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Robust Emergency Department Framework for Handling SARS, COVID 19, Monkey Pox or Any Other Threats: Making Resilience a Priority

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Abstract

The world has seen several large scale pandemics and infectious diseases (ID) outbreaks in more recent years. This, together with the other mass casualty, disasters and critical incidents point to the need for a robust and fundamentally strong, evidence-based model of care and response in Emergency Departments and healthcare institutions. The Covid 19 pandemic has shown us many gaps that need to be filled, the need to share best practices, the need for resilience engineering and adequate management of human factors. This paper shares the author's perspective on all the above and how a basic principled model can be used as a basis, upon which all other fine-tuning, customization and modifications can be done for every new disaster, crisis or pandemic that is encountered. The fundamentals have to be strong and understood by all staff. Resiliency is not just focused on the Emergency Department but must be inculcated downstream across all departments in any institution.

Elements categorized under Space, Staff, Supplies, Sequence, Sustainability and Security/ safety must all be looked into and integrated in the wholesome planning of response. Blind spots and latent threats should also be sought by regular practice through exercises and simulation. Only this way, can preparedness be stepped up, be made state-of-the-art and both staff and the institution will be ready for the onslaught of any incidents and upsurge.

Key words*: emergency department, resilience, pandemic, infectious diseases, crises, upsurge*

Introduction

The world has seen several large-scale pandemics and infectious diseases (ID) outbreaks in more recent years. Infectious diseases can become widespread due to factors such as climate change and migration, global movements as well as the increase in the spread of zoonotic diseases. One often overlooked cause of global ID is related to bioterrorism. Besides these, there are the other disasters, mass casualty incidents and upsurges to grapple with. With all these developments and changes, it is imperative that all Emergency Departments and healthcare institutions must ensure resilience. Whether it is in the event of handling crises and disasters or managing the "business as usual" patients, the delivery of resilient, versatile, state-of-the-art, safe (for patients, public as well as the staff) and sustainable healthcare is critical. (1-7)

Maintaining operations during upsurge, crises and pandemics requires robust, adequate plans which must also take into account the day-to-day "business as usual" patients who will continue to present to the ED as well as other operations and ID management, whilst maintaining the overall healthcare priorities of the institution. Whether a pandemic like SARS (severe acute respiratory syndrome), Covid 19 or Monkeypox comes about, all the necessary plans, pathways, algorithms, work processes and frameworks must be in place for immediate execution as needed. (1,5,6,8-10) This means it requires awareness, preparation, regular practice and updates as well as timely communications to all staff. The experiences and sharing from previous incidents are also valuable to study latent threats, vulnerabilities and also to make necessary customizations. No two disasters or pandemics are the same, but fist principles and lessons from previous ones can certainly value-add to the preparation for the current one. All these will become easier to implement when institutions have a robust and resilient design, with a spectrum of human factors "know-how". In the right context, the issue of resilience is indeed receiving more attention and focus now, more than ever before. (2,4,8,11)

Thus, it becomes imperative for EDs to be prepared because it represents a highly brittle component of the healthcare system. What this means is that the ED at the frontline of the institution, is the first place to encounter crowding, upsurges, uncertainties, lack of resources and other challenges. It is like the first 'port of call' or defence 'fortress' of the institution. It is like the VUCAH (vulnerability, uncertainty, complexity, ambiguity and hyper-connectivity) equivalent of the economic world. Like many other processes, when the first steps are correct, adequate and strong, the rest of the flow downstream will hopefully, follow suit. (12,13)

Resilient Design and Engineering

Resilience, in our context, refers to the capacity to adapt to changing conditions and still maintain functionality and vitality in the face of stressors, crises or pandemics. It is also linked to the capability to bounce back after the incident and continue with 'business as usual', after all the disturbance and interruptions. Resilient design in healthcare institutions and EDs must be intentionally planned and incorporated, such that the infrastructure can be expanded quickly in the face of the crisis (or collapsed when it is not required any further) (12-14). Besides resilient infrastructure, staff must also have a resilient mindset and approach to work. It is almost like a value or a commitment, similar to professionalism and altruism, as we deliver service to others. (15-17)

Resilience is not just for the ED, but for all divisions and departments across the institutions. When making resilience a priority, costs will be incurred, whether in building a new facility or upgrading an existing one. This must be seen as a worthwhile investment for the longer term. This is often viewed as a mitigation factor (often in retrospect), only when it is realized how important it is. Resilience in healthcare must also be seen as a dynamic and continual process, with the need for frequent reviews and changes. No two encounters or crises will be exactly the same, but the principles applicable are the fundamentals. Most importantly, if there is no preparation and inbuilt resilience, there is bound to be failures, liabilities as well as dissatisfaction. (18-20)

Resilient design requires resilience engineering in: (12,14,21,22)

1. The ability to execute performance adjustments within the ED processes and practices as the need arise. This must be tagged to constant monitoring and surveillance with an extremely dynamic capability to change and reorganize operations, flow and processes. In short, the people leading and managing ED operations must be fast and nimble.

2. The approach to handling the ED and its resources. An easy to recall mnemonic for this could be with the use of the "6 S Model".

Space

Supplies

Staff

Sequence

Sustainability

Security and Safety

The tables below elaborate on some of the important considerations under the 6 S framework. These observations are entirely from the author's perspective; having been through several disasters, crises and pandemics in her career as an emergency physician.

	Space Considerations
1.	Sufficient space to either be opened and collapsed as needed based on surge. The spacing between beds/ trolleys must be sufficient to maintain safe distancing and at the same time allow for staff to move in between to carry out care plans and treatment. The luxury of space should not be underestimated as it will enable segmentation of cohorts of different types of cases, set-up of new workflow such as differentiation between acute respiratory illnesses (ARI) versus non-ARI cases. During Covid 19, many EDs discovered this lack of space for the first time. When this happens in dealing with ID, inadvertent nosocomial spread can take place within the ED. Some EDs use adjacent space for expansion such as open carpark space, multi-storey carpark, open areas where tentage or shelter can be rapidly constructed, or even bringing in functional containers.
2.	Points of entry should be spacious and clearly demarcated. This is also where crowds may be seen especially during pandemics, crises etc. Not making allowance for crowd may create bottle-necking upfront. Decentralization of entry for different types of cases (eg. infectious versus normal noninfectious cases) is useful and helps create the first line segmentation after initial screening.
3.	During upsurge and pandemics, clear, streamlined workflow is helpful. This must be made known to all staff and would also be useful to have been practised and tried during insitu simulation exercises.
4.	Whichever type of expanded space is in your plans, it is necessary to ensure perimeter defence.
5.	Use of negative pressure ventilation areas can help reduce droplets and air-borne spread
6.	Isolation bays can also be useful when coupled with negative pressure ventilation capabilities. These are a definite bonus in pandemics and infectious diseases outbreak
7.	Downstream spaces from the ED: isolation wards and rooms, high dependency rooms and intensive care units (ICU) must also be provided for, and the numbers would need to be projected based on the estimated trajectory for each unique situation. For example, operating theatres can be converted and customized into ICU spaces as needed. This can represent the expanded numbers of bed spaces needed in a pandemic.
8.	Getting used to frequent changes in workspaces and work flow is important. This will be the norm and it is crucial to manage the mindset of all staff pertaining to this.
9.	Physical aspects of the ED set up must also be considered. Factors such as the ventilation in the different areas, air exchanges, flow patterns and treatment, climate, humidity and pressure control in the various rooms, method of disinfection of spaces and other related factors. These would require working with biomedical engineers, architects and other professionals.

	Supplies
1.	Demand for extra resources will always be there. Some institutions stockpile these whilst others may have arrangements to get them at rapid request. This must all be planned beforehand and not at the last minute. Covid 19 demonstrated the significant lack of personal protective equipment (PPE) on multiple fronts and there are many lessons learnt from this experience.
2.	What is essential is that staff and patient safety must be upheld, and no compromises must be taken. This represents a fundamental to ensure staff continue to perform their work optimally.
3.	There will be an increase in demand for the normal spectrum of medical care equipment. This is fundamental in being able to handle the crisis/ upsurge. There will definite be strain for these resources. In some countries, coordination, and inventory by a larger or umbrella body such as the local health district office or the Ministry of Health is conducted and there is benefit in such a central regulatory role. However, this needs proper and prompt coordination so as not to delay supplies to institutions where both needs and demand will be high
4.	Knowing and working with local/ regional vendors and suppliers is beneficial. The procurement office must be versatile and flexible as well as have all the necessary first line and subsequent lines of support established.
5.	Innovation was something much appreciated during Covid 19 where staff came up with many ideas to help manage challenges in resources. Individual institutions should look into these and support research, and development of such activities or products.
6.	Covid 19 was an impetus for a variety of IT (information technology) and technological development to exponentially flourish. These have been able to reduce direct contact (for safety purposes), enhance work processes, cut time wasters, carry out procedures more efficiently as well as keep staff updated with shared information quickly. Institutions would by now have pursued these and developed more. For example, having an IT system that can alert to syndromic surveillance can be very useful.

	Staff
1.	Staff resiliency is n important consideration in the management of human factors (versus physical or systems factors).This is often not mainstreamed and thus may be readily overlooked. Its importance cannot be underestimated
2.	Awareness and buy in by all staff is essential. This means good, effective, regular communications and updates. This must align with the frequent changes and transformation in work processes during the pandemic or crisis. Setting up group chats, team-based work groups, email blasts and other forms of correspondence is necessary. The objective is to get the new information disseminated quickly so that all staff can align appropriately.
3.	Training must be provided on a continual basis. This can range from proper mask fitting, donning and doffing PPE, testing new workflow, identification of latent threats, checking out the route for transfers (with minimal contacts and exposures in cases of ID) and many others. Proper training is a major art f an ED's preparedness
4.	Cross-training of staff to cover different roles is very useful so they can be deployed where needed during the pandemic or crisis. This also ensure staff are familiar with all the operations and processes. This way, the staff remain versatile and agile.

5.	Staff welfare and protection is important and must not be overlooked. Their physical and psychological safety must be maintained. Covid 19 brought up the importance of these, which may have been blind sighted before.
6.	Vaccination of staff, providing adequate PPE, ensuring sufficient rest and other human needs considerations
7.	During a crisis, the leadership and management of the ED plays a critical role. They must fulfil multiple roles, have a good bird's eye view of all the operations and processes and ensure a good reporting structure.
8.	Values which are important to inculcate and develop in the staff include continual learning and growing, situational awareness, adaptability, and flexibility, amongst others. Supervisors and faculty should be proactive in keeping a look-out for these.
9.	Staff should be trained to anticipate potential upsurge, trends, and threats. This is very useful rather than just having a reactive response to situations and crises. This approach can help staff maintain cognitive control
10.	It is important to be aware that the staff will encounter physical, psychological, and temporal demands. They may need avenues to vent their frustrations. Recognition of their effort thus becomes very meaningful

	Sequence
1.	In pandemics or crises, it is fundamental that the workflow, framework and processes are all clearly understood. Moving from section to section/ area to area and transfers must be well defined.
2.	The proper triage and segregation of patients must be appropriately done or else issues can arise downstream. (eg. nosocomial/ iatrogenic spread of infection) Tried and tested step by step algorithms are very useful
3.	Setting up models of care will be helpful during the preparedness stages. This involves setting thresholds and alerts for activation, establishing the buffering capacity, stretch limits and goals for certain management processes or groups of patients. Once established, these and other KPIs should be shared with all staff
4.	Execution of roles and responsibilities based on framework, policies, surge management protocols and surveillance are important. The importance of being able to ride out the changing dynamics and landscape of the crisis or pandemic is fundamental.

	Sustainability
1.	Performance of the ED must be sustainable. This would also include meeting all the Key Performance Indicators (KPIs). Indirectly, this links to the ED/ institution's reputation and ranking in some places
2.	Sustainability of processes and workflow must be maintained for the short to medium term. In the longer term, these will need to be reviewed and updated accordingly.
3.	Other investments eg. staff recruitment, training and talent retention or equipment purchases and IT system must at least be for the medium to long term for sustainability
4.	Often overlooked are also initiatives at 'greening the ED'; recycling, redundancy, use of plastic packaging and many other consideration for reducing the department carbon footprint must be a proactive measure. Only this way can healthcare in general, contribute towards 'saving our earth' efforts

	Security and Safety
1.	Use of guarded access control, card control and identification is already in practice in many institutions. This is implemented at all points of entry, entrance into areas such as intensive care units, isolation wards, operating theatres etc
2.	The unique consideration of whether the crisis/ incident can be linked to bioterrorism/ terrorism activity must always be entertained in this day and age
3.	Ongoing security education and reminders for all staff
4.	Security considerations must be mainstreamed into all aspects of infrastructure, work flow and processes
5.	Considerations for escape routes/ access routes in other emergencies such as fire, explosions etc must be present
6.	Widespread use of CCTV (closed circuit television) camera and surveillance monitoring as required. This is especially so in higher risk areas.

The 6 S Framework represent broad strokes for your checklists, but each point must be customized, and dealt with in greater detail as needed to ensure a practical, actionable surveillance and flow processes is implemented in an ED or institution. What works in one ED may not do so in another. Some simplification may be required to ensure streamlined flow. There may in fact be sophistication in simplicity. Compliance levels are a good gauge of staff buy in to your procedures and policies. However, at the same time, the achievement of safe practice is critical. Staff must feel they are cared for, respected and are heard in terms of their feedback and suggestions. Working with staff must adhere to all the principles of managing human factors. These would include understanding the fact that staff have emotions, feel tired and fatigue, have families and other responsibilities outside of the workplace and they can certainly get sick. (14, 15)

It may be surprising to some, that staff issues and human factors are included under Resilient Engineering. This really represents the Human Engineering aspects, whereby it is highly relevant in ensuring both the systems/ physical factors as well as the human factors are well integrated and coordinated. These two domains are highly interdependent on each other and there is no separating them. Once you have all the domains in order, with each new crisis or disaster, it will be easier to fine-tune, customise and adjust accordingly. The fundamentals and principles which are already in place are crucial, as the starting point to build upon. At the ED at Singapore General Hospital, we have been making these changes and customizations through incidents such as SARS, H1N1, Mers CoV and even Covid 19.

In Fig 1, the schematic shows some of the differences between non-infectious versus infectious diseases incidents/ outbreaks. In the latter, Resilient Engineering must focus on: Identification, Isolation, Containment and Separation. This is important in ensuring that nosocomial infections is kept to the lowest possible. Even with a good, solid basic plan, leadership and management must understand the need to incorporate versatility and anticipate any disruptions, interruptions and outlying events. The correct mindset is to understand that the situation is never static nor fixed. (23, 24) Fig 2 shares how the day-to-day upsurge is affected by a variety of factors, unique to individual institutions. These can be sorted out by having a "big picture view" of the issues and not treating these as 'problems of the ED" only. An ED problem is also an institution-wide issue which needs collaborative resolution and inputs.

In Approaching Resilience: What Works?

There are multiple factors that have been observed to be linked to resiliency in the ED and institution. As an initiation point, the political will and commitment must be serious and strong. The passion must ignite the will to drive for change and improvement. A pinch of altruism helps as it is about service and serving others and patients. Alignment and buy in from staff is important. This can only be gotten with good rapport, communications to share and update staff, in a timely fashion and to ensure inclusivity. Staff want their voices to be heard and they must be in the groups looking into resolution, innovation, joy at work and physical and psychological safety. During the Covid 19 pandemic, the Chief Executive Officer and Chairman, Medical Board at Singapore General Hospital sent weekly email to every staff to keep us updated and to share words of thanks and inspiration. Coming from leadership, this has a significant impact and helps build staff resiliency in so many ways. Leadership townhall sessions are very well attended, with very active discussions. Staff are recognized for their

contributions and teamwork. This messaging is reinforced again and again to show appreciation and keep motivation and morale high. Small acts as this may be viewed as “soft” but they certainly go a long way in inculcating and nurturing resiliency.

The physical and infrastructural factors must align with the human factors. Staff must work in environments which ensure their safety as much as possible. Unnecessary risks should not be undertaken. Although one may view working at the frontline, facing patients with SARS or Covid 19 directly as high risk, this should not be done without the provision of proper, evidence-based PPE and hygiene measures. Courage is needed to incur expenses in building up infrastructure and capabilities for the long term. As long as justification can be done, expenses are not extravagant and is for the necessary facilities, things and equipment, it needs to be done and carried out. This has been our experience in the ED at Singapore General Hospital.

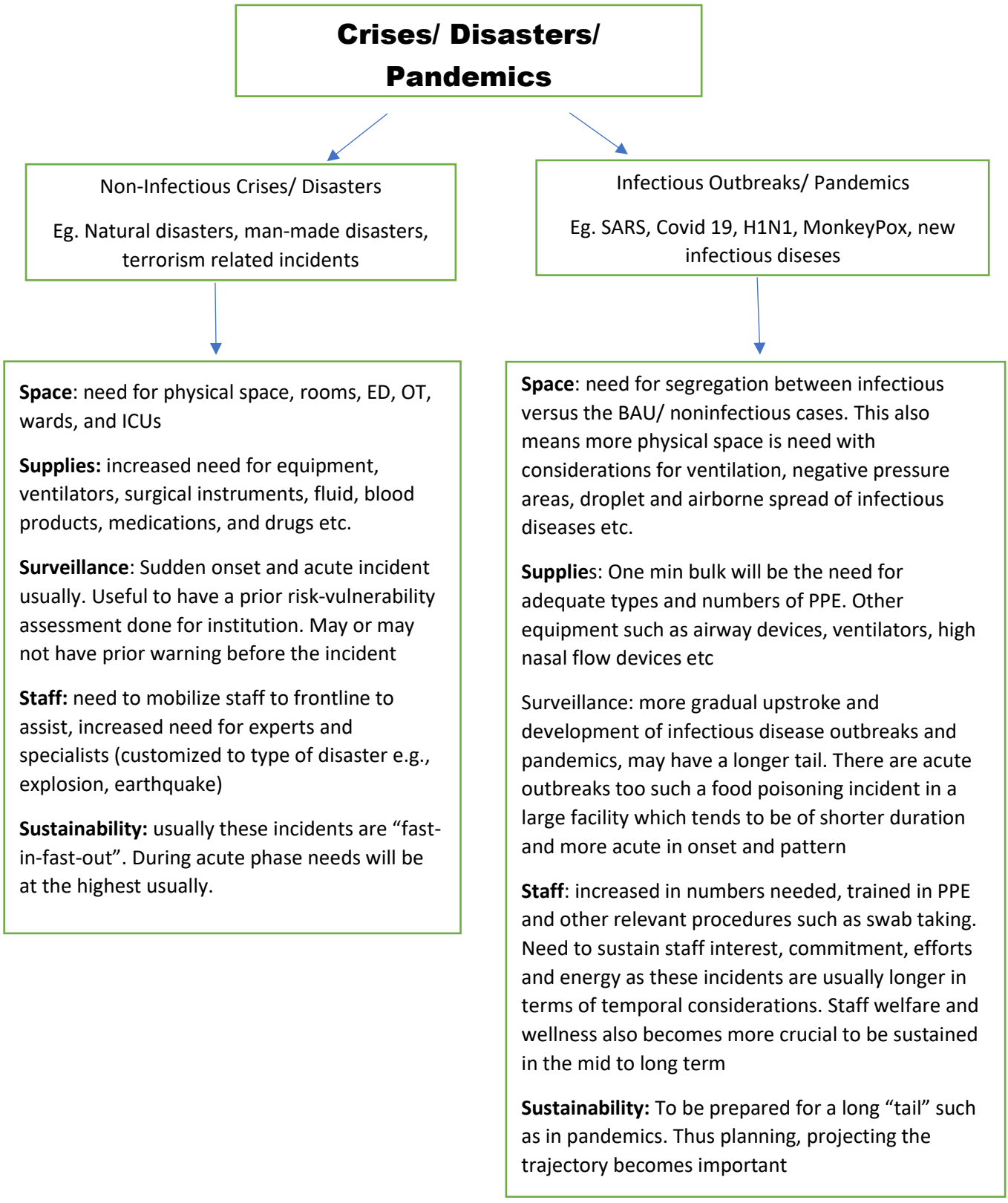

Fig 1: Resilient Engineering Considerations in Non-Infectious (Disasters) versus Infectious Diseases (Pandemics) Incidents

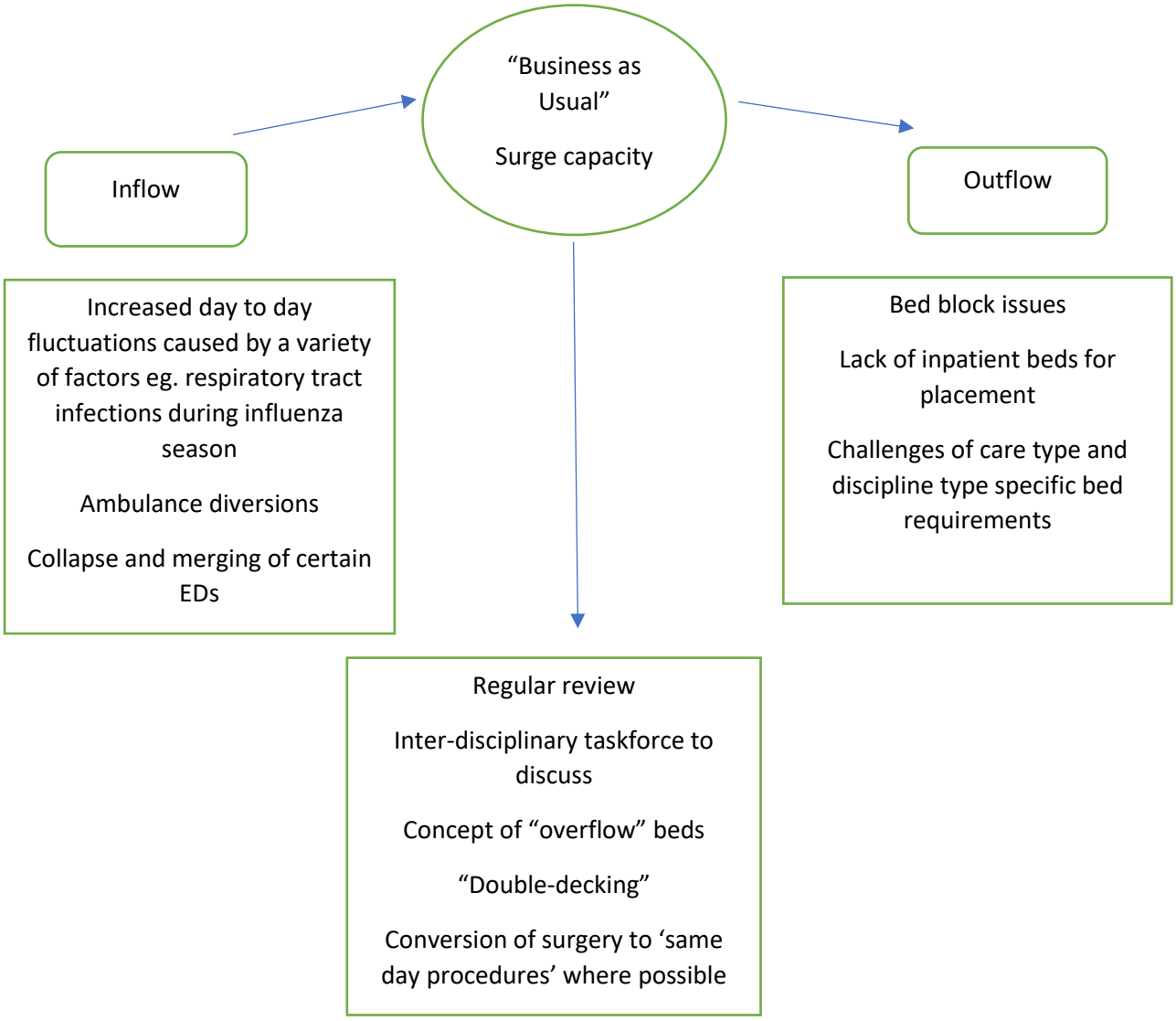

Fig 2: Map of the Issues Encountered with Surge during "Business as Usual" Periods

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