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Pandemic planning and its relevance to surgeons

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Abstract
This article will briefly discuss pandemic planning and its relevance to surgeons. It will cover principally the UK response to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), although it will also compare and contrast other diseases and reference more general principles of major incident planning. Areas that individual surgeons and departments can, and should, influence are discussed.

Keywords Major Incident planning; pandemic

Introduction
The pandemic due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), more commonly called COVID-19, or covid, has disrupted many aspects of life around the world in 2020, and is likely to continue to influence world affairs for years to come. Although this is not principally a surgical disease, it has impacted on surgical behaviour and daily activity in many ways, and has implications for the design and delivery of service, particularly if covid becomes endemic, or other infectious agents arise in the future. This article will briefly cover general issues of planning and response for pandemics, with regard both to surgical involvement, and to provide insight into other elements of such responses. Examples from the covid pandemic will be compared with other infectious diseases.

Pandemic planning versus major incident planning
Most major incidents are commonly regarded as being sudden ‘Big Bang’ type events (e.g. transport incident or terrorist bombing), generating an acute influx of casualties which require surgery, followed by a longer tail of ongoing surgical activity and with a relatively predictable recovery to a normal state. Although this is typically true for numerous prominent incidents, many of the principles and concepts of acute major incident management are also applicable to larger, longer term ‘slow growing’ ‘medical’ incidents such as currently being experienced during the covid pandemic.

Concepts of emergency planning
There are four key concepts of emergency preparedness, resilience, and response (EPRR). These involve:
- resilience
- preparation
- response

The four ‘S’ approach

| Consideration | Examples |
|---------------|----------|
| Staff         | Adequate: |
|               | - Number |
|               | - Training |
|               | - Skill-mix |
| Stuff         | Adequate and suitable: |
|               | - Major equipment, e.g. mechanical ventilators, laboratory equipment |
|               | - Reliable disposable supply, e.g. personal protective equipment (PPE) |
|               | - Drugs supply (including laboratory reagents, etc.) |
| Space         | Adequate: |
|               | - Isolation units/wards |
|               | - Critical care units |
|               | - Areas for ongoing ‘usual activity’ |
| Systems       | Adequate: |
|               | - Flexibility to escalate response in a timely manner to varying threats |
|               | - Distribution networks for consumables |
|               | - Background redundancy to function despite loss of parts of system |
|               | - Support services (catering, portering, IT support, etc.) |

Table 1

- recovery.

These four elements will be discussed in turn below. Each of these can be considered in more detail with regard to ‘staff, stuff, space and systems’. Examples of these are shown in Table 1.

Resilience

Proper prior planning prevents poor performance.

Resilience is an integral part of an organization’s ability to respond effectively to a threat. It must be a continuously reviewed and updated process, and no-one should rely on heroic last minute efforts to compensate for long-standing planning failures. In the UK, the Civil Contingencies Act 2004 obligates Healthcare providers to plan and prepare for, amongst others, ‘... an event or situation which threatens serious damage to human welfare ...’. Organizations should have an ‘all-hazards’ approach, with an ability to fine tune responses in a timely fashion for specific incidents. The all-hazards model is one of an ‘integrated approach to emergency preparedness planning that focuses on capacities and capabilities that are critical to preparedness for a full spectrum of emergencies or disasters’. Surgeons should be intimately involved in this background activity: co-operation between senior managers, administrators and clinical staff is essential to ensure an organizational plan is consistent, coherent and practical, from individual departmental level through to hospital, and above to regional and national level planning.

For acute major incidents, increasing surgical capacity to manage sudden surge for several days is often a key requirement,
so the natural focus for individual surgeons and departments will be this circumscribed component. For slower onset threats, organizations may have additional time to prepare. Consequently, it may be possible to undertake adequate larger scale planning (often at regional and national level) to ensure consistent and efficient approaches to a larger population than is typically involved in acute incidents. In the context of a pandemic, a resilient national response would be to escalate the track, trace and isolate processes necessary to control an infection and reduce overall clinical demand; provide large enough stocks of suitable PPE to allow safe working; have sufficient flexibility in business as usual work (including surgery) to allow redeployment of staff, equipment, and ward space to treat pandemic cases; and have sufficient fallow floorspace capacity to re-role as necessary.

Failing in any of these enduring details could result in system-wide or sporadic failure to deliver best care during the acute period of demand. These failures may trigger a requirement to triage for treatment, with obvious complex ethical and practical consequences. Decisions affecting resilience may be taken locally at hospital level, but many important strategic decisions are long term policy choices at regional or national level. The impact an individual clinician can have is therefore limited.

Preparation

Knowledge is power: Preparation is a combination of using available systems and structures, and of orientating them to best face the particular threat at hand. Major incident planning should be generic, since specific preparation for a single specific disease or situation may detract from the ability to provide for other, even superficially similar diseases. For example, the proportion of patients expected to be admitted to intensive care with covid changed from c.30% in early reports to c.15% in later cohorts as the success of different ward-based management strategies became more widespread (appropriate advance care planning, use of CPAP, steroids, etc.). An inflexible plan based on initial numbers would significantly overestimate the demand for ICU space, equipment and staffing. Likewise, H1N1 influenza A viruses (strains of which were responsible for the 1918 ‘Spanish flu’ and 2009 ‘swine flu’ pandemics) have many similarities to SARS-Cov-2, but the implications are different because of access to critical care, antivirals, antibiotics for secondary infections, vaccinations, less urban overcrowding, etc. An outbreak of Spanish flu today would have a very different impact on society than 100 years ago, and lessons learned from the smaller swine flu pandemic have informed planning for systemic responses such as inter-regional transfer and provision of extracorporeal respiratory support (such as ECMO).

One criticism of the UK planning and response has been that it was designed for pandemic influenza, yet covid produces sufficiently different infectivity, case mix, case fatality rate, etc., to make redundant many of the assumptions and consequent details of the influenza plan.

Preparation can be general or specific: General preparation may include creating ‘space’ by increasing capacity (re-purposing wards, moving services to other sites, e.g. private sector, building Nightingale hospitals), improving capability (getting ‘stuff’ such as mechanical ventilators, effective drugs, and additional PPE), or improving ‘systems’ (agreeing consumable and drug ordering processes, transport infrastructure, and clarifying coordination and control issues between regional bodies such as NHS England, local authorities, ambulance trusts and primary or secondary care). The potential for increasing effective ‘staff’ numbers is limited in many healthcare settings, including the NHS, which even pre-pandemic had a large and growing deficit in staff. Mitigation by training staff from other disciplines to deliver critical care or diluting usual staff:patient ratios is a strategy followed in many places. For example, initial national planning suggested a dilution of critical care nursing staff from a staff:patient ratio of 1:2 to 1:6 would be feasible. Work done in the author’s institution suggested 1:2 or 1:3 (depending on individual or cohort isolation, and on using operating theatres instead of the better laid out critical care units) would be the maximum safe dilution ratio. Subsequent national guidance has been to recommend 1:2 ratios. As with critical care staffing, surgeons should be involved in many of the strands of this general preparation, identifying reasonable plans, highlighting the practical implications of complex decisions, facilitating changes in service delivery as appropriate, but also speaking ‘truth to power’ when required.

Specific preparation is driven by accurate, timely information. With respect to covid, early issues reported included a high demand for prone ventilation, non-invasive ventilation and isolation/cohorting of infected patients. Preparation therefore included retraining staff (often from operating theatres and some surgical services) to work under the direction of critical care staff to act as proning and vascular access teams, training and supervising donning/doffing of PPE, and providing IT support for patients unable to have visitors. Given sufficient time, many hospitals built additional isolation areas, and repurposed operating theatres and associated equipment for critical care use. Concerns about the total expected demand against limited supply led to more emphasis on ward-based advance decision making, the possibility of implementing overt triage, and the provision of palliative care services.

Unfortunately, early information in dynamic situations is often incomplete, and situations develop beyond predicted as a consequence of policy or chance. Thus, a UK national lockdown in March 2020 reduced total critical care admission numbers, and an increasing understanding that covid did not behave as typical acute respiratory distress syndrome (ARDS), the role of continuous positive airway pressure (CPAP), and the higher than anticipated requirements for renal replacement compared to initial reports all altered the actual demand both for critical care and for ward-based treatments, as well as generating an unexpected shortage of equipment for renal replacement therapies. As the vaccination programme develops over 2021–2022, healthcare demand (and surgical activity) will be shaped by the efficacy of this. All these changes in practice based on increasing understanding of the pathophysiology of covid disease will affect how hospitals use existing operating theatres and staff, and this in turn will affect surgical business as usual activity.

With regard to covid, an example of general preparation (PPE) and specific preparation (Ebola versus covid) will be presented to demonstrate that even superficially relatively straightforward
decisions are often complex, and based on balancing competing factors. They illustrate that planning can never be perfect, given the multi-faceted nature of decision making.

**Complex choices 1: Providing adequate stockpiles of personal protective equipment (PPE)** – availability of PPE was a serious concern in many countries during early 2020. A frequent criticism of many governments was that insufficient PPE stockpiles were held. In January 2020, the UK held 400 million items of PPE, but this proved only a tiny fraction of that required. Unfortunately, even a superficially simple decision on this issue (‘How much PPE do we need?’) is very nuanced. Some of the factors to be considered in how much and what PPE to stockpile are shown in Table 2.

Incomplete and changing information on the nature of transmission of covid in Spring 2020 led to frequently updated, sometimes conflicting information regarding appropriate or minimum PPE being produced by different national bodies, which in turn rapidly led to a loss of confidence in not only national government, but the various bodies involved. Clinical management recommendations also changed rapidly during the first few months of the pandemic, but much of this was poorly reviewed and often of dubious quality. Controlling and co-ordinating the multiplicity of authors (including national bodies) producing conflicting guidance is a role that senior leaders must adopt early in the course of a new disease. However, this must be balanced against preventing the release of useful information pending high quality evidence. This difficult equilibrium is a role that researchers, journal editors, surgeons and other senior leaders must accept from the outset.

**Complex choices 2: How differences between ebola virus and covid affect strategy** (Table 3):

### Response

The surgical response to covid has varied between hospitals and healthcare systems, ranging from an almost complete cessation of elective activity and curtailment of many higher priority interventions, through to little loss of capability due to good screening procedures, safe streaming of high and lower risk cases, and appropriate prioritization of surgical cases. Predictably, waiting lists have increased markedly across the UK, and the ability to manage these for the future is partly dependent on maintaining activity through current and any subsequent increases in local and national covid cases. This is difficult in the face of redeployed staff, high staff absence rates, reassigned ward functions, and limitations on list bookings imposed by shortcomings in timely patient testing. Many of these decisions depend on Trust-level interventions such as sufficient testing capacity to screen patients, Trust decisions regarding use of surgical ward staff in other roles, volume of cases listed as high priority by surgical teams, and availability of theatres and critical care space if covid demand is high. Surgical leaders must understand the basis on which Trust executive teams make their choices, and act to influence them as appropriate. For example, preparation for transport between regional hospitals has been required during the pandemic. This may be transport of critically ill patients between ICUs, or may be transfer of high priority surgical/medical cases from hospitals at risk of collapse to other nearby units with capacity and capability. Surgical discussion and decision making regarding appropriate screening, priority by surgical teams, and availability of theatres and critical care space if covid demand is high. Surgical leaders must understand the basis on which Trust executive teams make their choices, and act to influence them as appropriate. For example, preparation for transport between regional hospitals has been required during the pandemic. This may be transport of critically ill patients between ICUs, or may be transfer of high priority surgical/medical cases from hospitals at risk of collapse to other nearby units with capacity and capability. Surgical discussion and decision making regarding appropriate screening,
management and subsequent repatriation of such referrals is essential to optimize healthcare delivery. This may involve difficult decisions regarding ‘adequate versus best’ management for individual patients. Many of the relationships between and within organizations become more hierarchical during situations of time constraint and pressure to deliver in a dynamic situation. It is important for all staff to understand and accept this, but they must feel they can trust the abilities and motives of those higher up the chain of command. Leadership from senior clinical staff is paramount to helping ensure other staff groups can perform at their best. This is especially important if the response phase is prolonged (as with covid) and over-sight of effort at all levels to prevent contradictions or overlaps and gaps in preparation.

National, regional, local, departmental level co-ordination should have a strong underlying rationale for decision making.

## Lessons from the covid pandemic

Some of the lessons of covid with regard to preparation and response include:

- Time and effort spent on long-term preparedness and systematic resilience is vital in being best placed to respond to new diseases.
- Many of the precise answers to fundamental questions are unknown in the early stages of a new disease, so a high degree of uncertainty must be lived with and factored into decision making, but basic concepts and principles should be used.
- Preparing an effective response requires attention to detail and to appropriate co-ordination — there should be oversight of effort at all levels to prevent contradictions or overlaps and gaps in preparation.
- National, regional, local, departmental level co-ordination should have a strong underlying rationale for decision making.

### Recovery

In an acute major incident, recovery to normal activity may take days to months. It seems likely that covid will become endemic, and have a much longer term effect on healthcare, including surgical activity. Remote consultations have increased markedly, and are likely to remain a significant part of practice. Screening and streaming surgical cases into priority categories based on urgency, testing and infective risk, available capacity, etc., will be reliant on surgical input to ensure best use of resource, and maximal throughput of elective cases with minimal risk to staff or patients. These decisions will be based on ongoing research, which again will require surgical input to make most relevant and effective.

### Table 3

| Consideration                     | Ebola                                      | COVID-19                                     | Consequence                                                                 |
|-----------------------------------|--------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------|
| Population at risk                | Highly specific areas and population at risk | Whole population, with particular groups at higher risk | Screening and isolation of at risk/infected population easier for ebola |
| Main forms of transmission        | Direct: body fluids/fomites                | Aerosol/droplet/fomites                      | Different isolation, PPE, donning/doffing and decontamination required |
| Disease identification            | Obvious common and relatively early onset of symptom constellation | Often asymptomatic                           | Harder to control spread of covid without mass isolation policies |
| Disease confirmation              | Rapid, highly sensitive & specific screening tests available. Tests to exclude other diseases (e.g. malaria) also available | Multiple alternative diagnoses No easily available high quality testing (initially) | Harder to diagnose (or exclude) covid initially; requires greater isolation capability |
| Organ Support                     | Rehydration, renal support                 | Respiratory support                          | More demand for critical care in covid disease                              |
| Patient numbers and disease burden| Small case numbers, high case fatality rate | Huge case numbers, low case fatality rate    | Overall demand for medical care (especially critical care) higher with covid |
| Vaccine availability?             | Not initially (before 2019)                | Not initially (before 2020)                  | Mass vaccination will alter overall approach to both illnesses, but likely to have greater impact on management of covid |
| Overall result on strategy        | Ebola is a disease that can be managed in specialist infectious disease units within a small number of designated hospitals, while covid requires most hospitals and primary care to be able to identify and manage the disease | The nature of the diseases require different training, consumables, logistics, staff usage/distribution, and the case numbers involved have very different consequences for other parts of the healthcare service |
making and policy to allow detailed clear, practical plans at lower level to be accepted and implemented. Hierarchical directives from above are more likely than consultative approaches.

- Research has a key role—there is a balance between fast track reporting of (perhaps inaccurate) case series against the delayed provision of high quality information. Multi-agency (non-silo) research should be co-ordinated at a high level to answer key questions.

Summary
Although sharing general principles, pandemic planning differs from single incident planning in that it relies more on strategic and infrastructure preparation at the level of national and regional decision makers rather than individual, departmental or hospital level. Much of the activity of local leaders is directed by these higher authorities, with less freedom of action than would normally be the case in planning for acute incidents.

Planning at local level generally involves ensuring that flexibility exists to respond in the most efficient way to the detailed demands of a situation. The details will depend on the local population at risk, understanding mechanisms of infection, and using available and practical PPE/isolation strategies to reduce this, along with generation of enough 'staff, stuff and space' to escalate appropriately safely to predicted increases in demand. Surgical staff have a range of important roles to play in this, ranging from screening surgical referrals for intervention, through to maintaining safe background activity, leading and supporting teams, and in some cases, changing individual roles and responsibilities to provide direct intervention in support of other specialties.

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