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Collaboration Among Paramedics, Health Assistants, and Pharmacy Technicians During Mass Casualty Incidents

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Abstract

Coordinated collaboration among paramedics, health assistants, and pharmacy technicians is essential for providing efficient, life-saving care during a mass casualty incident (MCI). Under this framework, each provider plays a distinct role in emergency response: paramedics assess patient needs and offer rapid, initial care; health assistants prepare equipment, document information, and ensure support functions meet frontline requirements; and pharmacy technicians anticipate demand, manage medication distribution, and prevent inventory bottlenecks. By clearly distinguishing responsibilities that complement one another, the combined team can deliver timely, effective assistance during an MCI.

Mass casualty incidents disrupt everyday social patterns and overwhelm communities' medical resources (Aruru et al., 2020). Well-managed cooperation among healthcare providers—across professions, organizations, and geographical settings—is therefore critical in minimising fatality rates and restoring order (Al-Salloum et al., 2020). The role of paramedics encompasses direct patient assessment and care, enabling rapid prioritisation and treatment; health assistants arrange equipment, monitor supplies, and manage communication channels, reducing potential logistical delays; and pharmacy technicians oversee the allocation and replenishment of vital medications, contributing to seamless resource availability. Through attentive, collective action in their respective domains, the three professions uphold an effective emergency-response infrastructure during MCI scenarios.

Comprehending the complex interplay among paramedics, health assistants, and pharmacy technicians during an MCI forms the basis for further exploration of cooperation in high-pressure medical contexts.

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1. Introduction

Mass casualty incidents produce multiple injuries that overwhelm usual emergency service resources. Multidisciplinary cooperation among paramedics, health assistants, and pharmacy technicians is critical in such situations. Paramedics provide advanced pre-hospital medical care and contribute to incident assessment and triage. Health assistants support paramedics in patient care, safeguarding, and transportation, and facilitate communication. Pharmacy technicians ensure the availability of appropriate medical supplies and manage medications (Al-Salloum et al., 2020). Effective communication and resource management are essential. Joint training and drills prepare teams for coordinated responses. Strategies include clear protocols, role clarity, communication tools, and continuous improvement. Case studies from natural disasters, terrorist attacks, and mass shootings offer practical examples of successful collaboration. Ongoing efforts are needed to overcome challenges and refine cooperative mechanisms, ensuring rapid, efficient, and optimal patient management during mass casualty incidents (Steinert & K Mendelson, 2024).

2. Understanding Mass Casualty Incidents

Mass casualty incident (MCI) refers to any event, planned or unplanned, in which medical care is needed outside of a hospital for an unusually large number of victims (Neeki et al., 2021). Historical reference to MCI emerges from the 1950s but the concept can be traced back much earlier when MCI happened regularly at the battlefields. Incident having more casualties than can be handled by the local resources qualify to be rightly called MCI. Natural disasters like hurricane, flood, earthquake, or man made incident like mass shooting, bombing, or chemical exposure may create MCI environment. In US alone there are more than 1000 MCI per year of various categories.

2.1. Definition and Scope

An MCI is defined as an event where the number of casualties exceeds local healthcare capabilities, necessitating a coordinated and efficient response to minimize mortality (Neeki et al., 2021). The scale and nature of MCIs require a multidisciplinary approach, with paramedics, health assistants, and pharmacy technicians playing vital roles in different stages of response. A MCI can be localized or widespread and may be natural or man-made in origin. Natural MCIs are often the result of hurricanes, earthquakes, or wild fires. Man-made MCIs generally involve acts of terrorism, armed aggression, and hazardous material incidents. Such incidents

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as mass shootings, bombings, or chemical leaks have the potential to generate an unmanageable number of victims in need of emergency medical treatment.

2.2. Historical Context

Mass casualty incidents (MCIs)—events where the number and severity of casualties exceed the local capacity for care—are classified as accidental, deliberate, or natural. Response control is administered at municipal, sub-provincial, or provincial levels through a comprehensive emergency management program comprising prevention and mitigation, preparedness, response, and recovery (Al-Salloum et al., 2020).

A mass casualty incident may be defined as: A situation with three or more patients, or demand and casualties exceeding local medical resource capability.

Mass casualty response plans depend on the incident and resource availability. The World Health Organization recommends preparedness that includes building capacities, awareness of early warning signs, response, contingency planning, and recovery.

2.3. Types of Mass Casualty Incidents

Mass casualty incidents (MCIs) constitute events that result in multiple casualties and overwhelm available medical services. Mass casualty events encompass various scenarios, including natural and environmental disasters, terrorist incidents, and mass shootings (Neeki et al., 2021). During natural disasters—such as tornadoes, floods, earthquakes, hurricanes, or wildfires—casualties can range from minor to severe, both physical and psychological. Some injuries may develop over time; for instance, floodwaters can cause infections, leading to additional medical needs. Terrorist activities often compound the damage caused by natural disasters; chemical and nuclear accidents and mass shootings—such as workplace or school shootings—also contribute to the range of possible incidents (Tankel & Einav, 2021).

3. Roles and Responsibilities

Collaboration among paramedics, health assistants, and pharmacy technicians is a crucial component for effective mass casualty incident (MCI) management (J. Reilly & Markenson, 2009). Each of the three professions has distinct roles and responsibilities during an MCI: • Paramedics provide emergency medical services, such as triage, assessment, treatment, and transport, at the emergency scene. Their initial evaluation of lanes and incident casualties determines the deployment and allocation of personnel and resources to minimize losses. • Health assistants offer logistical and medical support to paramedics, remain on alert to receive and transport patients, and assist with medical procedures during a medical emergency. By providing first-line treatment and care, they bridge the gap from incident response to hospital

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admission. • Pharmacy technicians manage medications and supplies, including recording and packaging, ensuring necessary materials for treatment are available. They also support hospital emergency departments by overseeing drug and equipment dispersion, ensuring operation without interruption (Kellner et al., 2019). Overall, MCIs overwhelm the emergency service system and healthcare organizations. Paramedics, health assistants, and pharmacy technicians collaborate closely to maintain the necessary balance between emergency service capabilities and incident site demands. By adhering to their responsibilities, each sector enhances the efforts of the others, guiding affected individuals through the response and recovery phases.

3.1. Paramedics

Paramedics perform advanced and extended emergency medical procedures on-site, en route to hospitals, or within pre-hospital settings. Their role includes rapid prioritisation of care during mass casualty incidents—natural disasters, terrorist attacks, or mass shootings—and stabilisation of trauma patients prior to hospital admission. In such contexts, paramedics work in tandem with health assistants and pharmacy technicians. Health assistants provide organisational support: transporting and positioning patients within triage and treatment areas, moving casualties from incident sites to transportation, and communicating with external support agencies. Pharmacy technicians manage pharmaceutical supplies: assessing needs, organising, locating, collecting, and distributing medicine to medical personnel at triage and treatment points. The complementary tasks of paramedics, health assistants, and pharmacy technicians align with the shared objective of delivering rapid and efficient care during mass casualty incidents (Krzyżanowski et al., 2021) (Al-Salloum et al., 2020).

3.2. Health Assistants

Health assistants hold auxiliary positions within health units, engaged in routine or unskilled work supporting the core functions of healthcare. Their responsibilities generally include transporting patients, collecting and delivering required materials, cleaning wards and health unit premises, and handling waste disposal. The support processes for these tasks are carried out by pharmacy assistants and health assistants.

Demanding coordination among paramedics, health assistants, health attendants, and pharmacy technicians in mass casualty incidents is widely acknowledged. Mass casualty incidents that overwhelm existing resources require systematic processes for the communication, control, and coordination of all available resources. In this context, the support functions performed by health assistants become vital to ensure smooth operations during such challenging events.

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3.3. Pharmacy Technicians

Pharmacy technicians are integral members of the healthcare team responsible for various aspects of medication pursuit and supply within the hospital setting, particularly during the chaotic circumstances of a mass casualty incident. These professionals vary by country in terms of licensure and employment modalities; however, in the Thai healthcare context, pharmacy technicians are typically licensed and operate within hospital environments, fulfilling responsibilities that encompass procuring, preparing, distributing, and assisting in the preparation of pharmaceutical products. The overarching goal is to ensure the availability and readiness of medical supplies for delivered patient care.

The duties of pharmacy technicians span across direct patient care, financial management, and general operational support within hospital pharmacy services. Specific tasks encompass the preparation and packaging of both liquid and solid oral and parenteral medications, maintenance of equipment, proper storage of pharmaceuticals, maintenance of stock integrity, and the organization of supplies and equipment for emergency situations such as mass casualty incidents. Additionally, pharmacy technicians are tasked with administering medical supplies to healthcare units inside the hospital, monitoring the return of medical supplies, assisting pharmacists in the accurate preparation of individual medications, managing staffing and resource allocation to fulfill daily pharmacy operations, and participating in disaster strategies and related training exercises to ensure preparedness and effective response during MCI events (K. Odukoya et al., 2015) (Al-Salloum et al., 2020).

4. Communication Strategies

Effective communication strategies are paramount during mass casualty incidents (MCIs), periods when large-scale collaborative efforts among paramedics, health assistants, and pharmacy technicians can mean the difference between life and death (Neeki et al., 2021). Information must be continuously updated and exchanged to establish a foundational shared understanding of how to coordinate different task dependencies across the three professions (Al-Salloum et al., 2020). Leaders play a key role in this information-flow process, guiding the group to redeploy available resources and temporarily close coordination gaps by articulating a clear course of action. Among the emergent solutions that take computers into account, voice-over-IP (VoIP) technology networks a wide range of communications devices and permits the simultaneous transmission of live video, text, and graphical data.

4.1. Inter-Professional Communication

Collaboration between paramedics, health assistants, and pharmacy technicians during mass casualty incidents hinges on effective inter-professional communication. Coordinated efforts are essential for the successful completion of transport, treatment, and medication tasks. During

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the descent phase of a response, paramedics often move patients from loading to unloading areas while health assistants prepare stretchers for receiving patients. Positioning oneself between the ambulance and designated unloading area facilitates interaction and coordination among these roles. Inter-professional care is characterized by components including coordination, cooperation, communication, responsibility, accountability, assertiveness, mutual respect, and trust (Al-Salloum et al., 2020). Frontline healthcare workers emphasize that effective communication and teamwork empower staff and support personal health during crises (R. Jordan et al., 2022). Healthcare administrators encourage the establishment of a shared-responsibility culture and clear role understanding to enhance inter-professional collaboration. Such efforts foster productive team dynamics, enabling paramedics, health assistants, and pharmacy technicians to harmonize their actions and contribute collectively to incident management.

4.2. Use of Technology in Communication

Collaboration among paramedics, health assistants, and pharmacy technicians during mass casualty incidents is essential to delivering effective health care. Communication plays a key role in coordinating teamwork, and technology offers powerful solutions for transmitting data and coordinating resources.

Telemedicine enables transfer of patients' data from the incident scene to the receiving facility, simplifying multiple dispatches and supporting local health networks (F O'Sullivan & Schneider, 2022). A combination of stationary and mobile devices links field operations directly to hospital teams, optimizing processes and reducing unnecessary visits to the emergency department.

Video communication systems can facilitate remote training and ensure personnel operate specialty equipment properly—a capability that is valuable in unpredictable scenarios requiring diverse expertise (H. Abadia de Barbara et al., 2012). Virtual simulation supports both initial and ongoing skill development at a distance, making specialized guidance widely accessible.

Tools to integrate messages among professions likewise increase situational awareness and improve the ability to plan across capabilities (Xin Nie et al., 2023). Designers must address the need for privacy, interoperability with electronic medical records, and access to comprehensive information with relevant context. Implementation must consider a complex interplay of requirements and practices to realize improvements in workflow and outcomes.

Mass casualty response benefits significantly from electronic media that strengthen communication between paramedics, health assistants, and pharmacy technicians—during both training and incident operations.

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5. Training and Preparedness

Effective collaboration between paramedics, health assistants, and pharmacy technicians at mass casualty incidents requires sustained training and preparedness (Kellner et al., 2019). Training exercises, simulations, national strategies, and emergency protocols help clarify processes, reinforce individual roles, and improve communication among the three disciplines. Health departments possess experts in infectious diseases, environmental health, and radiation safety who, in partnership with local emergency medical services (EMS) agencies and training centers, can prepare the workforce for emerging medical crises and disaster response (Markenson et al., 2005).

5.1. Joint Training Exercises

Mass casualty incidents involve the sudden influx of patients that overwhelms available medical resources (Foo et al., 2021). The time-critical nature of these events requires multidisciplinary collaboration to ensure effective response and recovery. Paramedics, health assistants, and pharmacy technicians integrate their unique skills to facilitate resource deployment, patient triage, and medical material management during such incidents (Schumacher et al., 2022).

Paramedics confront trauma injuries and coordinate emergency care on scene. Health assistants provide vital support in patient management and coordinate logistical aspects of the incident, serving as a liaison between ambulances and the emergency department. Pharmacy technicians manage drug inventory control and procured the required medical materials.

Collaborative exercises address this need by allowing participants to experience the arduous nature of extended shifts, the difficulty of manpower scheduling, the shortage of logistics supplies, and coordination between various agencies. In a Swiss study, an interprofessional team created full-scale scenarios, each representing regional-scale disasters involving approximately fifty casualties. Such training enhances teamwork and communication between these professionals during sudden crises.

5.2. Simulation Drills

Medics encounter numerous challenges when managing mass casualty incidents, including communication, resource, and coordination issues. The significant demand placed on healthcare personnel and emergency responders often restricts general responders from effectively addressing patient needs. Simulation drills enable paramedics, health assistants, and pharmacy technicians to practice adaptive techniques in a safe environment (L. Kerner et al., 2016). Engaging in both simulated and real-world scenarios develops strong teamwork skills and enhances inter-professional collaboration (Schumacher et al., 2022).

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Swiss hospital pharmacies conducted successive full-scale simulation exercises separated by at least four months. An interprofessional team designed two scenarios depicting credible regional-scale disasters with approximately fifty casualties: a major road accident and a terrorist attack. Four exercise assessors utilized appraisal forms to evaluate participants' actions and responses during the simulations, rating performances on five-point Likert scales. At a freestanding emergency department, standard training was coupled with two days of drills employing level 3 personal protective equipment. Day 1 concentrated on the selection and donning of level C PPE, including respirators and chemical-resistant apparel. Day 2 featured an eight-hour hybrid simulation involving moulaged mannequins exhibiting signs of chemical exposure. Teams were tasked with evaluation, decontamination, treatment, communication, and transfer of patients, incorporating high-fidelity mannequins displaying symptoms such as pinpoint pupils, diarrhea, nausea, and vomiting. Scenarios included a school explosion with ambulatory wounded, mannequin decontamination, and ambulance transfer to a hospital. Cadaveric tissue facilitated clinician skills refresher training to maintain competencies in procedures—particularly high-risk, infrequent interventions—while accounting for system-specific equipment and approaches.

5.3. Role-Specific Training

Following individual and team preparedness training, paramedics, health assistants, and pharmacy technicians undertake role-specific instruction that emphasizes the knowledge and skills required for their particular functions in mass casualty incidents. Training for paramedics stresses the recognition of emergent medical conditions, efficient triage strategies, and the application of lifesaving interventions. Health assistants study patient assessment and the monitoring of vital signs, elements necessary for the allocation of patients to appropriate levels of care and for ongoing situational awareness. Pharmacy technicians learn about the management of medical and hazardous materials, with a focus on maintaining sufficient inventories and supplying firefighters and healthcare personnel to permit the uninterrupted provision of emergency services during peak demand. This role-differentiated training aims to match the complementary duties of these professionals with the requirements of integrated response and to enhance the overall effectiveness of their collaborative efforts (Markenson et al., 2005).

6. Resource Management

Inventory control represents an essential component of healthcare management, particularly in the pharmacy. Its significance amplifies during emergency situations such as mass casualty incidents, in which the pre-positioning of stockpiled medical supplies—including therapeutics, surgical dressings, and emergency trauma care equipment—is necessary to sustain activities throughout prolonged periods and facilitate rapid, efficient response arrangements.

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Distribution and allocation of medical materials underpin effective healthcare delivery, especially if activities span more than 72 hours or if elements become bound to specific locations. In mass-casualty scenarios, such challenges potentially arise despite preventative measures, increasing the demand for material dispersion and systematic management aligned with personnel guidance (Steinert & K Mendelson, 2024).

6.1. Inventory Control

Stock control is one of the most important factors affecting the patient care department and patient care services. The supply services are in a major role ensuring the availability of necessary medical items available in the requisitioning points. If necessary items which are urgently needed are delayed, not only patients suffer physically, but also the healthcare provider suffers mentally. Everybody wants to be efficient in their works, so that all of them expect enough items which are nominated in the requisition points to be available when needed. Proper storage of items is essential to prevent damage and to make them available on a daily basis. Paramedics, health assistants, and pharmacy technicians can support each other during mass casualty incidents by managing inventory and distribution of pharmaceuticals.

Preparing and monitoring minimum and maximum stock levels enables transparency of what is in stock and what can be ordered. It minimizes unnecessary overstocking and understocking of pharmaceuticals. It also outlines the responsibilities of the recovering/storing and issuing officers. Health assistants and paramedics can support pharmacy technicians in controlling the inventory of pharmaceuticals by monitoring the minimum and maximum levels of pharmaceutical items. They can support by checking inventories that could create an API if they are used in an exceptional circumstance such as a mass casualty incident.

6.2. Distribution of Medical Supplies

The ongoing provision of a limited number of medications creates an issue in a patient's treatment. Once the urgent need is over, paramedics and health assistants continue to coordinate and communicate as they distribute more medical supplies to different areas of the incident. Pharmacy technicians further support utilization of drugs and medical supplies to alleviate supply shortages (Neeki et al., 2021).

7. Case Studies

Mass casualty situations necessitate rapid and effective collaboration between paramedics, health assistants, and pharmacy technicians. Natural disasters such as hurricanes and floods frequently require a multidisciplinary response. The 2021 Texas winter storm highlighted key response challenges for pharmacists and pharmacy technicians involved in mass dispensing operations during natural disasters. During the Boston Marathon bombing in 2013, paramedics,

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health assistants, and pharmacy technicians confronted the challenges of the largest mass shooting incident in the northeastern United States. The 2019 Poway synagogue shooting illustrates the devastating impact of mass shootings. Effective multi-agency collaboration between paramedics, health assistants, and pharmacy technicians was critical to a successful incident response and patient outcome (Krzyżanowski et al., 2021).

A coordinated approach to disaster preparedness and response among paramedics, health assistants, and pharmacy technicians can optimize readiness, response, and recovery, using their respective technical expertise and comprehensive knowledge of medical care within their scope of practice, and supported by shared information technology. Facilitated coordination may also ensure efficient medical supply distribution and resource management through trusted medical supply inventories and formalized inventory procedures and documentation. These practices can enhance the overall efficiency and effectiveness of the incident management process (Neeki et al., 2021).

7.1. Case Study 1: Natural Disasters

A natural disaster results from a natural hazard such as a flood, tsunami, or earthquake that causes significant financial, environmental, and human damage, creating burdens for impacted communities and emergency response teams. Paramedics have responsibility for the immediate treatment of casualties, in addition to providing overall coordination of medical efforts under the guidance of clinical authorities (Moss et al., 2021). Health assistants provide clinical assistance to paramedics and other medical personnel during casualty assessments, administer medications and injections under paramedic direction, facilitate patient transport, assist with record-keeping and communication, and perform other clinical and reception duties. Pharmacy technicians support paramedics and health assistants by maintaining medical and response supplies, conducting stock takes to ensure preparedness, and operating supply vans that deliver equipment to facilities such as hospitals and medical centres during ongoing incidents. During a mass casualty incident, these professionals integrate their skills to address patient care and operational requirements while also participating in long-term recovery and rehabilitation efforts. Case Study 1 examines the modes of collaboration among paramedics, health assistants, and pharmacy technicians during natural disasters.

7.2. Case Study 2: Terrorist Attacks

Between 2013 and 2019, there were 151 mass shooting events in the United States (Smith et al., 2020). What drives an individual to commit such an act is difficult to understand, yet the frequency of these mass shootings is on the rise.

Terrorism has escalated in the United States since the first attack in 1990. Terrorism has escalated in the United States since the first attack in 1990.

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The term “terrorist” originated in 18th century France during periods of government upheaval. Definitions of terrorism vary, but for this purpose, it is defined as the creation of a general climate of fear or dread in a population by a group or individual. The aim is to bring about a political or social change. Terrorists seek rapid and devastating publicity through their actions. Terror is widespread and unpredictable.

More specific to terrorism are weapons of mass destruction (WMD). These are comprehensive instruments or weapons that have the capability to cause large-scale death and harm. WMD can be further divided into biological, chemical, radiation/nuclear, explosive, and incendiary categories. These weapons could create an MCI. Medical personnel such as paramedics, health assistants, and pharmacy technicians should be aware of the pathology of each agent, its potential significance in a well-known patient presenting to the Emergency Department (ED), and its potential for contamination or dispersal. A health worker need not have a comprehensive knowledge of each agent to begin treatment or take necessary protection and safety measures (Markenson et al., 2005).

7.3. Case Study 3: Mass Shootings

Mass shootings constitute a critical subset of mass casualty incidents (MCIs). Defined by the FBI as events involving four or more victims shot in a single incident, a substantial portion of these incidents 60approximately 59% 60involve three or more victims in the United States.

These MMCSs have become the focus of increased national concern and empirical research. Between 1966 and 2019, the global community endured 168 shooting sprees, underscoring the urgent need for effective response strategies. The recent terrorist incident at the Inland Regional Center in San Bernardino, California, serves as a poignant example of the unique operational and psychological challenges faced by emergency medical service (EMS) providers during MCIs (Smith et al., 2020). Prompt management of the event required rapid deployment of all available EMS personnel and effective collaboration with local police and fire departments.

8. Challenges in Collaboration

During mass casualty incidents (MCIs), collaboration among paramedics, health assistants, and pharmacy technicians may encounter multiple challenges. Communication barriers significantly impede information exchange and coordination. These barriers may arise from differences in professional language, lack of shared understanding of roles, anxiety under high-stress conditions, or technological failures that disrupt communication channels. Additionally, limited availability of essential equipment and supplies constrains the ability to provide timely treatment and manage patient flow. Resource scarcity can lead to rationing decisions and exacerbate tensions among team members. Fragmented or incomplete coordination among roles produces duplications of effort or unmet needs, while unclear delineation of

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responsibilities causes confusion and delays in executing critical procedures. Overlapping tasks may provoke conflicts and reduce overall efficiency. Finally, personnel shortages impose excessive workloads on existing staff, increasing fatigue and diminishing performance (Al-Salloum et al., 2020). These factors collectively hinder the seamless integration of interventions necessary to manage MCIs effectively, placing greater strain on navigating complex treatment environments.

8.1. Communication Barriers

Mass casualty incidents are often sudden and unexpected, leaving a little time for reflection and planning. The likelihood of miscommunication increases during these events, with an almost immediate demand to act rather than talk about what needs to be done. Despite this, unspoken, nonverbal communication is an instrumental component in establishing clear intentions. If multiple agencies are involved, such as law enforcement and emergency medical services, multiple channels and party lines may become easily overwhelmed, creating an extra barrier to timely communication. (Jafari Varjoshani et al., 2014) Stress, anger, and time pressures are other sources of communication breakdowns that can trigger error propagation or cascade failure. Repeated telephone calls, especially with family members, may also cause much of the confusion; after a disaster, multiple calls might take place between the emergency department and family wishing to check on an injured member. This creates a situation of telephone tag where the receiver in the emergency department is constantly engaged in other conversations, only exacerbating the issue.

8.2. Resource Limitations

Mass-casualty incidents create sudden demands that exceed resources and personnel. Although military medics have a larger scope of practice than their civilian counterparts, military health-assistant capabilities during domestic mass-casualty incidents or in temporary Federal Emergency Management Agency–sponsored medical shelters have not received attention. During mass-casualty incidents, pharmacy technicians work under the constant pressure of supporting properly stocked pharmacy inventory. This support helps ensure that the pharmacies can make life-and-death decisions with fewer limits on pharmaceutical supplies.

The importance of pharmacy technicians' work is sometimes overlooked, as is the impact their contributions have in mass-casualty support. Support often comes from operational areas being overstocked with supplies. When this occurs, excess supplies can be passed toward the disaster area. Tracking all of these resources, whether originating from outside sources or within pharmacy operations, is vital. Every prescription sent out of the disaster area must be tracked to a consolidated list with respective batch numbers. This information helps prevent duplication

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of the effort and point-of-dispensing locations from becoming overtoppled. These processes become exponentially more important with increasing numbers of casualties.

8.3. Role Confusion

Role confusion has long been cited as a major breakdown during disaster response (J. Reilly & Markenson, 2009). In addition, the emergency department offers an excellent example of the insidious confusion over professional roles, which too often limits the effectiveness of interprofessional collaboration. The way out of this dilemma is for pharmacists to develop an irresistible presence, built around the shields of care, especially in medication safety, and incessantly broadcast and demonstrate that presence when opportunities arise (Al-Salloum et al., 2020). Even if the implementation details require some finesse, role clarity must first be established if collaboration is to flourish.

9. Best Practices for Effective Collaboration

Collaboration among paramedics, health assistants, and pharmacy technicians proves critical during mass casualty incidents, enabling effective delivery of medical resources and emergency patient care. This sector-specific collaboration ensures seamless operational capability when responding to the initial outbreak of mass casualties. The ability of paramedics to coordinate with pharmacy technicians and health assistants facilitates the delivery and management of essential resources, while allowing each party to leverage their expertise. In such scenarios, paramedics operate as the frontline clinical practitioners, supported directly by health assistants and pharmacy technicians who manage discrete roles that contribute to the continuity of care (Al-Salloum et al., 2020). The paramedic component represents a crucial linkage between out-of-hospital and emergency care services, a connection that requires the understanding and application of contemporary medical concepts and principles by support personnel. Inter-professional collaboration in the mass casualty context also aids in preventing the public presentation of patients with immediate life-threatening conditions; when it occurs, emergencies mandate rapid transport to preserve life. The effectiveness of this approach underscores the essential nature of collaboration among these professions during critical mass casualty deployments (Steinert & K Mendelson, 2024).

9.1. Establishing Clear Protocols

Developing clear protocols is critical for effective collaboration among paramedics, health assistants, and pharmacy technicians during mass casualty incidents (Al-Salloum et al., 2020). Protocols define roles, responsibilities, and procedures that reduce uncertainty in complex settings. They should be comprehensive but flexible, covering triage, treatment pathways, resource allocation, information flow, and equipment use. Protocols address communication, teamwork, and integration with external agencies. They can be based on established templates,

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augmented with lessons learned from real events, and refined iteratively. Protocol dissemination, training, and regular review ensure consistency and continuous improvement. Clear protocols enable orderly, task-focused, and efficient collaboration across multidisciplinary teams while supporting rapid decision-making and maintaining care standards. They contribute to preparedness by providing a common operational framework and reference point for managing dynamic and challenging situations.

9.2. Fostering Teamwork

High-quality interprofessional collaboration is a key factor in patient safety and successful communication (R. Jordan et al., 2022). Effective teamwork has proven essential to supporting healthcare workers during responses to past crises. Rates of stress, anxiety, and depression are high among frontline responders, and working during COVID-19 has resulted in chronic fatigue, insomnia, post-traumatic stress disorder, and burnout among healthcare professionals. Communication and interprofessional teamwork are necessary when navigating crises and have a significant role in staff empowerment and personal health. Several hospital systems succeeded in mobilizing frontline interprofessional teams to respond to the COVID-19 crisis, facilitating crucial communication and collaboration. Understanding the social and structural conditions that facilitate or obstruct interprofessional work in hospital settings and studying the impact of COVID-19 on the nature of interprofessional work are important in preparing for future crises.

Pharmacy services have been identified worldwide as a crucial element within emergency preparedness and disaster management initiatives (Al-Salloum et al., 2020). A co-ordinated effort between doctors, pharmacists, and other healthcare professionals is key for responding to mass casualty incidents. Roles should be clearly defined for a safe shared experience and positive patient outcomes. Interprofessional collaboration between pharmacy and the emergency healthcare team is vital for high quality care and shared patient safety. Further research on a larger scale and in multiple contexts should explore specific facilitators and barriers of interprofessional care. Positive results would be visible once a shared responsibility culture is established among professionals. The role of pharmacists in emergency care is proven to improve patient outcomes, but crossing a collaborative care chasm is a tedious process. Healthcare administrators need to encourage interprofessional capacity building as an investment towards an improved system of practice. Pharmacists should gradually participate and master their skills to be useful in the team. Once role clarity develops with respectful team dynamics, interprofessional collaboration between doctors and pharmacists will become productive.

Mass casualty incidents are a deviating point of practice that requires consultation, planning, and team cooperation between emergency first responders. Teamwork during mass casualty

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incidents builds on trust, leadership, conflict resolution, seeking information, and availability. Interprofessional collaboration between doctors, paramedics, health assistants, and pharmacy technicians focused on effective communication, training, and resource management is pivotal to the success of mass casualty incident preparation and response.

9.3. Continuous Evaluation and Feedback

Continuous evaluation and feedback are essential for maintaining and enhancing the effectiveness of collaboration among paramedics, health assistants, and pharmacy technicians during mass casualty incidents (MCIs). Implementing a system that provides constructive, timely, and relevant feedback helps identify the impact of collaborative arrangements and clarifies improvement opportunities without disrupting ongoing workflows. This mechanism should monitor compliance with predefined guidelines and assist in evaluating overall performance. Repeated testing of the system through real-life scenarios and simulations ensures sustained applicability and relevance, enabling swift identification of problems and the questioning of established practices in the constantly evolving response environment (Al-Salloum et al., 2020).

10. Future Directions

The ongoing efforts to enhance collaboration among paramedics, health assistants, and pharmacy technicians during mass casualty incidents highlight several avenues for future development. Innovations that improve existing communication channels, training programs, and logistical frameworks can further strengthen inter-professional coordination.

Telemedical support combined with wearable devices and real-time tracking systems has been proposed as a means to regulate and document the activities of medical personnel at large-scale incident sites, thereby enhancing command over ongoing operations and staff availability (Aruru et al., 2020). Consolidating communications through interconnected applications that also monitor resource status can streamline information sharing and facilitate better decision making.

Augmenting training curricula with modules focusing explicitly on collaboration strategies prepares the workforce to realize the full potential of these innovations (Al-Salloum et al., 2020). Embedding interactive workshops and simulations into existing programs enables participants to develop the requisite skills and attitudes in a practical context.

Integration of innovative communication tools into resource management frameworks can increase the efficiency and responsiveness of supply distribution during emergencies. Such integration also allows for more agile adaptation of tactics based on real-time situational

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awareness. Funding models that favor integrated system development and infrastructure upgrades encourage coordinated implementation and continuous refinement.

Beyond technical advances, fostering a culture of collaboration, training continuity, and support mechanisms remains essential to sustain expert performance in high-pressure environments.

10.1. Innovations in Inter-Professional Collaboration

Inter-professional collaboration is the keystone for effective response to disasters with the mass casualty incident paradigm (Hahn et al., 2014). The roles of paramedics, health assistants, and pharmacy technicians complement each other (Al-Salloum et al., 2020) and an understanding of their respective responsibilities is essential to appreciate their collaboration. The paramedic's immediacy of response to significant traumatic injury presents three tasks. Performance of triage accepts the incident or rejects it as beyond the capabilities of the available responders. Production of a definitive clinical impression provides the first stage of on-site clinical management and guides subsequent activity. Transfer of care initially to a health assistant delivers definitive on-site patient assistance and frees the paramedic to supervise wider clinical care within the incident.

10.2. Policy Recommendations

Policy recommendations to enhance collaboration among paramedics, health assistants, and pharmacy technicians during mass casualty incidents emphasize the importance of clear protocols, teamwork, and continuous feedback. Implementing well-defined guidelines supports effective coordination and role clarity in high-pressure situations. Fostering teamwork among these professionals encourages mutual support and efficient information exchange. Establishing mechanisms for ongoing feedback and open communication facilitates prompt resolution of issues and continuous improvement of collaborative efforts (Aruru et al., 2020).

11. Conclusion

Mass casualty incidents involve numerous casualties that overwhelm emergency service resources. These events often arise from natural disasters or large-scale accidents, with recent instances such as the Nepal earthquakes and the Christchurch mosque shootings underscoring the scope of the problem.

Paramedics, health assistants, and pharmacy technicians function synergistically during mass casualty incidents. Paramedics and specialized teams conduct systematic hazard assessments and triage patients to allocate medical resources effectively. Health assistants administer basic medical care, provide comfort, and manage basic technical operations. Pharmacy technicians

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maintain comprehensive inventory records and facilitate the storage and distribution of medical supplies.

Collaboration among emergency responders is crucial during complex mass casualty scenarios. Effective teamwork mitigates the inevitable resource constraints and enables paramedics to perform vital tasks efficiently. Health assistants complement paramedics by addressing secondary and administrative requirements, thereby supporting the operational capacity of the team. Pharmacy technicians contribute indispensable support through precise inventory management and timely distribution of medical resources.

In the context of mass casualty preparedness, authorities must recognize the potential for incidents to overload existing clinical capacities. Systems-oriented modifications and strategic collaboration among paramedics, health assistants, and pharmacy technicians form the backbone of an adaptive emergency response. By establishing and reinforcing these interprofessional partnerships, service providers can respond to sudden, surging demands with greater agility, thereby safeguarding public well-being and safety (Al-Salloum et al., 2020) (Aruru et al., 2020).

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