PERSPECTIVES FROM THE FIELD

Avoiding Catastrophe in a High-Risk Environment: AUSMAT at Howard Springs

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Abstract

The Australian Medical Assistance Team (AUSMAT) led the implementation, establishment and management of Howard Springs International Quarantine Facility at the Centre for National Resilience from October 2020 to May 2021. The operation is internationally renowned for its success to mitigate leakage of the coronavirus disease from the quarantine facility to the community during a national policy of virus elimination or suppression. The operations success led to other Australian jurisdictions seeking to replicate the quarantine model. Here, we use three theoretical frameworks to describe AUSMATs approach to risk mitigation at the quarantine facility.

Keywords: COVID-19, quarantine, emergencies, Disease Outbreaks, Medical Assistance

Introduction

The coronavirus disease (COVID-19) pandemic has resulted in unprecedented challenges to workplace safety, especially in health care and related settings. From March 2020 to February 2022, quarantine of international arrivals formed a key part of the Australian Government's COVID safety policies. The Howard Springs International Quarantine Facility at the Centre for National Resilience (HSIQF) provided a national quarantine centre for the repatriation of Australian citizens and permanent residents and was established by the Australian Medical Assistance Team (AUSMAT) following a request from the Australian Government with agreement and support from the Northern Territory Government. AUSMAT managed the facility between October 2020 to May 2021, before formal handover to the Northern Territory Government. Staff and community safety were the primary goal in the operation, and successful implementation of this goal resulted in the Northern Territory being the only Australian jurisdiction without COVID-19 community transmission from a quarantine facility [1]. The success of the operation led to other jurisdiction seeking to replicate the quarantine model [2, 3]. Here, we use normal accident theory (NAT), high reliability theory (HRT) and error modelling to describe AUSMATs approach to risk mitigation at the quarantine facility.

Normal accident theory

Normal accident theory argues that accidents are inevitable, particularly in complex environments, so prioritisation should be to develop initiatives to safeguard against failure and make sense of failures as they occur [4]. AUSMAT prioritised three key principles of NAT throughout operations at the quarantine facility. Firstly, that much was unknown about the novel virus and situation, therefore it was unrealistic to expect that accidents and failures would not occur. Secondly, responding to novel situations will likely provide ongoing challenges, even with initiatives to safeguard against failure, therefore a precautionary approach with continuous risk evaluation of activities is required. Thirdly, as accidents inevitably arise, they need to be quickly understood to adapt to the changing risk, to avoid exacerbating existing accidents or bringing new ones [5].

In recognizing these principles, AUSMAT accepted that much was unknown about the transmission of COVID-19 and that quarantine for returned travellers was a novel situation requiring a combination of enforcement and infection prevention control expertise, which to that point was not present in any scaled way nationally. Therefore, the operational development was iterative, continually adapting, including but also going beyond national COVID-19 guidance to optimally mitigate risk. Key examples of these efforts are provided in Table 1. The ability to forward think and continuously adapt was informed by AUSMAT's operational experience with COVID-19 in early 2020. This includes establishment and operation of the quarantine sites in Christmas Island and Howard Springs for Australians evacuated from Wuhan, Australians repatriated from the Diamond Princess cruise ship off Japan and staff and passengers on MV Artania cruise ship in Perth, Western Australia.

High reliability theory

HRT emphasises that organisations can avoid catastrophes in an environment where normal accidents are inevitable through effective leadership with a consistent safety climate [6, 7]. Organisations that achieve this goal are known as highly reliable organisation (HRO). HROs share a collective mindfulness where systems are informed by diverse perspectives to prevent operational failures that would be catastrophic to the operation and others the organisation seeks to protect [8]. To prevent these failures, HROS have a preoccupation with failure that is shared by the team through the safety climate [9]. HROs are effective as they have a strong governance structure with dynamic leadership, whereby the delegation of authority occurs according to three situational factors: criticality, technical knowledge and novelty [9].

AUSMAT is an HRO, as evidenced by operating throughout the pandemic in high-risk, unpredictable environments with significant rates of infection without a single staff infection, contrary to other comparable operations in Australia [1]. AUSMAT was built upon a multidisciplinary workforce, incorporating clinical, logistics and operational staff, with principled decision making that allows for dynamic leadership. At HSIQF, there was clear governance at the top end of the operation, with triangular leadership consisting of mission, logistics and clinical leads. However, AUSMAT are uniquely able to have flexible leadership across teams and layers of the operation, where the active leader may not be the most senior member, but rather a member closer to the "action" or frontline and better informed of the specific interdependency and situations risks. The ability to have dynamic leadership depends on individual and team trust in the organisation's safety values [8]. At HSIQF, AUSMAT built trust and confidence in processes by exceeding national COVID-19 guidance, fostering a no blame culture for infection prevention control (IPC) breaches, and developing a collective mindfulness with widespread understanding that leakage of the virus from the facility would be catastrophic to the operation and the wider community [9, 10].

Error modelling

In accepting that accidents are inevitable, a systems approach is required to defend the organisation and its employees. Error modelling focuses on the ways human factors lead to active failures or latent conditions, which can collectively result in accidents. Active failures usually involve front-line staff and cause immediate consequences [11]. They may be prevented by design, training or operating systems. Latent conditions are the managerial influences and social pressures that make up the culture influence the design of systems. Error modelling recognises that when systems fail, errors will flow and increase the likelihood that latent risks will become active, leading to an accident [12].

At HSIQF, error modelling of active and latent errors informed iteration of operations. The need for leadership in the development of initiatives to safeguard against failure is also fundamental to NAT, HRT and many workplace theories. At HSIQF, the identification of potential errors and implementation of appropriate systems was again informed by the cumulative intelligence of operational experience, along with real time feedback (team survey's, group training, photo evidence, daily video review). Examples of these are provided in Table 2.

Conclusion

At HSIQF, AUSMAT followed precautionary principals of protection, with forward thinking and gathering of cumulative intelligence from their clinical and technical experts and past deployments to iteratively mitigate risk. AUSMAT reconceived and prioritised safety in a time of unprecedented challenges to workplace safety. The approach described using three well known safety theories, can help understand what lead to the minimisation of accidents, avoidance of catastrophe and overall achievement of optimal outcomes of the operation.

Authorship statement

Conceptualisation – AT and SC. Manuscript writing – AT and SC. All authors reviewed, edited and approved the final version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

Table 1. Example of risk review and iterative adaptions by the Australian Medical Assistance Team at Howard Springs International Quarantine Facility at the Centre for National Resilience

Timeline	Risk detected	Accident foreseen	Action to reduce risk	So what?
January 2020	Emergence of a global infectious disease.	Supply shortages in essential equipment, notably adequate personal protective equipment (PPE).	Prior to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) arriving to Australia, AUSMAT immediately purchased a large quantity of essential equipment, including PPE.	AUSMAT logistics preparation enabled adequate supply of essential equipment in subsequent COVID-19 response and avoided equipment shortages during the peak of supply issues.
October 2020	Early evidence emerged of SARS-CoV-2 airborne transmission.	The use of inadequate PPE, such as surgical masks would fail to provide adequate protection of staff.	Utilisation of N95 by staff when within 1.5 meters of other staff members or returned residents, regardless of residents COVID-19 status.	Airborne transmission of SARS-CoV-2 was not yet recognised by the Australian Government or the WHO despite early scientific evidence on the contrary [13].
			Active cohorting of passengers based on potential infectious risk (countries of origin and family group) with staff cohorted accordingly with specialised teams to manage higher risk cohorts.	Cohorting of travellers was not a formal recommendation from AHPPC until July 2021.
December 2020	Arrival of the first SARS-CoV-2 variant of concern at the facility	There was increased transmissibility of the new variant, which reiterated the need for early detection of COVID-19 infection and resident cohorting.	Day 7 polymerase chain reaction (PCR) COVID-19 testing of residents was introduced for early identification of infection.	Day 7 testing of residents was not used elsewhere in Australia and was in advance of guidelines, which only recommended testing in the first 48 hours and then on day 10-12 [14].
December 2020	Limited laboratory capacity to process PCR tests.	Delayed detection of COVID-19 infection in staff, resulting in a potential outbreak at the facility.	Staff COVID-19 testing regimes increased to include weekly PCR and daily rapid antigen testing (RAT).	In Australia, mandatory staff COVID-19 testing was not yet implemented and RATs were not yet used by other health services, though Therapeutic Goods Administration approved [15].
January 2021	The size of the quarantine operation increased, with many new staff members.	New staff that had not worked in a quarantine facility or used PPE before, may threaten the performance of IPC procedures.	To improve personal protective equipment doffing technique and to identify technique errors early before a major breach occurred, video surveillance of doffing activities commenced.	Doffing video surveillance is not standard practice in quarantine or healthcare facilities but can identify technique errors early, allow for real-time feedback and lead to behaviour modification in response to awareness of being observed.

Table 2. Example of human errors and systems in place to mitigate risk by the Australian Medical Assistance Team at Howard Springs International Quarantine Facility at the Centre for National Resilience.

Human error	Factors causing accidents	Accident foreseen	Action to reduce risk of accident
Active	Slip, fumble or lapse: When familiar tasks are carried out without much conscious attention if the worker's attention is diverted	Compromise of PPE during routine activities, donning or doffing	• Daily training by all staff members to create 'muscle memory' for hand hygiene and PPE donning and doffing technique. • Video surveillance of doffing procedures with daily footage review to identify potential compliance issues and initiate immediate feedback to individuals and/or specific staff groups. • Pause points prior to entry into a high-risk zone, involving sign-in with a security officer and mandatory photograph of donned PPE that was shared with an all-staff WhatsApp 'chat', to refocus workers attention and create an opportunity for correction.
	Mistakes: when the employee is under time pressure or tasks are too complex	Compromise of PPE due to confusion of the level of PPE required for activities	• Simplified protocols and language with only two levels of PPE required by staff depending on activity: either high risk (face-to-face contact with resident) or low risk (no face-to-face contact with resident) • Active signage on IPC procedures at all PPE stations to prevent entrance to a high-risk zone in the incorrect PPE. • Buddy system used for all activities, including active spotting during intensive periods with the spotter supervising and verbalising each step of the doffing procedure.
	Violations: Deliberate deviations from standard operations usually due to a desire to perform work satisfactorily given constraints and expectations	High caseloads and work activities leading to rushed hand hygiene and PPE donning/doffing	• Frequent supervision and audits of procedures to monitor compliance, identify errors and near misses, then perform routine critical error reviews as a multidisciplinary team to learn from experience. • Empowerment of all staff to identify and report potential IPC compliance issues, irrespective of background or rank. • Maintain manageable workload and adequate staffing, monitored through daily staff well-being surveys and daily team huddles.
Latent	Job: Distractions, unclear procedures, high workload, inadequate, extreme temperature, poor equipment or workplace layout	Staff intentionally or unintentionally deviate from standard operations to compromise the safety of operations	• High-risk zones used a one-way personnel flow layout with physical barriers to prevent potential cross-contamination. • Standardised check-sheets used during the movement of any resident within the quarantine facility, which required signatures from a range of teams to confirm that all steps were completed correctly. • Multidisciplinary simulation rehearsal of high-risk procedures prior to completing the procedure for the first time.
	Individual: Physical ability, competency, fatigue and stress	Staff unable to perform at the standard required, comprising the safety of operations	• Individual PPE competency audit prior to commencing workplace activities. • Daily heat surveys completed to monitor fatigue and support active changes in policy • Comprehensive heat and stress management strategies for Darwin's tropical savannah climate, including reducing staff activities in peak hours of heat, mandatory minimum rest periods and active cooling.
	Organisational: poor health and safety culture, inadequate responses to previous incidents, or insufficient co-ordination and responsibilities	Staff perceive the workplace as high-risk, become disengaged and reduce performance	• Active coordination of operations by senior leadership team in a command-and-control structure to ensure all staff receive direction and a safe environment. • Daily staff briefings to support alignment to mission and team culture. • Enhanced surveillance through staff COVID-19 testing regimes, including a minimum daily RAT and weekly PCR.

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