Tiba Partnership has calculated oxygen requirements for each African country using projected doubling time of disease spread and current clinical knowledge on average patient oxygen requirement.

Optimise use of PPE. Some countries are considering **reprocessing of personal protective equipment** in the context of severe shortage, balancing risks against needs.



1 In anticipation of a surge:

- Ensure PPE is used properly and only when necessary by staff.
- Reduce need for PPE wherever possible: for example, ensure patients are properly cohorted to facilitate extended use of PPE. Restrict the number of healthcare workers entering the rooms of Covid-19 patients and minimise face-to-face interaction to reduce need for PPE.
- Hospitals should map current inventory, supply chain and utilisation rate of different types of PPE.

2 Consider how protocols may be amended in the event of a critical shortage. The World Health Organization identifies a number of options:

- **Extending use:** Using same PPE for multiple interactions with several different patients and without removing it in between.
- **Using beyond expiry date:** Using PPE from storage that has surpassed expiry date.
- **Prioritising use:** Reserving PPE for particularly high-risk environments or activities.
- **Using alternatives:** Using another device that can fulfil the same function to an inferior extent. May be approved under international standards or be of non-medical grade.
- **Limited reuse:** Reusing same PPE for multiple interactions with several different patients, removing it between each interaction.



All modified protocols entail risks but data is limited. There is no global consensus on these strategies. WHO considers these to **last-resort temporary measures**. As shortages ease and a situation de-escalates, strategies should be reconsidered and less risky practice resumed. Clinicians should be conscious in any adapted use of PPE to prevent viral transmission.

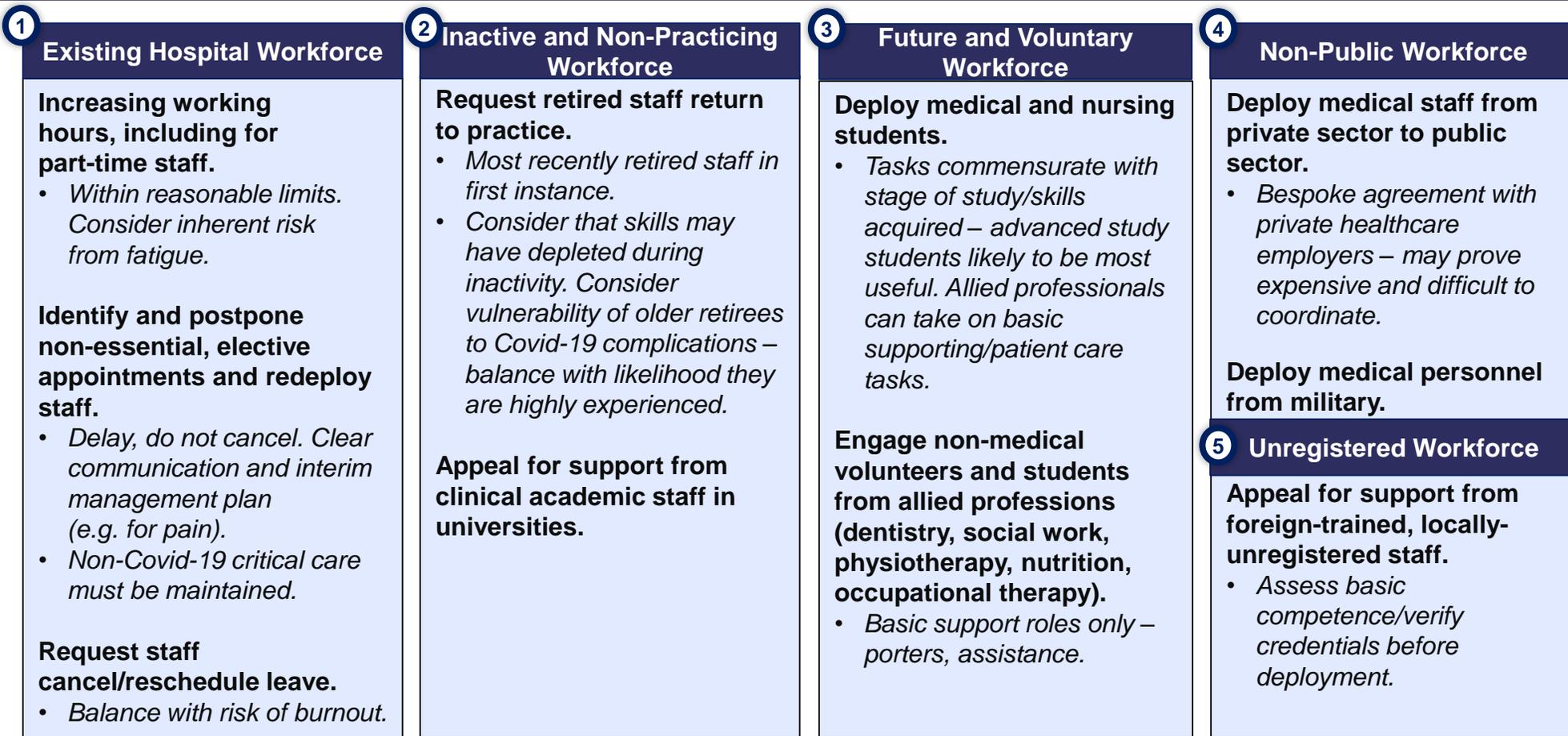


In the UK, Public Health England has issued guidance on acute personal protective equipment shortages that adopt some of these strategies, but public health agencies in Scotland, Wales and Northern Ireland maintain single use PPE should not be reprocessed.



In the US, the Centres for Disease Control and Prevention have identified a continuum of optimisation and reuse strategies for different types of PPE depending on severity of forecasted or actual shortage. The Food and Drug Administration has issued emergency use authorisation for other categories of safety-approved respirators (including N99, N100, P95, P99, P100, R95, R99 AND R100 and elastomeric respirators) approved overseas with similar methodology.

Countries are using a range of options for **expanding health workforce capacity** They may be used in combination as part of bespoke strategies.



Urgent, non-Covid-19 procedures and care should continue and be sufficiently staffed. Hospitals should consider appropriate staffing ratios in acute and intensive care.



As staff are redeployed to cope with the surge, **consider their competencies and level of experience** to make responsible and effective use of scarce resources across both Covid-19 and essential non-Covid-19 care.

1 Staff will be **required to work outside their area of specialism and usual hierarchies** but should not undertake tasks for which they are clearly unqualified. Staff should **self-assess their suitability** to perform a range of tasks which should be confirmed by supervisors during a simulation or in practice. Information about a staff member's usual department or grade may also be used to infer competencies.

Rapid induction and training can be considered to appropriately upskill, but novices should be properly supervised. Standardised courses for non-ICU staff such as BASIC course, might be considered.

Various models for structuring surge capacity exist. The suitability of a structure depends on the number of staff available, the diversity and distribution of competencies, the proportion who have experience in critical care environments and the current demand for care. **Ideally teams should be overseen by a senior clinician with experience in intensive care.**



Skills checklist	Competent? Yes, No, With Additional Training Supervision Required? Direct, Indirect, None
Patient care <input type="checkbox"/> PPE donning and doffing <input type="checkbox"/> Washing and personal hygiene <input type="checkbox"/> Lifting and handling <input type="checkbox"/> IV drug administration	Renal <input type="checkbox"/> Renal replacement therapy
Resuscitation <input type="checkbox"/> Basic, intermediate and advanced life support	Daily Assessment (medical, ED, critical care) <input type="checkbox"/> Ultrasound of chest <input type="checkbox"/> Echo screening/full study <input type="checkbox"/> Central line insertion <input type="checkbox"/> Arterial line insertion <input type="checkbox"/> Tracheostomy <input type="checkbox"/> Blood gas sampling <input type="checkbox"/> EZ-O Insertion
Airway management <input type="checkbox"/> Basic mask ventilation skills <input type="checkbox"/> Advanced airway management <input type="checkbox"/> Covid-19 intubation trained	Psychological care <input type="checkbox"/> Debriefing <input type="checkbox"/> Family interaction
Respiration <input type="checkbox"/> Ventilator management <input type="checkbox"/> Proning trained	Support tasks <input type="checkbox"/> Preparing equipment
Circulation <input type="checkbox"/> Insertion of peripheral lines <input type="checkbox"/> Insertion of central lines <input type="checkbox"/> Cardiac output monitoring interpretation <input type="checkbox"/> Arrhythmia management	Recent work experience <input type="checkbox"/> Intensive care <input type="checkbox"/> Anaesthetics <input type="checkbox"/> Emergency department <input type="checkbox"/> Operating theatres

Sources: Based on framework from [NHS England](#)

Protecting staff from infection and optimising isolation time for those with Covid-19 will minimise lost work days and healthcare worker attrition. Without adequate protection staff may strike.



1 Protecting staff is the most basic way of mitigating against shortages.

- **Protect staff with PPE.** Provide PPE for all healthcare workers in all settings. Implement clear guidance and training so it is used optimally.
- **Ensure application of safety protocols in hospitals, clinics and communities** including physical barriers, triaging patients waiting for tests, cohorting sick patients into appropriate wards and ventilation of hospital spaces.

2 Isolation time for suspected and confirmed infections among staff should be optimised. All symptomatic staff should be tested immediately with rapid results turnaround. Staff should not enter prolonged isolation on basis of symptoms alone.

Symptoms	Positive Test	Isolate
	Negative Test	Return to Work ¹
	Inconclusive	Isolate or Retest ²

Three main tests should be applied to determine return to work suitability for symptomatic staff. Individual risk should be assessed but staff should not isolate for longer than is necessary. In the UK and the US, the following tests are being applied.

7–10 days since symptom onset	24–48 hours since end of fever without use of medication	Improved symptoms (cough/anosmia may persist for weeks)
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 In the US, the Centres for Disease Control and Prevention has developed guidelines in times of very severe staff shortages where physically able and willing infected staff may be able to carry out some duties.

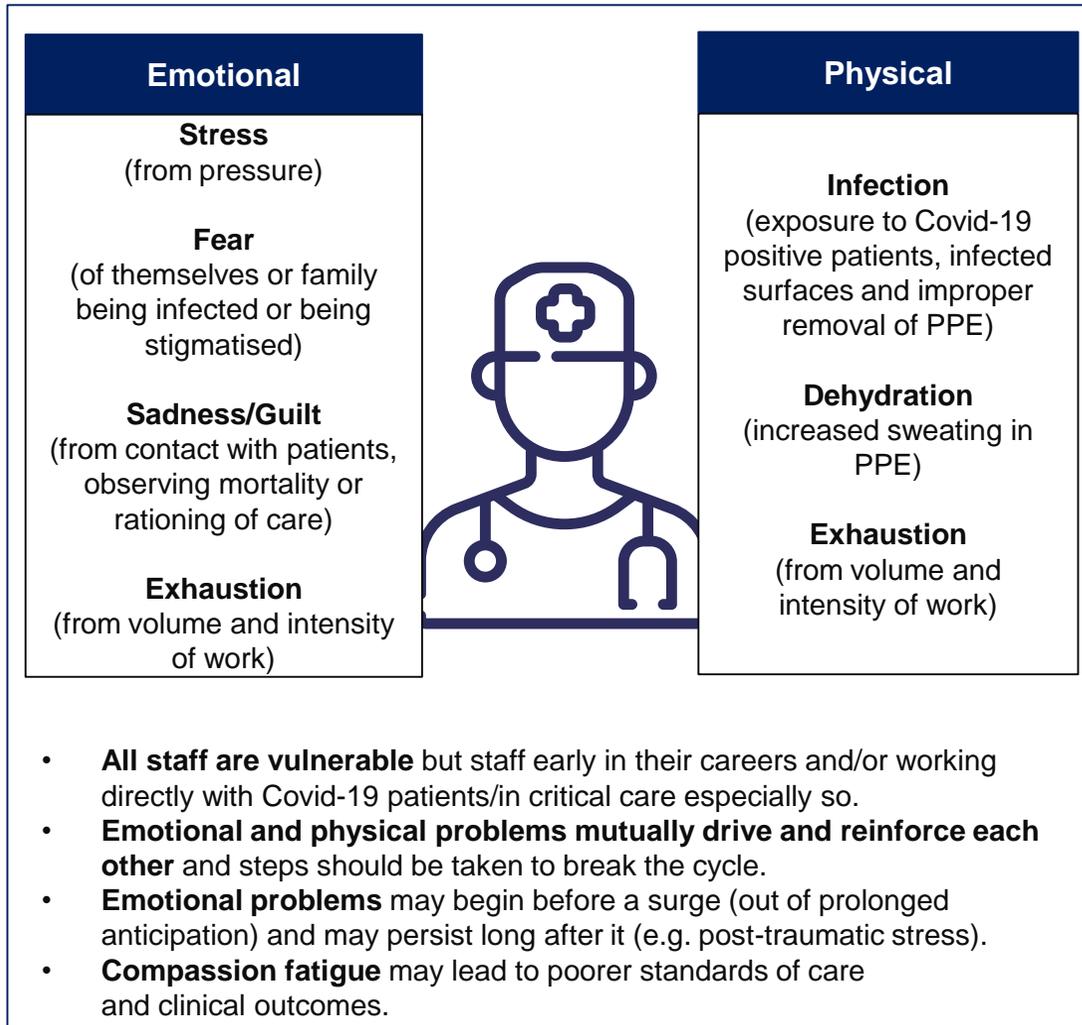


1. Duties that do not require in-person contact with others (patients or staff), preferably done off-site (e.g. dealing with queries from less experienced staff members by phone)
2. Working exclusively with patients with confirmed Covid-19
3. Working additionally with patients suspected to have Covid-19
4. Working with patients not suspected or confirmed to have Covid-19 (only when every other option has been exhausted)

Sources: Adapted from material by [Public Health England](#), [Public Health England](#), [Centres for Disease Control and Prevention](#)

¹If medically fit to do despite symptoms and in line with to normal operating protocols. Professional judgement and caution should be used. Where there is strong reason to believe result may be false negative (e.g. textbook symptoms, close contact with confirmed Covid-19 case), may be retested. ² May retest if symptom onset was very recent.

Staff wellbeing is likely to be particularly strained during surges. This may drive absenteeism through **strikes** and **illness**. Poor wellbeing may also cause **declining effectiveness** and **efficiency**



Tools for promoting staff wellbeing

- 1 Lead:** Ensure management are visible and available, that clear escalation policies are in place, and that staff feel comfortable asking questions and obtaining guidance. Experienced staff should reassure, encourage and mentor others.
- 2 Consult:** Communicate plans and policies clearly. Work constructively with medical associations and unions to discuss conditions in Covid-19 peaks and anticipated changes in policy during surges.
- 3 Protect:** Ensure protocols for protecting staff from infection are respected. Breaks (in designated areas) and time off should be taken whenever and wherever possible, though opportunities will be more limited during a surge. Senior staff should judge when breaks may be taken. Rotate staff between high- and low-stress activities (though generally not between Covid-19 and non-Covid-19 care).
- 4 Talk:** Make counselling therapy available, schedule 1-to-1 meetings and encourage peer support.
- 5 Compensate:** Pay staff reliably and on time. Identify any realistic and time-bound pay enhancements during the pandemic in anticipation of negotiations.