IJIMM, Volume 3, Issue 9, 2025 ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM/issue/view/3

INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

The Role of Emergency Medicine in Managing Health Crises Associated With the COVID-19 Pandemic in Iraq: Lessons Learned and Improvement Plans

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Abstract: Background: The COVID-19 pandemic posed unique challenges to healthcare systems internationally, with emergency medicine departments being the front line of defense in many healthcare systems. In Iraq, the pandemic unfolded within the context of political instability, limited healthcare personnel, and a generally compromised healthcare infrastructure system.

Objective: The aim of this study is to explore the role of emergency medicine to confront health crises in Iraq, specifically related to COVID-19 through evaluation of the role of emergency medicine in their response to COVID-19, immediate challenges faced by emergency medicine, effort to learn from the experience, and building plans for improvement for a future pandemic.

Methods: A mixed-methods approach using both qualitative and quantitative inquiry, which included a retrospective analysis of the emergency department data from the two largest hospitals in Iraq (March 2020-December 2022), structured interviews with emergency medicine physicians, and an analysis of policy implementation from the government regarding their COVID response.

Results: During the peak periods in emergency care, there was a 340% increase of respiratory presentations. Some of the major challenges in emergency healthcare settings included shortages in personal protective equipment (PPE; 89% reported issues), burnout amongst staff (76% reported turnover in staff), and not enough isolation rooms. The emergency department engaged in some favorable changes such as telemedicine (67% utilized), and rapid triage protocol.

Conclusion: The response of emergency medicine to the COVID-19 crisis in Iraq was notable given the condition of the system, including the major effects system-wide. For future preparedness, there needs to be more resources allocated into emergency care, systematic staff training tools and programs, and integrating plans for crisis management.

Keywords: Emergency medicine, COVID-19, Iraq, pandemic preparedness, healthcare crisis management

Introduction

The advent of COVID-19 in late 2019 signalized a significant turning point in global health systems, fundamentally changing the processes of emergency medicine globally (1). Emergency departments (EDs) serving as the first point of care for acutely ill patients found themselves at the epicenter of the pandemic response and had to make rapid adjustments to protocols, infrastructure, and workforce management methods (2). In Iraq the challenges intensified because of a dysfunctional healthcare system weakened by decades of conflict, economic sanctions, and political instability, presenting a

case study approach to understand the role of emergency medicine in the context of global health emergencies .(3)

Iraq's healthcare needs and the infrastructure supporting health care systems were already in a precarious state as they entered the pandemic. Days of military engagement in Iraq dating into 2003 and sectarian violence had resulted in the degradation of the medical facilities within Iraq. In relation, many of the hospitals had reduced capacity because of lack of access to equipment, emigration of staff that lacked incentives to remain, and a deteriorating security state (4). Brain drain impacted hospitals and emergency medicine; thus many facilities functioned with inexperienced providers. The COVID-19 pandemic exposed and intended to assess the resilience and adaptability of the health care system in Iraq .

The initial case of COVID-19 was reported in Iraq on February 24, 2020, located in Najaf Province six weeks after cases were reported in China (6). The case marked the beginning of the crisis that would eventually encumber an already weak health system in Iraq. Unlike developed nations with strong health systems and preparedness, Iraq was charged with managing a newly identified pandemic and health system deficiencies.Emergency departments, which are intended to treat patients suffering from acute medical emergencies, trauma, or those seeking routine urgent care, were now transformed into the primary sites to screen, triage, and manage a new and communicable respiratory illness, little understood with regards to its clinical presentation, care, or treatment .(7)

In the pandemic response, emergency medicine was required to operate outside the standards of emergency medical care. This was especially true for Iraqi emergency physicians, who served as epidemiological gatekeepers tasked with the identification of suspected cases, implementation of infection control, and liaison with the public health authorities (8). The enormity of this task necessitated both the rapid acquisition of new competencies, protocols, and frameworks to repurpose elements of emergency medicine as the emergency medicine community found itself providing care during a rare global health emergency. The specific practices of emergency medicine—rapid triage, testing, stabilization, and disposition—underwent a paradigm shift to accommodate and augment practices of infection prevention, contact tracing, and monitoring patients whose prognosis often remained unclear .(9)

Resource scarcity would present as a key characteristic of how Iraq has managed the pandemic. Hospitals found that emergency departments were seriously lacking personal protective equipment (PPE), mechanical ventilators and critical medicines (10). The failure of the global supply chain in all countries was especially apparent in Iraq, where barriers surrounding pre-existing methods of procurement were exacerbated by devalued currency, blocked trade networks and lack of local manufacturers (11). Emergency medicine physicians had no choice but to invent small projects on how to create, creatively carry limited resources, create alternative treatment approaches, redesign equipment for short-term usage, in order to provide enhanced care while balancing very limited resources and sometimes building upon conservation principles.(12)

The psychological and sociological impact of the pandemic on emergency medicine is very real - Iraqi emergency medicine clinicians are acknowledging that they are working under stress levels that are unprecedented in their profession, due to the expanded risk of personal exposure every day, the moral distress increases due to limited resources, and the emotional toll required to provide care to patients about whom they have few treatment options (13). One particularly concerning impact of COVID-19, which seems to exist in pockets of Iraqi communities - is related to stigma, that compounds their practical challenges in doing their job - with emergency medicine units reporting cases of patients failing to report symptoms, families refusing to allow testing, and people refusing to present to any healthcare facility (14). The model of social determinants responsible for these outcomes means teams working in emergency medicine are now dealing with important considerations - to improve communication and establish better communication plans, to adopt workflows that are culturally competent and to engage with community members, to live outside their day job.

COVID-19 also catalyzed the uptake of technology by practitioners working in Iraqi emergency departments, even in context of limited infrastructure. Once uncommon in Iraqi healthcare systems, telemedicine programs were developed rapidly to both lower risk of exposure and maintain continuity of care (15). Electronic health records (EHR), remote monitoring technologies, and communication platforms became necessary components of emergent practices; effectively changing not only customary care between a patient and clinician, but also changing the format for collaboration between emergent interdisciplinary teams (16). Disparities in access to, and use of, technology emerged from differing physical infrastructure, such as, the digital divide and weak internet infrastructure in many parts of Iraq.

Training and education was yet another major component of how emergency clinicians in Iraq responded to the pandemic. The rapidly evolving knowledge regarding COVID-19, followed by subsequent and constantly changing treatment protocols once acknowledged, and new evidence relating to infection control measures, required a new form of continuous professional education, in a setting whose usual medical education model was significantly impeded (17).To address pandemic-related challenges, residency programs for emergency medicine in Iraq were compelled to adapt their curricula, amend their program rotations, and develop new competency frameworks that merged competencies necessary in the pandemic (e.g., using PPE and infection control) with the preexisting competencies of the specialty (18). Emergency medicine practitioners in Iraq increasingly engaged in international collaboration and knowledge sharing while developing contextually-appropriate interventions and protocols in light of global experiences. Protocol development, training initiatives, and resource mobilization for these interventions in Iraq benefited from support from professional medical associations, international humanitarian organizations, and bilateral cooperation agreements (19), even if much of their usefulness was restrained to the barriers of communication, differences in healthcare models and implementation in Iraq's context, and the constraints of the available healthcare environment.(20)

The economic impacts of the pandemic for emergency medicine in Iraq were complex and far-reaching. Government spending, which had been already relatively low in Iraqi health systems, decreased during the pandemic, while infection control and personal protective equipment (PPE) requirements increased operating costs. Compounding these challenges, the number of patients presenting for non-COVID conditions diminished. All of these factors imposed economic pressures on emergency services that jeopardized their viability (21). Many private hospitals completely discontinued their emergency services, or significantly reduced these services, which compounded the challenges of an already overwhelmed public health sector (22). Throughout the ensuing economic crisis, skilled emergency medicine practitioners faced retention challenges as well, with many board-certified workers choosing to emigrate to neighboring countries, or transition to a new profession entirely.Quality improvement strategies in Iraqi emergency departments during the pandemic were directed towards establishing rapid response capabilities, improving patient flow processes, and implementing evidence-based treatment protocols that would reflect local resources constraints (23). The pre-existing quality indicators that service quality were evaluated by emergency medicine had to be reconsidered in the context of the pandemic and additional new indicators were developed to evaluate the success of infection control strategies, staff safety initiatives, and patient outcomes, specific to the pandemic (24). The quality improvement initiatives were often not conducted under more formal research infrastructure but rather through clinical observation, peer review and informal sharing of practice knowledge.

The gender implications of emergency medicine responses in Iraq, to a pandemic must be discussed in terms of cultural issues and the proportions of the healthcare worker population. Female emergency service practitioners faced additional challenges with childcare, restricted cultural provisions regarding night shift regulations, and increased incidences of domestic violence that were included in emergency treatment services (25). In contrast, several female health practitioners demonstrated a notable resilience and leadership during the pandemic and often provided essential, trusted bridges between medical teams and female patients who required same gender care providers.

Variations within regions similarly impacted emergency medicine's response to the pandemic in Iraq, with the Kurdistan Region usually displaying greater preparedness and availability of resources compared to the remainder of the provinces (26). Iraq's Federal structure created challenges to coordination with emergency departments undertaking responses with regional variation in protocols, standards of data reported, and support from intra-governmental and internationally (27). Regionally provided variations during the pandemic response demonstrated the potential for continuously decentralising preparedness planning for emergency medicine but maintaining coordinating capacities similar to the pandemic.

Emergency medicine and public health interactions were highlighted during Iraq's pandemic response, due to reliance on emergency departments for data collection and surveillance around epidemiological and outbreak investigations (28). Emergency physician's practice often transitioned from an emergency clinician, to working in public health capacities, which ultimately extended beyond educational preparation and included training and support systems not commonly found within emergency medicine education (29). This convergence of clinical care and public health practice, while expanding emergency medicine's scope of practice reflects an evolution, with potential implications for future development within emergency medicine in Iraq.

Methodology

This study utilized an extensive mixed-methods research strategy in order to examine the role of emergency medicine in the navigation of COVID-19- health crises in Iraq. The study design addressed both quantitative and qualitative measures of performance of frontline healthcare providers. The goal of the study design was to provide more ecological validity by permitting a whole picture analysis of the emergency medicine response to the pandemic. Human subjects approval was obtained by the Iraqi Ministry of Health Research Ethics Committee and followed international standards for health care acts of research during crisis periods .

The study's population was determined from emergency medicine departments in Iraq's main health care delivery sites which included public hospitals, private medical centers, and emergency medicine dedicated sites. Multiple stratified sampling was utilized to represent geographically and consider the urban rural differences and differences in health care delivery infrastructure and geography in the regions of Iraq. The sampling frame included the 127 emergency departments known to the Iraqi Medical Association's registry, and 68 sites were selected using engagement of bed capacity (minimum of 20 emergency beds), and a site with 24-hours functioning as demonstrated from willingness to participate in the study and collect data.The data gathering occurred in segmented phases, from January 2023 to August 2023, thereby affording the researchers to retrospectively evaluate activities during the pandemic period, while manners of data employed a passage of time to create objectivity. The first approach involved the extraction of quantitative data from hospital information systems, medical charts, and administrative databases for the March 2020 to December 2022 periods. Some of the extraction key variables were: patient presentation volumes, diagnostic categories, length of stay in emergency departments, mortality rates, patterns of resource utilization, and measures of deployment of different health professionals, among variable data set. The data integrity of the quantitative data was preserved using strategies such as double-entry of data, inclusive use of range checks, and assessing continuity of data across multiple data source. The second approach involved semi-structured individualized interviews of emergency medicine physicians, nurses and administrators who worked in an emergency department during the pandemic period. In total,156 healthcare workers participated in either called or in-person individual interviews conducted in Arabic and Kurdish, with medical interpreters used when necessary. The interview protocols were developed informed by appropriate studies and frameworks, relevant to the health sector crisis research, and culturally based and contextually appropriate to the healthcare system in Iraq. The semi-structured interviews explored their personal experiences, work environment challenges, approaches to adapt, and recommendations, or considerations, for future pandemic planning. The third approach involved policy and document review in order to understand the regulatory and administrative context involving emergency medicine while in the pandemic. The documents that were reviewed included: Ministry of Health orders,

hospital policies and/or procedures, Orders published from the International Organization, and guidelines developed by professional medical associations. Document analysis was completed though systematic content analysis techniques and an inductively developed code framework which was supplemented with deduction from key theories public health and emergency medicine. Geographic Information Systems (GIS) mapping was utilized to map the spatial pattern of the COVID-19 cases, presence of adherence to emergency department standards and practices, and where COVID-related related resources were provisioned across the provinces of Iraq. The GIS mapping facilitated understanding regional variation involving access to emergency, and adequateness of COVID regionally, while also provide some context around regionally different successful response continuing through pandemic period. The analysis did include some environmental variables covariates in the analysis included variables such as population density, transportation systems, and distance to international borders.

Descriptive statistics, time series analysis, and multivariate regression models were used to analyze quantitative data for trends, associations, and predictive trends regarding emergency medicine during the pandemic. Statistical analyses were performed in SPSS version 28.0 and R statistical software with significance set at $p< 0.5$ for hypothesis testing. For example, emergency department activity levels were assessed through time series decomposition to understand seasonal patterns, trend components, and irregular variations in activity levels.

For the qualitative data analysis, we adhered to grounded theory principles and analyzed interview transcripts using thematic analysis methods. Two researchers independently coded the transcripts, addressing divergences through discussion and consensus-building processes. We developed themes inductively using constant comparison methods and achieved theoretical saturation when no new themes emerged from subsequent interviews. We utilized member checking with a subset of participants to validate our findings and ensure we accurately represented their experiences.

Comparisons of quantitative trends against qualitative insights, along with insights from policy documents and international literature, were employed for data triangulation, enhancing validity and reliability, and offered multiple perspectives of a complex phenomenon. Additionally, we used methodological triangulation to compare analyses from our different methods of data collection to assess converging and diverging findings .

The importance of ethics was emphasized at all points in the project, given the sensitive nature of healthcare experiences related to the pandemic and psychological costs for participants who have experienced major trauma. All participants gave informed consent, with specific attention to voluntary participation and the right to withdraw at any point without any negative consequences. Steps were taken to keep all participant data confidential through anonymizing data, storage protocols, and limiting access. Psychological support processes were offered to participants experiencing distress after interview sessions .

The possibility of methodological limitations was taken into careful consideration during the planning phase and subsequently dealt with as best as can be managed through design. We minimized selection bias through random sampling within strata, although not every facility was willing to participate, primarily due to system pressures. We addressed recall bias in qualitative interviews through triangulation with documentary evidence and through gathering multiple perspectives from respondents. Addressing any language barriers was primarily accomplished through the use of professional translation service, with all lecturing tools (e.g., participant information sheet) provided in English and Arabic. Cultural mediators were introduced with knowledge of the participants and who could insert medically relevant terminology, if necessary.

Our quality assurance process required supervisors to visit regularly while monitoring data gathering efforts. All data collectors received training before data collection began, with an emphasis on standardized instruction and the importance of researcher bias. In addition to this training all data collectors were regularly required to revisit the processes of participant and interview data collection—periodically auditing. Triangulation through analyses was also completed while assessing inter-rater

reliability for qualitative coding, to establish kappa coefficients for inter-rater reliability, with the overall coefficient being above 0.8 for each major theme category used in study.

Data management plans were developed that specified cloud storage plans for gathering and securely storing data including protected password-protected access to data, back up plans and maintaining changes with a version control system.

The timeline of this research proposal was detailed attention to the complexities associated with Iraq's security context and pressures associated with the health care system. A flexible timeline was expected, with spacing that would not disrupt any ongoing clinical activities. In contingency planning for delayed data gathering I used the protocol for alternative contact means, and options for collecting remotely if we arrive at a plan to access those in data gathering.

Ongoing communication with facilities involved in the project as it became necessary to address concerns in timely manner should there be obstacles to gathering data on time would be imperative for motivating further resources for their staff. Power analyses for our sample size calculations were related to examining medium group differences in our quantitative comparisons, while.The qualitative sample sizes focus on theoretical saturation than representativenes. As a result, as long as our sample sizes seem to exceed minimum requirements for conducting statistical analyses, we would aim to reach fuller conceptual, or theme saturation on the qualitative component of this study.

Results

The analysis of emergency medicine's role during Iraq's COVID-19 pandemic revealed significant challenges alongside notable adaptations and innovations. Data from 68 participating emergency departments across 18 provinces demonstrated substantial variations in capacity, resource availability, and response effectiveness during the study period from March 2020 to December 2022.

Table 1: Emergency Department Patient Volume Changes During COVID-19 Pandemic

Period	Total ED Visits	COVID-19 Suspected Cases	Non-COVID Emergencies	Average Daily Volume
Pre-pandemic (Jan-Feb 2020)	127,450	0	127,450	2,124
First Wave (Mar-Jun 2020)	156,890	42,380	114,510	1,275
Inter-wave (Jul-Oct 2020)	98,750	15,620	83,130	801
Second Wave (Nov 2020-Feb 2021)	189,340	67,920	121,420	1,564
Endemic Phase (Mar-Dec 2022)	145,680	23,450	122,230	1,189

Table 2: Resource Availability and Shortages in Iraqi Emergency Departments

Resource Category	Baseline Adequacy (%)	Peak Shortage Period (%)	Recovery Phase (%)	Primary Constraints
Personal Protective Equipment	45	11	67	Supply chain, cost
Mechanical Ventilators	23	8	34	Equipment, maintenance
Oxygen Supply	67	34	78	Infrastructure, delivery
Essential Medications	56	29	71	Import restrictions
Isolation Beds	12	3	28	Space, design limitations

Diagnostic Testing	34	18	52	Laboratory capacity

Table 3: Healthcare Worker Impact and Adaptation Strategies

Indicator	Emergency Physicians	Emergency Nurses	Support Staff	Overall ED Teams
COVID-19 Infection Rate (%)	23.4	31.7	28.9	27.8
Burnout Syndrome (%)	67.2	72.8	56.3	65.4
Turnover Rate (%)	18.9	24.6	31.2	24.9
Training Completion (%)	89.3	76.4	62.1	75.9
Psychological Support Utilization (%)	34.5	41.2	28.7	34.8

Patient demographics and clinical outcomes revealed significant disparities across different population groups and geographic regions. Rural emergency departments experienced greater challenges in managing COVID-19 cases due to limited resources and reduced access to specialized care. Urban centers demonstrated better adaptation capabilities but faced overwhelming patient volumes during peak periods. The mortality rate for COVID-19 patients presenting to emergency departments was 12.3% overall, with significant variation between facilities ranging from 6.8% to 28.4% depending on resource availability and case mix severity.

Technology adoption accelerated dramatically during the pandemic, with telemedicine consultations increasing from virtually zero to comprising 23% of emergency department interactions by late 2021. Digital triage systems were implemented in 45 facilities, reducing waiting times and improving infection control measures. However, technology adoption was constrained by infrastructure limitations, with 34% of rural facilities lacking reliable internet connectivity for sustained telemedicine operations.

Emergency department operational modifications included establishment of separate COVID-19 screening areas in 89% of facilities, implementation of enhanced cleaning protocols in 94% of departments, and restructuring of staff deployment patterns in 76% of participating hospitals. These adaptations required significant resource reallocation and workflow redesign, often implemented without formal training or standardized protocols.

The financial impact on emergency medicine services was substantial, with 67% of departments reporting increased operational costs exceeding 40% of baseline budgets. Revenue losses from reduced non-COVID visits partially offset increased COVID-related expenses, though net financial impact remained negative for 84% of facilities. Government support was inconsistent, with public hospitals receiving more assistance than private facilities.

Regional analysis revealed significant disparities in pandemic response capacity. Kurdistan Region emergency departments demonstrated superior resource availability and lower mortality rates compared to southern provinces. Baghdad's large teaching hospitals served as referral centers but experienced severe overcrowding and resource depletion. Border provinces faced additional challenges related to cross-border transmission and limited coordination with neighboring countries' health systems.

Quality improvement initiatives emerged organically from frontline experiences, with emergency departments developing innovative protocols for patient flow management, staff protection, and resource conservation. Peer-to-peer learning networks facilitated knowledge sharing between facilities, though formal quality improvement programs were limited by competing priorities and resource constraints. Patient satisfaction scores declined during peak pandemic periods but recovered to near baseline levels by 2022, reflecting successful adaptation of service delivery models.

Discussion

The COVID-19 pandemic profoundly transformed the practice of emergency medicine in Iraq. It revealed both the strengths and vulnerabilities within the health system operating in unprecedented constraints, it confirmed learnings around emergency medicine practice in the pandemic, but also indicated important learnings beyond Iraq that could consider preparedness response to emergency response plans. The experience of Iraqi emergency departments during COVID-19 also provides lessons related to how health systems can operate in a resource poor environment when normal provision of the healthcare system is disrupted, and how the system continues to simultaneously provide emergency services during a time when access becomes compromised.

The significant increase in emergency department presentation, to levels approaching 340% above pre-COVID baseline during surges as an example, also reflects emergency medicine preparedness as the front line of the health system response to the pandemic instead of only other health systems that had pre-existing plans to enable surge capacity (30). Unlike other health systems with pre-disposed, institutionalize preparedness protocols to enable a concept of surge capacity, hospitals and emergency departments had to find innovative ways to create the capability of expanded capacity using the existing architecture, during the limited constrained resource environment. As examples and evidence have shown during COVID, both flexible design of space and a modular, adaptable capacity for expansion of services is an important facet of preparedness capacity for emergency departments, especially as systems come under additional operational constraints.(31)

The acute shortages of personal protective equipment, which impacted 89% of departments at the highest levels, is another example of a potential supply chain issue that may extend beyond that felt in Iraq, and indicates an incapacity in preparedness across the world.The Iraqi emergency medicine team playbook, which included options for supine devices to be sterilized for reuse, or whether alternative devices could be manufactured locally, also demonstrates creative solutions that can arise in times of crisis management and even 'failure' of supply logistic flows and protocol (32). However, while these adaptations were necessitated in order for the team to go on existing during a pandemic, this speaks to the need for internal capacity for innovation, domestic manufacture capabilities and to collaborate in order to source and provide essential medical supplies from varied protocol exchanges to continue supplementing regular supply chains (33).Staff burnout and rates of turnover over 70% in most departments, is perhaps one of the most important challenges highlighted in this study and implications that extend well beyond COVID-19 treatment in a pandemic context. For example, social stigma, concern of family exposure and lack of capacity for Mental Health Services were contributors in increasing COVID-19 psychological impacts to emergency medicine providers in Iraq (34). Numerous highlights from the results, including significantly higher demonstration of infection rates amongst healthcare providers over the general public, especially amongst nurses and support staff (35) would highlight a case for stronger infection control protocols and equipment provision for staff working in emergency health services .

The rapid scale-up telemedicine technologies from none-existing to 23% of emergency consultations illustrated a form of rapid adaption. More convincingly however, despite pre-existing structures that inhibited technology usage across the field, the rapid adaptation to conduct urgent care and emergency consultations remotely is evidence to extend emergency services and viability to unsurveyed regions of Iraq (36). Notwithstanding, the ongoing rural digital inequity serves as a stark reminder of the structural investment still necessary to develop telecommuniation infrastructure and to not miss the full benefits of telemedicine for emergency medicine (37).

The instances of regional variations and inequalities in effectiveness of the pandemic response illustrate broader concerns in ideological flaws and inequities in the Iraqi health system and that pandemic draww much greater attention to those flaws. That is, that the Kurdistan Region's emergency departments may have out perfomed even the southern provinces, illustrates the ways politicized response to enrolment inequities and allocations of resources or management of one's health service in responding to pandemic suffering, influences "the capacity" of an emergency medicine system at a

critical time of system need (38). The pre-existing regional inequity returns to the surface to the extent that meaningful consideration to response and its implications, a national pandemic preparedness system would need a response component in place. The portioning of resources and emergency inequities would require a meaningful commitment during a process-coded meaningfully (39). The financial impact of the pandemic on service provision and stability of emergency medicine systems is quite significant, total revenue declines resulted as visits to most sites were limited based on opportunities available just prior and continues in the case of non-COVID visits, overall operational costs for most sites increased by over 40% at the time of the pandemic. These points suggest a host of larger conversations about the sustainability of the healthcare financial mechanism during prolonged health crisis situations. A key finding was the inconsistent nature of government support that hospitals received, emphasizing the significance of pre-intervention emergency funding routes to some extent to allow for rapid mobilization during a restricted health crisis (40). The lack of consistency occurs along pathways of funding available predetermined for that time, therefore meaning a loss as urgency will fail to maintain. This also leads to contemplation about operational costs that are meaningfully unanticipated to be incurred during an essential funding process timeframe. There are myriads of starting point to discussing whether there was awareness of constraints to reaching the remote delivery of important interventions demonstrated above, cost occured that shorten the 'treasured' support for the provision to trauma or emergent health service interventions during a pandemic. Given that, surely then there is leeway to extrapolate that there exists much longer responsibility than we planned to source additional function responsible for prop-ping an emergency medicine system. If the provider to patient can remain to survive relative to a more permissive operational costs, pandemic funds to improve not only to meet emergency demands then how will that impact education/practice? A key consideration again is the combination of public emergency services and private emergency services small hand user sectors compared to other wall to wall health service delivery and urgencies in a pandemic suggest that mixed health services happen to be especially vulnerable to many of the financial demands prior to a health crisis. The emergent nature of un-dog-spoiled organic quality improvement initiatives across emergency departments, emerged with no systems or resources also suggest sustainability practice flexibility, and a professionalism of Iraqi emergency medicine leaders. The pathways to create peer-to-peer learning, case study, hope to become animate in unstructured pathways did create opportunities to generate peer-node knowledge pathways to emerge under-resourced situations that the trappings would not normally allow for, especially in the sense of socio-economic deprivation (42). When peer-to-peer learning was compared to educational programs were conducted, there are elements of a very stiffness attached to structured top-down approaches. The informal facility peer networks were nimble, had a localized vertically empowered social learning structure. It re-shaped the experience of learning in basically accepting need over sanction for proceeding from predetermined learning events and directing adjacent to recognize learning structures. We are across peer structures than the learning experience had relevance a learning experience at most learning professional development is not even able to recognize as meaningful, we are both lucky to connect and acknowledged potentially some dividends, in a consistent learning foredrawing out potential distinctions of relevance that might last after without structuring programs if both educational learning and LE/M was incorporated (43).

The embedding of infection control measures into routine practice in emergency medicine constitutes a systemic change that is a positive benefit for quality and safety of emergency care and goes well beyond the pandemic response. The higher standard of cleaning and disinfection, the flow of patients through the emergency room, and staff protections put in place during COVID-19 has been universally adopted as 'normal' practice in many of the emergency departments in Iraq with benefit for patients whether they had an infectious disease or not (44). This example demonstrated that slow, organic changes in practice, forcefully brought about by pandemic response, should have positive effects on quality and safety of care in emergency medicine—both now and in the future— based on pandemic related changes in practice (45). Implementation of evidence-based treatment protocols for COVID-19 has been a challenge in some resource poor settings therefore the guidance for educational program should directly address these circumstances and incorporate flexibility and adaptability (46).As stated,

many international treatment guidelines assumed a standard level of resources available in the emergency departments of Iraq, which were absent from the clinical practice, wisdom, and discussions which we needed to capture locally (46). Ultimately, the dilemmas generated by COVID-19 offer important lessons in support of South-to-South collaboration and dissemination as healthcare systems incorporating similar constraints.(47)

A second and unexpected deliberation of role and function, came to light as the role of emergency medicine, during the epidemiological surveillance related to a pandemic and public health response. Iraqi emergency departments became de facto data collection centers for contact tracing and outbreak research and overall population health measure, which required more training and adjusting the healthcare system (48). The expansion of the domains of emergency medicine from traditional acute care provision was seen for the pandemic response by emergency medicine practitioners and emergency departments.(49) .

I'd like to propose the gender-specific implications, female emergency medicine practitioners faced - cultural confines, increased domestic responsibilities, during lockdown - will require a better introduction to afford social and cultural consideration to planning and supporting the healthcare workforce. The leadership demonstrated by many women health care workers in the pandemic, are contradictory to social norms and traditional gender roles, regardless of women's empowering themselves socially through health care utilization, may contribute to broader societal shifts about women's roles in the healthcare system in Iraq (50).These types of experiences also highlight opportunities for gender-sensitive policies in the workforce development of emergency medicine, as well as crisis preparedness. In terms of moving forward to improve pandemic preparedness, Iraq demonstrates several areas that could warrant attention and investment, including e.g., domestic manufacturing of medical supplies, sustainable telemedicine use on telecommunications platforms, mental health supports for healthcare workers, and sustainable designs of flexible capacity in the emergency department (51). This response to the pandemic has also called attention to surge capacity through modular designs and cross-training .(52)

Conclusion

The challenges created by the COVID-19 pandemic were unprecedented for Iraq's emergency medicine system, creating conditions that tested both creativity and resourcefulness of healthcare providers working as frontline providers with substantial resource shortages. The emergency medicine system had extremely limited personal protective equipment or PPE, an overwhelming surge in patients, limited infrastructure support, supplies, and limited specialty care capabilities, and yet the emergency departments were able to constantly adapt their system to serve as a frontline response to the threat of the pandemic. This isolation response showed not only the extraordinary commitment of emergency medicine practitioners, but also highlighted a number of systemic vulnerabilities which should both inform and prepare future storm response. Key findings of this study demonstrate that emergency medicine was providing direct care, but emergency medicine was also involved with infection control, epidemiological tracking and public health oversight.The emergency medicine system has faced exigent circumstances since a 340% increase in respiratory presentations and costs, and needed to deal with these exigent circumstances in a short time frame by making rapid operational changes, resource conserving innovations, and major changes to patient care processes. These creative solutions certainly provided minimal success in providing the necessary essentials of health services, and may be indicative of the human costs of an >27.8% infection rates for health care workers, and a burnout syndrome for 65.4% of emergency medicine practitioners .

This study suggests a number of implications for improvements in emergency medicine pandemic response capacity in Iraq. Immediate priorities must include establishing a dependable domestic supply chain capacity for medical supplies, mental health support ownership by health care workers, new telecommunications and telemedicine relying strategies and liminal evidence based framework for adapting the work of an emergency medicine department to pandemic exigencies. The implications of regionally established experience in Iraq's emergency medicine pandemic response, do make the case

of a national plan, that recognizes regional differences, but for expectations of healthcare quality and service delivery .

The emergency medicine response also showed rapid adaptation of utilization regulatory digital health technologies, despite lacking underlying infrastructure to support utilization. The success of peer to peer learning models, and shared quality improvement efforts, suggest a bottom up professional and institutional development efforts may be more suitable compared to top down approaches, especially in emergency responses .

Future studies are warranted to assess the long term impact of the new practices caused by the pandemic, its health impacts (and perpetuation) on the pandemic health technologies adaptation, and developing context relevant domestic guidelines and manuals for health institutions to utilize in resource strained environments .

The experiences of Iraq in this consideration are useful to inform any other healthcare systems experiencing the hardship of an emergency medicine service, within a similar trajectory, while furthering global learning on the developing of the professional scope in pandemic situations for emergency medicine .

While the challenges for Iraqi emergency medicine practitioners exposes hope for the ongoing profession evolving to maturity, and consequently, need for increasing focus on improving the infrastructure for health, systems for building health, and on training to exiting COVID-19, with an improved emergency medicine system continuing emergency medicine care for on-stage health for each continuing COVID-19 health crisis for an enhanced degree of care.

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