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Investing in health workforce development will make health workers more resilient and strengthen their capacity to continue to provide routine and emergency services

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المجلة الصحية لشرق المتوسط

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Investing in building a resilient health workforce for the Eastern Mediterranean Region

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A vibrant health workforce is the backbone of any health system and key to advancing health care goals. However, there is a general shortage of health workforce globally, as health workers remain overstretched, underpaid and sometimes undervalued. Without immediate and sustained investment in a resilient and well-supported workforce, we risk being unprepared for the next pandemic. We will be unable to control the surge in non-communicable diseases and fall short of achieving Universal Health Coverage and the health-related targets of the Sustainable Development Goals (SDGs) by 2030.

The WHO Eastern Mediterranean Region (EMR) is home to 10% of the world's population and is projected to have 20% health workforce shortage by 2030 if appropriate and timely investments are not made to boost the health workforce (*1*). Political instability, conflict, fragile health systems, economic challenges, and chronic underfunding over the years have taken their toll on the health workforce in the region.

The economic case for investing in health workforce development in the EMR is not just strong, it is irrefutable. The High-Level Commission on Health Employment and Economic Growth has already highlighted the triple impact of investing in health workforce development: job creation, improving health and boosting economic growth (*2*). For every US$ 1 invested in health and in sustaining the jobs of health workers, the potential return is as much as US$ 9 (*3*).

The health sector is a major contributor to employment, with health care jobs comprising up to 20% of the total employment in high-income countries and around 5–6% in low-income countries. In low-income countries, each health sector job generates an estimated 3.4 additional jobs across related sectors (*4*). The health sector is 1 of 5 sectors that could generate local jobs at such scale: energy and infrastructure, agribusiness, health care, tourism, and value-added manufacturing. These sectors have a high potential for job creation and may be more resilient to the broader forces reshaping the global economy (*5*).

Half of all economic growth globally over the past decade have resulted from improvements in health: for every added year of life expectancy, the economic growth rate is boosted by 4% (*3*). Although the COVID-19 pandemic is estimated to cause US$ 47.7 trillion in global economic loss between 2020 and 2030, more than 17 times the cost of achieving the health-related Sustainable Development Goals (*6*).

Recognizing the critical role of the health workforce as an accelerator in achieving the health goals, the Regional Office for the Eastern Mediterranean presented the flagship initiative on "investing in a resilient health workforce" to the Regional Committee in 2024 and the initiative was adopted during the 71st Session of the Committee in October (*7,8*).

This initiative is a comprehensive, multi-pronged, strategic effort to sustainably transform health workforce in the EMR. It will strengthen the health workforce in the EMR by unlocking domestic resources and securing sustained levels of financing required for continuous development, employment and retention of health workers. To strengthen the health workforce, we must give priority attention to the key issues influencing domestic health policy by giving health a central position in the economic and development agenda at country level (*6*).

Considering that majority of EMR countries are challenged by limited employment capabilities and imbalances in health workforce distribution and skill mix, efforts must be made to improve the efficiency of investments in health workforce by focusing on high-impact priority issues. Investments that optimize, reskill, retrain, retain, and protect the health workforce will help deliver quality care, improve service delivery in underserved areas, expand access to services, and strengthen the capacity to respond to health emergencies.

Returns on investment in the health workforce may take a while to realize, therefore, it is critical to invest in current as well as future health workforce, taking into consideration the demographic, epidemiologic, social and digital transformations and the demand for a more diverse and multidisciplinary workforce for resilient health systems.

Resilience today goes beyond physical infrastructure, it is also about having trained professionals who can be rapidly mobilised during crisis. Resilience must be built for the long-term through sustainable workforce planning and continuous training to empower health workers to adapt to everyday health needs and future challenges.

There is a need to transform health professions education in the EMR to ensure availability of the required competencies and skill mix for a fit-for-future health workforce. There is also a need to strengthen the regulation of education and practice of health practitioners across the region to improve service quality. To do this, we must work together collaboratively in harnessing and strengthening the immense health expertise, experience, capacities, and resources in the EMR. Investing in the health workforce will accelerate progress towards achieving our health goals. It is critical for advancing Universal Health Coverage and health security and will help boost national economies.

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Empowering adolescents through school-based smoking cessation programmes in Pakistan

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Tobacco use by adolescents constitutes a significant public health concern globally with serious implications for Pakistan (*1*). Globally, 19.3% of adolescents use tobacco, and in Pakistan, the situation is particularly concerning, as adolescent smoking rates range from 9% to 61.1% across different populations (*1,2*). Smoking-related health problems costed Pakistan US$ 3.85 billion during the 2018–2019 fiscal year (*3*), including short-term risks such as nicotine addiction, pneumonia, asthma, gingivitis, gingival bleeding, oral malodour (halitosis), and reduced physical performance (*1,2*). Three major long-term diseases – cancer, cardiovascular disease and respiratory disease – and their associated mortality collectively accounted for 71% of the total estimated cost (*3*). The escalating health problems, mortality and financial burdens associated with tobacco use underscore the urgent need for effective strategies to prevent smoking initiation and promote cessation (*1*). Policymakers and health care providers should focus on prompt and comprehensive measures to address this avoidable public health issue.

Adolescence is a critical developmental period between childhood and adulthood characterized by substantial physiological and psychological changes that significantly influence an individual's health and wellbeing in the future (*4*). Adolescents are highly susceptible to external influences such as peer pressure, family dynamics and media portrayals, which affect their decision to start smoking (*1*). Around 1200 children aged 6–15 years start smoking everyday in Pakistan, which is one of the highest rates of adolescent smoking initiation in South Asia (*5*). Early tobacco use increases the risk of nicotine dependence and other health problems, contributing to the global tobacco epidemic, especially in low- and middle-income countries like Pakistan (*6,7*).

The need for school-based smoking cessation programmes in Pakistan

Current smoking cessation initiatives in Pakistan have been limited in their effectiveness to reduce tobacco use by adolescents (*1*). Research from different parts of the world has shown that school-based interventions in formal education settings effectively reduce cigarette smoking among adolescents (*8,9*). However, such school-based smoking cessation programmes for adolescents should incorporate evidence-based strategies, monetary incentives, group support, and cognitive therapy with social cognitive theory through mobile applications to enhance effectiveness (*10,11*). Digital technologies and online platforms have been found to enhance the effectiveness of smoking cessation programmes for adolescents (*11*). A recent review found that graphic health warnings and anti-smoking campaigns helped raise awareness of tobacco risks among adolescents in Pakistan (*1*). Such programmes should leverage social media to engage youths, encourage community participation and boost confidence in quitting smoking (*11*), and should be tailored to the cultural and social norms of Pakistani adolescents to enhance their relevance and effectiveness.

Potential challenges and solutions

In Pakistan, school-based smoking cessation initiatives may face societal and cultural challenges, which may hinder open discussions and reduce programme participation (*6,12*). Therefore, programmes should be tailored to the local context to address the challenges effectively. For instance, involving community and religious leaders and family members can boost support and acceptance (*6,13,14*). Interventions should involve open dialogue while respecting cultural norms and include gender-specific strategies so they can address gender-related issues and enhance accessibility.

Socio-economic factors significantly impact adolescent smoking behaviours (*7*) and school-based programmes can effectively tackle these challenges by incorporating financial education, vocational counselling and stress management in their activities (*1,8*). Such multifaceted approach can empower adolescents with essential skills for the future.

The tobacco industry exerts considerable influence on tobacco consumption in Pakistan by exploiting regulatory loopholes, evading taxes and misleading the public through corporate social responsibility initiatives that mask the actual harms of tobacco consumption (*15*). This creates a false narrative of corporate goodwill and diverts attention from the much-needed policy reforms

that could save millions of lives. To address this, the government should eliminate the loopholes, for example by establishing policies on the age at which individuals can legally buy cigarettes, ensuring stricter enforcement of smoking bans in public spaces, including restaurants, cafes and schools. Increasing taxes on cigarettes has proven to be one of the most effective measures for making tobacco products less affordable and for discouraging smoking among teenagers. Educating adolescents on tobacco marketing strategies and the health risks associated with smoking can empower adolescents to make informed decisions about their health (*16*). Participation rates may be low at the beginning, but if the programmes are well-designed, peer-led and use the social media they can boost engagement over time (*1,11*). Success stories and visible health improvements among compliant individuals can encourage broader participation, particularly in Pakistan's collectivist society, where peer influence and community success stories can be powerful motivators (*1,6*).

Educational institutions are crucial in addressing the issue of smoking among adolescents. Evidence indicates that school-based anti-smoking initiatives can decrease adolescent smoking behaviours (*8*), particularly when reinforced through commitment by educators to model non-smoking behaviours (*17*). Evidence suggests that teachers who smoke can undermine the efficiency of school-based interventions (*18*). Therefore, comprehensive training for educators on tobacco control and implementing strict anti-smoking policies within schools is essential.

Existing interventions that could be adopted

Some successful models of school-based smoking cessation programmes can provide valuable insights for implementing effective interventions in educational settings. For example, the United States Project EX: a program of empirical research on school-based adolescent tobacco use cessation (*19*), the nurse-led 5As cognitive behavioural counselling school-based programme (*8*) and the classroom-based smoking prevention and cessation intervention in Spain (*20*). Although implementing these interventions may present certain cultural challenges, adapting them to the specific cultural situation in Pakistan, with culturally tailored incentives that incorporate AI-driven tools, would be helpful (*14*).

Success metrics for school-based smoking cessation programmes

The success of school-based smoking cessation programmes can be measured in several ways. For example, reduction in smoking rates, which measures the percentage decrease in students identifying as current smokers at various intervals during and after an intervention; quitting rates, which tracks the number of individuals who have successfully quit smoking; knowledge and attitude changes, which uses pre- and post-intervention surveys to evaluate changes in knowledge about smoking risks and attitudes towards tobacco use; engagement metrics, which monitors participation rates in interventions and support groups; resource use, which tracks the number of participants using cessation resources such as hotlines and counselling; peer influence measurement, which assesses changes peer smoking behaviours and attitudes; and social media engagement, which measures interactions (likes, shares, comments) on anti-smoking campaigns on social platforms (*8,9,11,19*). Using these metrics can help assess the immediate and long-term effectiveness of smoking cessation programmes among adolescents.

Call to action

Certain actions should be prioritized to enhance the impact of school-based smoking cessation initiatives. Policymakers should allocate resources to train schoolteachers and healthcare providers and enforce comprehensive tobacco control policies in schools, including smoke-free campuses and mandatory anti-smoking education programmes. Banning cigarette sales near educational institutions and imposing severe penalties on violators can significantly reduce access to tobacco products by teenagers. Establishing a national taskforce to assess the effectiveness of existing interventions will ensure continuous improvements and adaptation to new trends in tobacco use among youths. It is important to develop partnerships with local media outlets and social media platforms to launch awareness campaigns that target Pakistani youth and their families. This should include investments in digital health interventions, such as mHealth applications, tailored to Pakistani adolescents. For guidance in developing and implementing effective, comprehensive tobacco control strategies, policymakers should review successful models such as the Truth Initiative in the USA or the WHO's Framework Convention on Tobacco Control (WHO FCTC) and its MPOWER package.

Conclusion

The significantly high rates of smoking among adolescents in Pakistan and the substantial economic and health-related burdens underscore the need for immediate and comprehensive interventions. Adapting successful international models to the local context could effectively enhance smoking cessation efforts among adolescents in Pakistan. Collaborations among policymakers, educators and health care providers, such as school nurses, paediatricians, community health service workers, and family caregivers, are essential to foster a healthier future for Pakistan, free from the burdens of tobacco-related health issues. Investing in the wellbeing of our youth will help create a smoke-free generation.

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Palliative care in United Arab Emirates: Response to The Lancet Commission on the value of death

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As palliative care specialists practicing in the United Arab Emirates (UAE), we express our sincere appreciation to The Lancet Commission on the Value of Death for highlighting the crucial, yet often underappreciated, role of end-of-life care in contemporary health care. The Commission's reflections on the importance of recognizing death as a part of life, and the need for compassionate, person-centred approaches to end-of-life care, resonate deeply with us. We find that many of the themes discussed in the report align with our experiences in providing palliative care in the UAE, a country that is undergoing rapid transformation in its health system and societal values. However, as we reflect on the findings of the Commission, we also recognize that the context of end-of-life care in the UAE presents unique challenges and opportunities. In this response, we seek to contribute our perspective as palliative care professionals working in a culturally diverse and rapidly developing nation.

The value of death in a rapidly changing society

UAE is a young nation characterized by a blend of modern healthcare infrastructure, a commitment to innovation and a deeply rooted cultural and religious heritage. For many in the UAE, death and dying are heavily influenced by Islamic traditions, which emphasize the sanctity of life and the importance of a peaceful transition from life to death. However, with a growing expatriate population and increasing integration with global health care practices, there is a shift toward more diverse perspectives on death, end-of-life care and patient autonomy.

While the Commission rightly emphasizes the value of death in the sense of accepting it as a natural and inevitable part of life, we find that in the UAE, death is still frequently viewed through a medicalized lens, especially in the private health sector (*1*). This has led to challenges in balancing the desire for aggressive life-prolonging treatments with the need for a more compassionate, patient-centred approach. We believe there is an urgent need to bridge these perspectives and foster a national dialogue about death and dying that is culturally sensitive and aligned with modern palliative care principles.

Cultural sensitivity and the role of palliative care

In the UAE, palliative care is a relatively new specialty, and its development has been shaped by the country's rapid modernisation and its Islamic cultural context. The principles of palliative care align with many Islamic values: alleviating suffering, providing compassionate care to patients and their families, and emphasizing the dignity of the individual, especially in the final stages of life.

The stigma surrounding the conversation about death often limits the adoption of palliative care services. Many families, particularly in the local Emirati communities, may be hesitant to engage with palliative care services due to misconceptions that it equates to giving up on life or abandoning hope (*2,3*). We echo the Commission's call to educate the public about the importance of palliative care and to challenge the prevailing cultural taboos surrounding death. This can be achieved through health system reforms and public health campaigns that emphasize the role of palliative care in enhancing the quality-of-life, rather than diminishing hope.

We also note that religious and cultural differences among the expatriate population in the UAE add another layer of complexity to this issue. Understanding how diverse cultural and spiritual beliefs about death shape patients' needs is crucial to providing effective palliative care. In this context, training for health care providers in cultural competency and spiritual care is essential.

Integration of palliative care into the health systems

While the UAE has made significant strides in advancing health care, with state-of-the-art hospitals and medical technology, there is still limited integration of palliative care within the broader health system (*4*). Palliative care is often seen as an afterthought, rather than as an integral component of comprehensive patient care. The

Commission's recommendation to include palliative care early in the care trajectory is a call to action we fully support.

In the UAE, we continue to see an overreliance on curative treatments, even in advanced stages of illness, often due to a lack of awareness about the availability and benefits of palliative care. Palliative care is not well integrated into general hospitals or primary care settings, which means that many patients do not receive this specialized care until it is too late. Providing palliative care in the community, particularly for patients at the end-of-life, is limited by a lack of suitably trained professionals and a legal framework which restricts the provision at home of some essential medications, including injectable opioids and does not support expected deaths at home.

We encourage policymakers and health authorities in the UAE to prioritise palliative care and enable the provision of palliative care in the community by establishing dedicated hospice and palliative care units. It is essential that palliative care becomes part of the standard health care offerings, just as it is in many Western countries.

The need for comprehensive education and training

We echo the Commission's call for greater investment in the education and training of health care professionals in palliative and end-of-life care. In the UAE, although there has been some progress in medical education, specialized training in palliative care remains limited (*5*). Few institutions offer formal education or certifications in palliative care, and there is a shortage of trained palliative care specialists. The very first conference dedicated solely to palliative care was held in Abu Dhabi in October 2024. We call for the establishment of dedicated palliative care programmes in all medical schools and universities, as well as the development of continuing education opportunities for health care providers. The implementation of specialised palliative care units in hospitals, with dedicated training and support for doctors, nurses and social workers, is essential to ensure that patients receive holistic and compassionate care.

The role of families and community support

In many cases, families in the UAE play a central role in caregiving and decision-making at end-of-life (*2,6*). This reflects the strength of familial bonds and the cultural expectation that families care for their own, even in difficult times. The Commission's emphasis on family-centred care is particularly relevant in this context. However, families often lack the resources or knowledge to provide the level of care needed during end-of-life, and many are burdened by the emotional and physical stress that comes with caregiving. Particularly pertinent to the UAE context is the large community of non-Emirati, expatriate workers who are often resident but without the benefit of the presence of their immediate or extended family network (*7*) – unfortunately accurate data on this has not been published.

We believe that palliative care should not only address the needs of patients but also provide vital support to families. This includes emotional support, spiritual counselling and practical guidance on navigating the complexities of end-of-life care. It is also essential to ensure that caregivers are given the respite and support they need to maintain their own wellbeing.

Conclusion

Regionally, palliative care in the GCC countries and Eastern Mediterranean Region is still in the early stages of development, with significant disparities across countries. Jordan is a regional leader, having integrated palliative care into its national cancer strategy and offering specialised services in at least 4 major hospitals (*8*). In Saudi Arabia, palliative care is available in more than 20 tertiary hospitals but remains largely inaccessible in rural areas (*9*). Kuwait and Oman have launched home-based care pilots, but national coverage is lacking (*10*). Conflict-affected States like Yemen and Syria report almost no formal palliative care services (*11*). Key barriers include limited trained personnel, opioid regulatory restrictions and cultural taboos surrounding death.

We fully support the findings of The Lancet Commission on the Value of Death, especially its call for greater recognition of the value of death, the integration of palliative care and the need for cultural sensitivity in end-of-life care. In the UAE, we face unique challenges, but we also have unique opportunities to shape a compassionate and effective palliative care system that aligns with our cultural values and meets the needs of our increasingly diverse population.

We are committed to advancing palliative care in the UAE, advocating for policy changes, improving education and raising public awareness. We encourage stakeholders, including policymakers, health authorities and the community, to join us in this effort in ensuring that every person in the UAE receives the compassionate, dignified and comprehensive care they deserve at end-of-life.

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Maintaining essential non-communicable disease services in the Eastern Mediterranean Region during the COVID-19 pandemic

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Abstract

Background: Health systems, particularly in low- and middle-income countries, struggled to maintain essential non-communicable disease services during the COVID-19 pandemic.

Aim: We assessed the extent of disruptions to non-communicable disease services in the Eastern Mediterranean Region during the COVID-19 pandemic, exploring the challenges and mitigation strategies.

Methods: From October to December 2021, we interviewed WHO country focal points for non-communicable disease from 16 Eastern Mediterranean Region countries and analysed the data.

Results: Emergency and primary care services were disrupted in most of the countries. One country experienced total disruption to primary care while 7 experienced at least 50% disruption. The proportion of fully disrupted essential non-communicable disease services was highest in the lower-middle income countries. Specialized services, including cancer screening and radiotherapy, were more severely affected, while dialysis was relatively well-maintained. The most frequently mentioned reasons for disruption were fear of contagion, staff redeployment to COVID-19 response, lack of access to services due to lockdowns, and cancellation of elective procedures. Two of the mitigation measures were use of telemedicine and community volunteers and home drug delivery.

Conclusion: COVID-19 caused disruptions to non-communicable disease services in the Eastern Mediterranean Region, however, some countries implemented measures to mitigate the disruptions. There is a need for long-term, sustainable, integrated and well-coordinated national and regional strategies that will ensure the continuity of non-communicable disease services during emergencies and pandemics.

Keywords: COVID-19, non-communicable disease, health system, health service, health emergency, pandemic, Eastern Mediterranean

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Introduction

Non-communicable diseases (NCDs) are the leading cause of death in the Eastern Mediterranean Region (EMR), with the 4 main NCDs (cardiovascular disease, diabetes, chronic respiratory disease and cancer) claiming around 2.8 million lives annually (*1*). The health systems in many EMR countries have not yet been fully developed to cope with the changing needs of populations, and low- and middle-income countries bear the highest age-standardised death rates attributable to NCDs.(*2*)

NCDs often progress silently. Therefore, they are usually not prioritised during emergencies. People living with NCDs were especially vulnerable to the COVID-19 pandemic on several levels. First, they were at higher risk of hospitalisation and death due to COVID-19 (*3–5*). Second, they depend on long-term care, to which access was restricted, as a planned infection control measure, due to reassignment of staff and facilities to the COVID-19-response, self-isolation of health workers, and full capacity at hospitals. Even where services remained open, various levels of disruption occurred. A rapid survey conducted by WHO revealed that in 58% of countries where outpatient and inpatient services remained open, one or more NCD-related services were disrupted (*6*). Third, disruption to supply chains affected medicine and equipment stocks. Fourth, the stay-at-home policies reduced access to fresh food and medicine, aggravating the challenge of unhealthy diets. There may also have been increased alcohol and tobacco use, lack of physical activity and stress (*3*).

Study objectives

This study explored the extent of disruption to essential NCD services in the EMR during the pandemic, and strategies adopted by countries to mitigate them. These are crucial in informing policies to build more resilient health systems that are better equipped to face future shocks, and to promote integration of NCD services into pandemic preparedness plans.

Methods

We developed a questionnaire containing 110 questions that were adapted from the previous WHO pulse survey and from "Maintaining essential health services: opera-

tional guidance for the COVID-19 context". It contained multiple-choice, "check all that apply" and open-ended questions, with an option for additional explanation at the end of each set. It assesses disruptions across various health care services, including emergency services, primary health care, specialised care, surveillance, research, reasons for disruption, and mitigation measures adopted. Since disruption may have occurred as a planned infection control strategy or a consequence of the impact of the pandemic on health services or access to them, we did not specify a starting point for the duration of disruption.

The web-based questionnaire was sent to WHO NCD country focal points in the 22 EMR countries/territories in October 2021, with 2 follow-up reminders at 2-week intervals. The focal points coordinated with the Ministry of Health (MoH) in their respective countries to complete it. We received responses from the occupied Palestinian Territory and 15 countries (Afghanistan, Bahrain, Djibouti, Iran, Jordan, Kuwait, Libya, Lebanon, Morocco, Oman, Pakistan, Saudi Arabia, Syria, Somalia, and Yemen). Aggregate results as number of countries that faced disruption were presented. Permission was sought from respondents where specific country examples were mentioned.

Results

Extent and duration of service disruption

Emergency services were partially disrupted in most countries and ambulance services were fully disrupted in 2 low-income countries (Figure 1). Most countries experienced 3–6 months of disruption, but these had been fully or partially restored in all countries at the time of the survey (Figure 2).

Disruption to primary care was reported in all 12 countries that provided response on this, with 50% disruption or more in 7 and full disruption in one. Disruption lasted 6 months or less and was fully restored in most countries (Figure 2).

Non-emergency cardiovascular disease services were disrupted at various levels in most countries. Cancer screening was fully disrupted in 5 of 11 countries. Disruption lasted 6 months or longer in half of them. Cancer diagnostics were substantially disrupted, but for a shorter duration (6 months or less in 7 of 9 countries) (Figure 1, Figure 2).

Cancer treatment was relatively well-maintained; with less than 6 months of partial disruption reported by most countries. Radiotherapy had the longest disruption among cancer treatment modalities (Figure 1, Figure 2).

Dialysis was relatively well-maintained in all countries. Only 4 countries reported disruption, and this was less than 50%. Among these, 3 had disruptions due to pre-existing political and economic instability, which caused supply shortages. Most countries had partial disruption to diabetes complications management (Figure 1).

Cancer registration was suspended in 4 of 8 countries. Of 4 countries that reported having other NCD registries, registration was partially suspended in 2. Disruption was attributed to restricted access of cancer registrars to hospitals, and the redeployment of staff to COVID-19 surveillance. Some disruptions predated the pandemic due to resource shortages.

Only 4 countries reported running clinical trials, all of which were at least partially suspended. Other health research was less disrupted (Figure 3).

The proportion of essential NCD services that were fully disrupted was highest in lower-middle income countries (7) (Djibouti, Islamic Republic of Iran, Pakistan, Palestine, Morocco) compared to the higher-middle income countries (Libya, Lebanon, Jordan), and higher in the latter group than in high-income countries (Bahrain, Kuwait, Saudi Arabia and Oman). In low-income countries (Yemen, Afghanistan, Syria, Somalia), no data were available on the status of more than half of the essential NCD services. Only in lower-middle- and low-income countries were any services disrupted for more than 12 months, and this impacted over 50% of services in both groups (Figure 4).

Reasons for service disruption

The most frequently mentioned reasons for disruption were fear of contagion, staff redeployment to COVID-19 response, and lack of access due to lockdowns and cancellation of elective procedures. Government interventions to control the pandemic, namely, closure of outpatient services and lockdowns or suspension of transport services were most frequently given as the main reasons for disruption in outpatient and inpatient care. Fear of contagion among patients and staff, and hospital bed shortages were also important contributors (Figure 5).

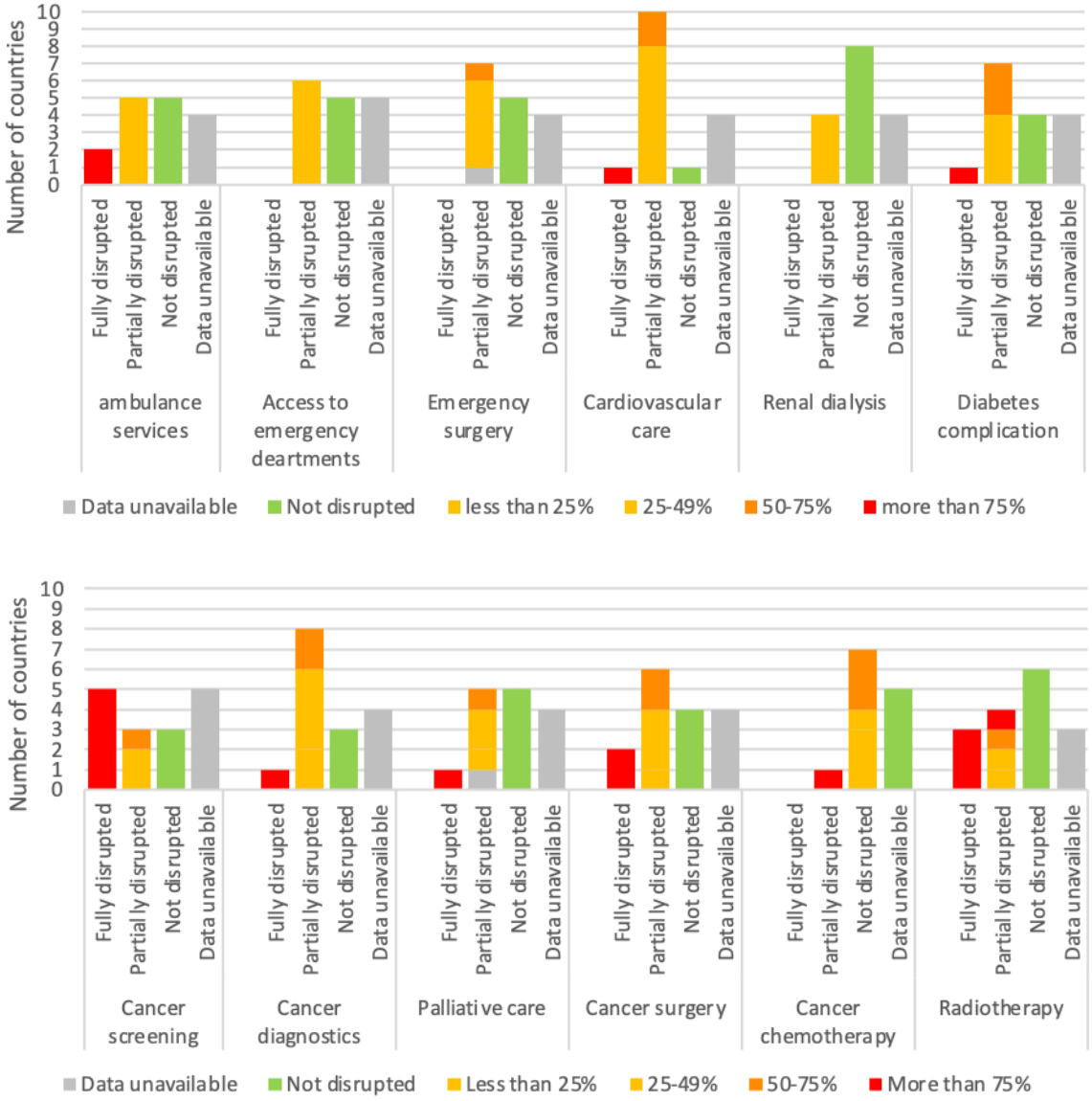
Mitigation measures

Although 9 countries had previous experience with outbreaks (e.g. SARS, MERS, H1N1 or cholera), only 6 had pre-existing pandemic preparedness plans (Table 1). Nine countries designated a focal point for essential health services in the COVID-19 incidence management team, but designated fewer than half of those established mechanisms for monitoring essential health services delivery.

In all 8 countries where essential health services were defined, NCD services were included. However, only 8 out of 14 countries included essential NCD services in their pandemic preparedness plans, and in 4 of them, these services were inadequately funded. Half of the countries had mechanisms to reallocate routine care towards essential health services, but only half of these had triggers or thresholds to activate the process.

Six countries allocated extra or flexible budgets to frontline service providers, but only one reported suspending user fees for essential NCD services. Routine NCD services were delayed or cancelled in 11 countries,

Figure 1 Extent of disruption to primary, emergency and specialized health services in Eastern Mediterranean Region



and only 2 of these had a clear roadmap for reintroducing services during the recovery phase.

In 9 of 13 countries, there was a need to prioritize essential NCD services. These needs, however, varied between countries; while some focused on urgent care (e.g. cancer treatment, acute cardiovascular care), others included diabetes and hypertension management, cancer early detection, cardiovascular disease risk assessment, and primary care NCD services (e.g. Morocco). In Jordan and Bahrain, there was also a focus on mental health.

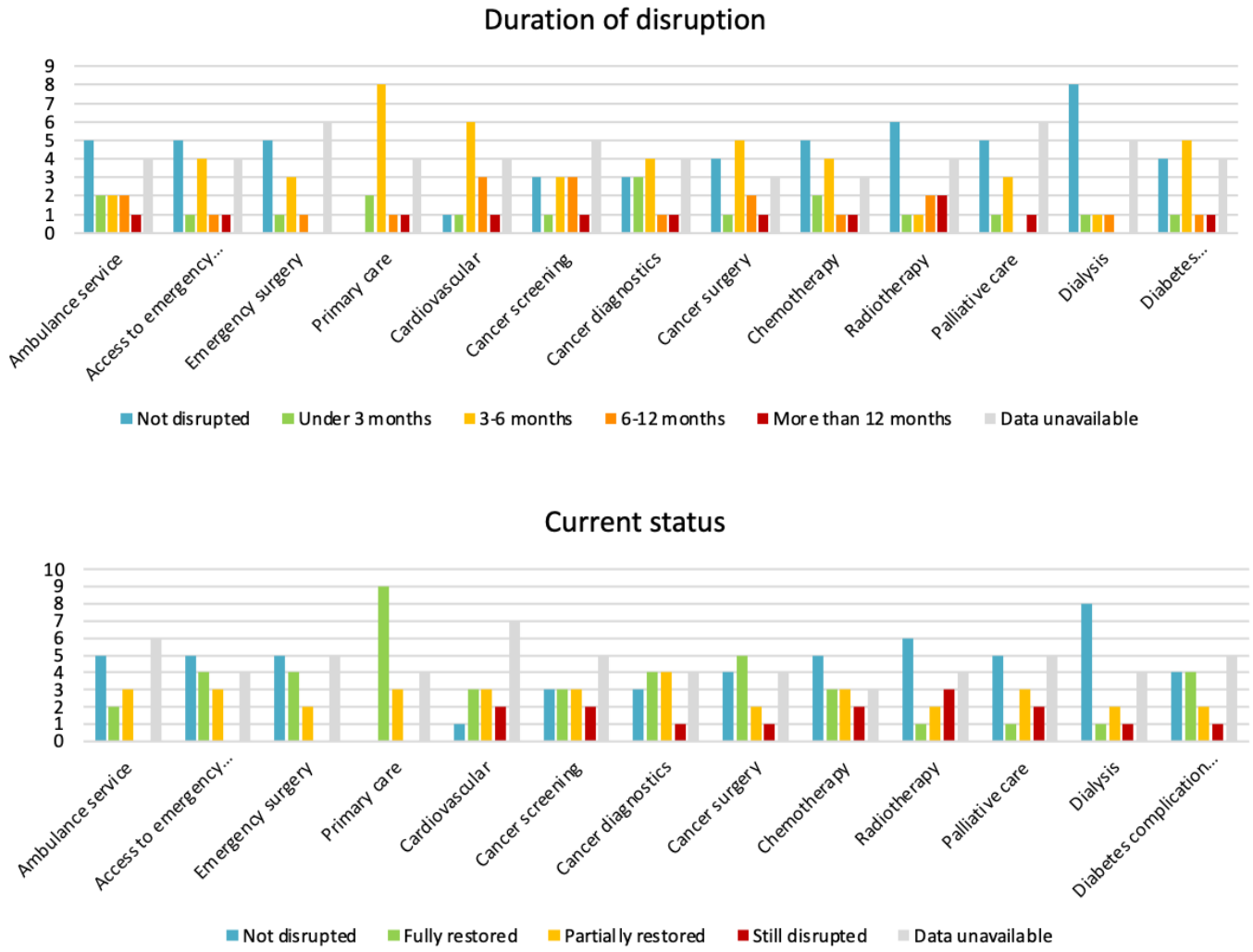
Eight countries implemented new supply chains or dispensing approaches (e.g. local production, home delivery and medication dispensing for a longer duration). Seven countries established outreach mechanisms to deliver NCD care, often as mobile clinics provided by non-government organizations and humanitarian agencies or MoH. However, in only about half of the countries have the public been informed of these changes to service delivery platforms. Ten countries provided contact numbers for safe care guidance but only 7 used digital platforms and telemedicine for service delivery. In Morocco, telemedicine was piloted to deliver care to NCD patients for the first time. In Bahrain, telemedicine was used for mental health but not NCDs.

Social media was the most widely used communication channel to inform the public about NCD services, alongside television, radio, telephone, press conferences, MoH website, community centres, home visit, and mobile clinic.

Only 5 countries reported that all patients were screened for COVID-19 on entry to health care facilities. In some countries, these measures were only implemented in hospitals or selected facilities.

Health workforce capacity remained a particular area of weakness across the region, with most countries having inadequate plan for reassignment and funding for

Figure 2 Duration of disruption and status of noncommunicable services in in Eastern Mediterranean Region



additional workforce. However, volunteerism played an important role; at least half of the countries had trained volunteers to support essential NCD services.

Although pharmacies and suppliers of NCD medication and equipment were identified in 11 countries, resources to maintain these platforms for reporting stockouts and coordinating redistribution were available in only 5.

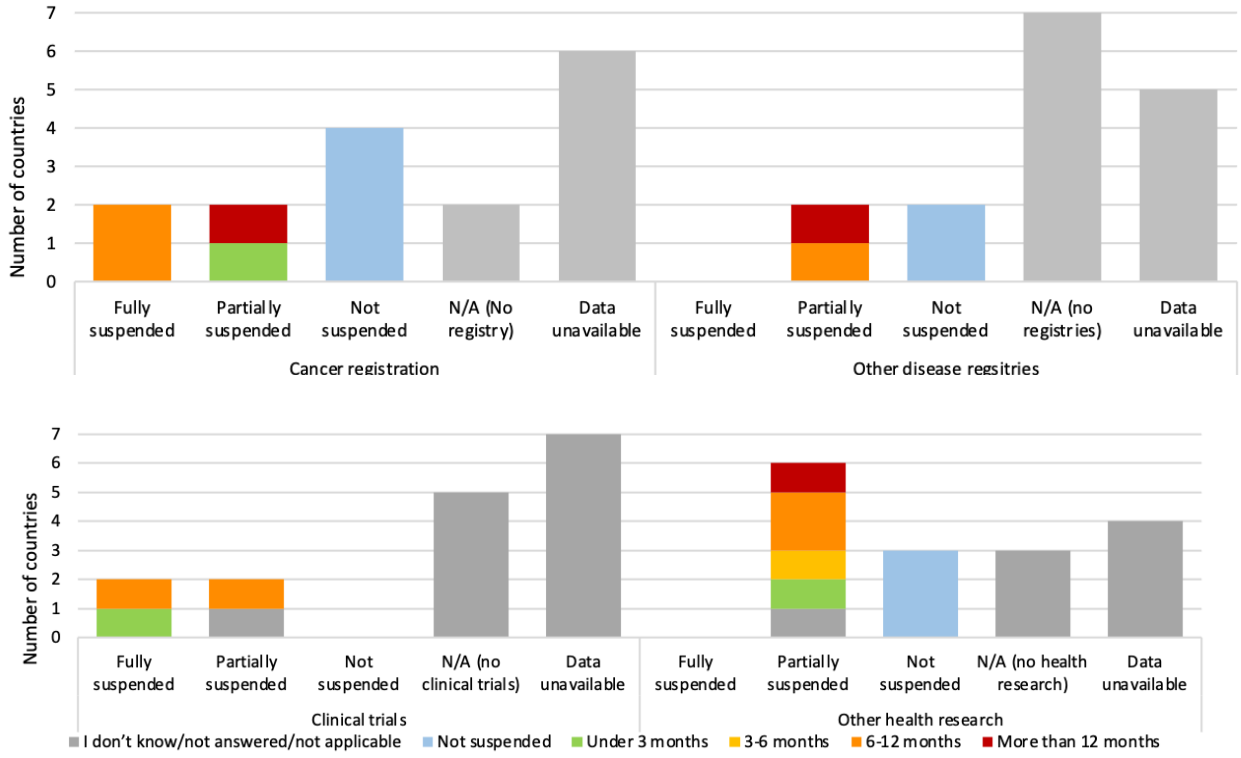
Besides the domains included in the survey, other measures were successfully implemented. For example, in Oman, there was a focus on enabling home-based NCD management by providing devices for diabetes and hypertension testing, telemedicine and medication delivery. In Jordan, a home medication delivery programme required extensive effort to compile patient lists and contact information, ultimately improving patient records. In Syria, public health centres were maintained with infection control measures, continuous capacity building for essential health services delivery and stockpiling of essential medicines and supplies. In Libya and Morocco, some health facilities were transformed into COVID-19 triage centres to allow other facilities to continue essential health services.

Discussion

There were various levels of disruptions to essential NCD services across the EMR during the COVID-19 pandemic. Most countries prioritised critical services such as emergency and cancer treatment, and suspended elective care, some kept their primary care centres operating to continue early diagnostic services and follow-up for NCDs, aiming to prevent disease progression and complications. Several countries prioritised NCD medications supply maintenance. This supported short-term treatment continuity but did not replace long-term follow-up.

There were substantial disruptions to cancer screening and diagnostics, probably due to limited access to primary and ambulatory care and elective procedures. Efforts to maintain cancer treatment through strict infection control measures, COVID-19 screening and other institutional measures showed success in Morocco and

Figure 3 Extent and duration of suspension of noncommunicable disease surveillance and research in Eastern Mediterranean Region



Saudi Arabia (*8,9*). Radiotherapy was the most impacted treatment modality, but this was rooted in longstanding healthcare infrastructure and political challenges. In the 3 countries that reported fully disrupted radiotherapy (Djibouti, Palestine, Afghanistan), the service was not available before the pandemic (*10,11*).

Dialysis was mostly maintained, likely due to its relatively independent operation. In contrast, diabetes complications management was partially disrupted in most countries due to the closure of outpatient clinics.

There was disruption to cancer registration, attributable to the inability to actively collect data, poor staffing and funding shortages (*12*). Timely cancer registration is crucial for monitoring the impact of the pandemic on cancer diagnosis, including delayed diagnosis, which impacts cancer survival. In the United Kingdom, this has been estimated to cause a substantial increase in cancer deaths (*13*).

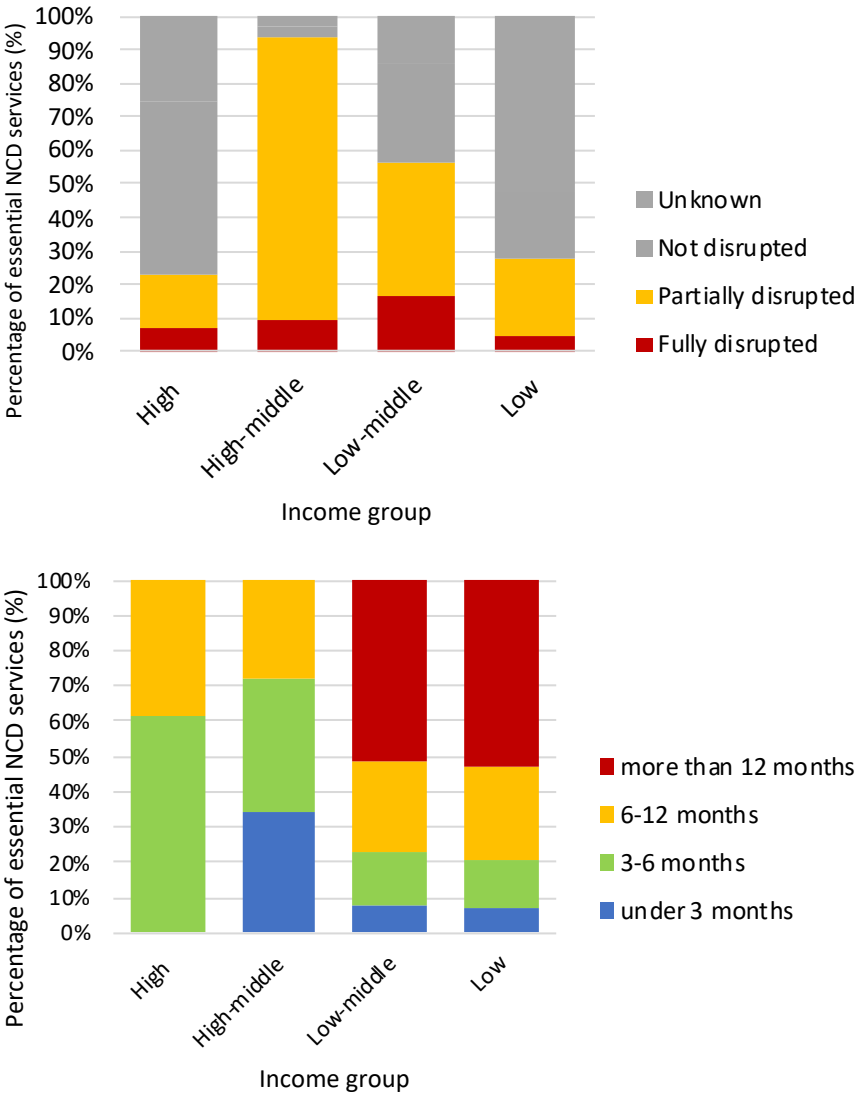
Clinical trials were disrupted in all countries that reported conducting them, while other health research was less disrupted. The clinical trials typically included electively admitted patients and elective admissions were limited in all the countries.

Some countries reported disruptions that coincided with the pandemic but were not primarily caused by it. For example, in Yemen, armed conflict and aid cuts limited the country's pandemic response capacity. Security challenges and fuel shortages impacted transportation. In the occupied Palestinian territory, referrals to East Jerusalem were halted for political reasons and medication shortages existed before the pandemic. Similarly, Afghanistan experienced widespread disruption to health services due to the fragile security situation. Countries with severely limited health care capacity returned to "normal" sooner. Yemen, already operating at only 50% capacity, could not afford to further restrict services. COVID-19 was perceived as an additional burden rather than the main concern in these communities.

NCD service suspension, lockdown or public transport suspension were the main reasons for disruption to outpatient care, followed by the fear of contagion. Similar findings were reported by International Rescue Committee for primary health care services in Jordan and Somalia, which observed a decrease in NCD visits although services remained accessible during the pandemic (14). Government policies should clearly designate priority groups for access to care during restrictions and communicate these to patients and all relevant authorities, including law enforcement.

There were bed and staff shortages for inpatient care because all hospital beds were used to full capacity and many health workers were isolating. Besides the public health measures to control infection, this challenge can only be mitigated by increasing bed capacity, training staff and equipping field hospitals, and it requires resources that many countries do not have. The United Nations and humanitarian agencies supported low-

Figure 4 Extent and duration of disruption to essential NCD services (by World Bank country income groups) (all services combined)



income countries with personal, protective equipment, ventilators and medicines (15).

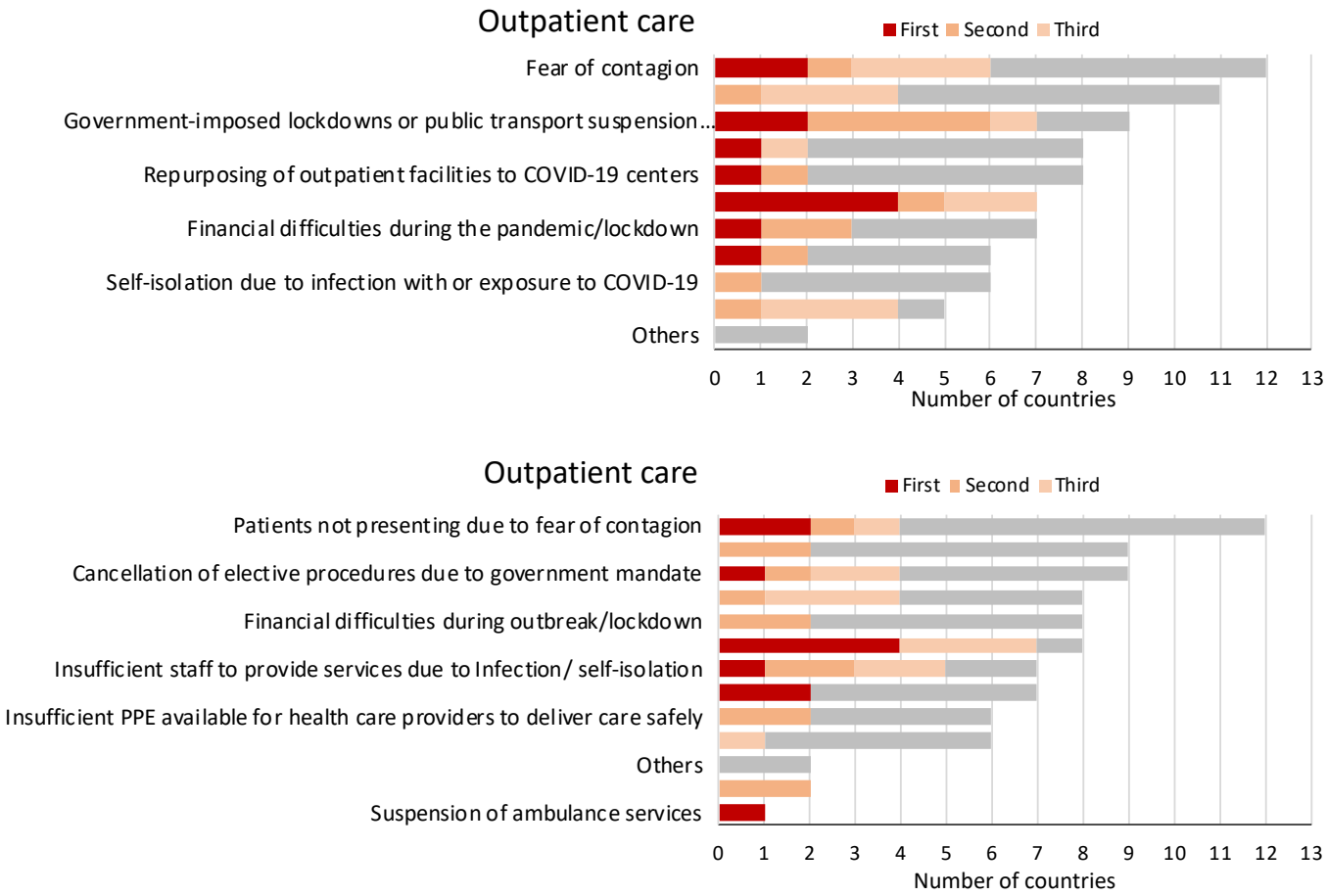
Triage according to priority, screening and isolating suspected COVID-19 cases are the most basic measures to take at health facilities. However, staffing and space shortages and, sometimes, resistance from patients, made these challenging. Implementing triage routinely with dedicated resources should continue post-pandemic to ensure appropriate prioritisation and reduce the risk of infection.

Telemedicine and digital prescribing were widely adopted, although their successes varied. Countries with stronger digital infrastructure like Saudi Arabia and Oman reached a wide proportion of their populations, while the occupied Palestine territory faced challenges in coverage and continuity because of the lack of pre-existing platforms, staff and funding. A WHO assessment of digital technologies use in 7 EMR countries reported challenges including the lack of data protection, unacceptability by patients, incomplete patient records and contact information, and time-bound funding (16). Successful telemedicine implementation requires an understanding of the smartphone, access, literacy, and user guidelines. Since family physicians were the first teleconsultation contacts at the ministry of health, this presented an additional opportunity to build trust in primary care and increase its utilisation (16).

Although WHO recommended task shifting as a mitigation strategy (17) it was essential to exercise caution to avoid exposing vulnerable patients to infection when alternating staff between COVID-19 and NCD care. For instance, in Morocco, oncology staff were exempted from COVID-19 duties.

The pandemic highlighted the urgency of achieving Universal Health Coverage, including financial risk protection, access to quality essential health care services and essential medicines for all (SDG 3.8). In the occupied Palestinian territory, the United Nations Relief and

Figure 5 Reasons for disruption to in- and outpatient essential NCD services (all that apply) and top 3 reasons for disruption to in- and outpatient essential NCD services



Works Agency expanded its services to include elderly non-refugees, offering free NCD care amid widespread income loss. Saudi Arabia provided free COVID-19 testing and treatment to undocumented migrants without legal repercussions. Outreach clinics were used in about half of the responding countries, helping to reduce health facility crowding and to bring care closer to patients.

Considering the workforce constraints and strong community ties, training volunteers for tasks such as screening and medication distribution could be highly effective across all income groups in EMR countries. Despite the minimal resources needed for training and coordination, only about half of the countries adopted this approach. Digital platforms or community networks, with supervision to ensure quality, can facilitate volunteer coordination.

Strategies used by countries have proved successful in enabling the continuity of NCD service delivery, including in humanitarian settings. Expanding the responsibility of community health workers and taking measures to protect NCD patients in health care settings (e.g. yellow cards during triage, separate waiting areas and designated clinical teams, measuring vital signs prior to appointment) have been very helpful (*14*). Although more difficult to measure, resilience and anti-fragility are also system attributes that have helped health authorities and stakeholders to address the pandemic especially when compounded with natural or human-made disasters. The rapid deployment, coordinated responses and resource mobilisation show the high adaptability of health systems to rapidly changing situations (*18*).

Study limitations

Certain unexplored factors may have affected the continuity of NCD care. For example, the stay-at-home orders may have led to a loss of informal care, which many people in the region depend on. Our study focused on the public sector, but other government sectors that provide health care services (e.g. military) and the private sector may have different capabilities which may have influenced their pandemic response. Despite efforts to obtain complete response from all 22 countries, the pandemic restrictions affected participation. Respondents did not always fully answer some of the questions, which may be a reflection of the limited mechanisms to monitor service disruption and mitigation strategies.

Table 1 Number of participating countries that had mitigation measures to maintain essential NCD services

	Yes	No	No data	Not applicable
Policies and plans (pandemic preparedness)				
Did the country have a pre-existing pandemic preparedness plan?	6	7	3	0
Does the country have previous experience with outbreak management (e.g. MERS, SARS, H1N1)?	9	5	2	0
Is there a focal point for essential health services as a member of the COVID-19 incident management team (IMT) or equivalent?	9	2	5	0
Is there a mechanism for monitoring and assessment of essential health services delivery and incorporating data into the IMT?	4	6	6	0
Governance, finance and coordination mechanisms				
Is there a mechanism for reallocation of routine care towards essential services during the pandemic if the need arises?	8	5	3	0
Have triggers/thresholds been established that activate a process of prioritization and reallocation of routine care towards essential health services?	4	8	4	0
Is there a coordination mechanism between finance and health authorities to finance essential health services (including NCDs)?	2	7	7	0
Have extra/flexible budgets been allocated to frontline service providers?	6	6	4	0
Have co-payments/user fees been suspended for essential health services (including NCDs), regardless of insurance or citizenship status?	1	9	3	3
Are essential health services clearly defined?	8	4	4	0
Are NCD services included in the list of essential health services?	8	0	3	5
Have routine NCD services been delayed/ cancelled?	11	3	2	0
Is there a road map for re-introduction of services (including NCDs) during the recovery phase according to needs?	2	3	8	3
Prioritising essential health services				
Are essential NCD services included in the pandemic preparedness plan?	8	6	2	0
Are the included essential NCD services adequately funded?	1	5	4	6
Did the need arise to prioritize essential NCD services?	9	4	3	0
Service delivery settings and platforms				
Have healthcare facilities including those in public, private, and military systems been mapped?	11	3	2	0
Have supply chains for chronic disease medication been maintained?	10	5	1	0
Have novel supply chain and/or dispensing approaches for medicines through other channels been used?	8	5	3	0
Have outreach mechanisms been established to ensure delivery of essential NCD services?	7	8	1	0
Have the public been made aware of changes in NCD service delivery platforms, including 24-hour acute care services, those in repurposed facilities, or outreach services?	8	7	1	0
Are contact numbers available to guide safe and speedy care?	10	5	1	0
Have digital platforms/telemedicine been used to support essential NCD service delivery?	7	8	1	0
Mechanism for rescheduling cancelled appointments				
Preventive care (screening)	4	5	6	1
Primary care (diabetes, hypertension, chronic respiratory disease)	7	4	3	2
Ambulatory specialised care (cardiovascular disease, cancer care, renal dialysis)	6	2	6	2
Elective surgery	10	3	3	0
Patient flow				
Are all patients screened for COVID-19 on arrival to healthcare facilities?	5	10	1	0
Are there mechanisms for isolation of those fitting COVID-19 case definitions at all sites?	12	3	1	0
Are there effective acuity-based triage systems at all sites providing acute care?	9	5	2	0
Are there clear criteria and protocols for referral pathways (including NCDs)?	9	6	1	0
Is there clear communication on safe use of healthcare facilities?	11	4	1	0
Redistribution of health workforce and task sharing				
Have health workforce requirements for various COVID-19 transmission scenarios been mapped?	6	5	5	0
Is there a plan for health workforce redistribution/task shifting for NCD services?	4	8	4	0
Have funds been allocated for timely payment of salaries, overtime, sick leave, incentives, or hazard pay for healthcare workers delivering NCD services?	1	9	6	0
Are training mechanisms in place for additional/ volunteer workforce to ensure the continued safe delivery of essential NCD services? (e.g. triage, diagnosis, infection control)	8	5	2	1
Maintaining the availability of essential medications, equipment and supplies				
Have resources required to maintain essential NCD services been identified?	6	5	5	0
Have pharmacies and suppliers of essential NCD medications and equipment been identified?	11	4	1	0
Is there a platform for reporting inventory and stockouts of NCD medications, equipment, and for the coordinated redistribution of NCD supplies?	5	8	3	0

Adapted from "Maintaining essential health services: operational guidance for the COVID-19 context"

Conclusion

At the time of this survey, new infections were decreasing in most countries, and most services had been partially or fully restored. However, countries should aim to plan for the long-term impact of pandemics on people living with NCDs, reflecting on lessons learned to build stronger and more resilient health systems.

The pandemic highlighted the interconnectedness of communicable and non-communicable diseases, which are often treated separately in research, funding and policies. Several instruments existed at the onset of the pandemic, including the International Health Regulations 2005 (*19*), the Sendai Framework for Disaster Reduction (2015–2030) (*20*), and the Global Health Security Agenda (GHSA) (2014) (*21*), however, none of these integrates NCDs in the preparedness or mitigation of public health emergencies. New multilateral and multistakeholder governance systems are needed to address this challenge (*22*). Effective NCD control is a reflection of a strong health system that is well-equipped for pandemics or health emergencies.

Mitigation measures found to be effective and safe such as triage, screening for respiratory symptoms and hygiene measures can continue to provide benefits beyond the pandemic. Telemedicine for medication refills and home delivery may improve access for those with limited mobility. To sustain these measures, they must be recognised as essential services. Low-income countries need financial support to implement basic mitigation measures.

Viewing the pandemic as just history could risk missing important lessons for future emergencies. Countries should seek innovative ways to prepare for surges in demand, such as training volunteers for simple roles, expanding digital infrastructure and educating the public.

Beyond building capacity in healthcare, building healthy societies should be a priority to enhance resilience against infectious diseases in the long-term, and to control the increasing demand for services. Given their toll on society, NCDs should be addressed with the same urgency given to new infectious diseases through the whole-of-society approach. For example, there is a need to design cities to promote active transportation, increase physical activity and reduce air pollution; remove barriers to healthy diets; tightening tobacco control; and address the social and economic determinants of health.

Maintenir les services essentiels de lutte contre les maladies non transmissibles dans la Région de la Méditerranée orientale durant la pandémie de COVID-19

Résumé

Contexte : Les systèmes de santé, en particulier dans les pays à revenu faible ou intermédiaire, ont rencontré des difficultés pour maintenir les services essentiels de lutte contre les maladies non transmissibles durant la pandémie de COVID-19.

Objectif : Évaluer l'ampleur des perturbations des services liés aux maladies non transmissibles dans la Région de la Méditerranée orientale durant la pandémie de COVID-19, en examinant les défis et les stratégies d'atténuation.

Méthodes : Entre octobre et décembre 2021, nous avons interrogé les points focaux de l'OMS pour les maladies non transmissibles de 16 pays de la Région de la Méditerranée orientale et analysé les données recueillies.

Résultats : Les services d'urgence et de soins primaires ont été perturbés dans la plupart des pays. La perturbation des soins primaires a été totale dans un pays et a impacté au moins 50 % des services dans sept autres. La proportion de services essentiels de lutte contre les maladies non transmissibles dont la continuité a été totalement interrompue était la plus élevée dans les pays à revenu intermédiaire de la tranche inférieure. Les services spécialisés, notamment le dépistage du cancer et la radiothérapie, ont été plus gravement touchés, tandis que la dialyse a été relativement bien maintenue. Les motifs de perturbation les plus fréquemment mentionnés étaient la peur de la contagion, la réaffectation du personnel pour renforcer la riposte à la COVID-19, le manque d'accès aux services en raison des confinements et l'annulation des procédures non urgentes. Les mesures d'atténuation mises en place comprenaient notamment la télémédecine et la mobilisation de bénévoles communautaires, ainsi que la distribution de médicaments à domicile.

Conclusion : La COVID-19 a perturbé les services de lutte contre les maladies non transmissibles dans la Région de la Méditerranée orientale, mais certains pays ont mis en place des mesures pour en atténuer les effets. Il est nécessaire d'établir des stratégies nationales et régionales à long terme, durables, intégrées et bien coordonnées, qui garantissent la continuité des services de prévention et de prise en charge de ces maladies durant les situations d'urgence et les pandémies.

الحفاظ على الخدمات الأساسية لمكافحة الأمراض غير السارية في إقليم شرق المتوسط خلال جائحة كوفيد-19

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الخلاصة

الخلفية: واجهت النُّظُمُ الصحية، لا سيما في البلدان ذات الدخل المنخفض والمتوسط، صعوبةً بالغة في الحفاظ على الخدمات الأساسية لمكافحة الأمراض غير السارية خلال جائحة كوفيد-19.

الأهداف: هدفت هذه الدراسة الى تقييم مدى تعطُّل خدمات مكافحة الأمراض غير السارية في إقليم شرق المتوسط خلال جائحة كوفيد-19، واستكشاف التحديات واستراتيجيات التخفيف من حدة تلك الاضطرابات.

طرق البحث: في الفترة من أكتوبر/ تشرين الأول إلى ديسمبر/ كانون الأول 2021، أجرينا مقابلات مع مسؤولي التنسيق القُطريين التابعين لمنظمة الصحة العالمية، المعنيين بالأمراض غير السارية، في 16 بلدًا من بلدان إقليم شرق المتوسط، وحللنا تلك البيانات.

النتائج: تعطلت خدمات الرعاية الطارئة والأولية في معظم البلدان. وتعرَّضت خدمات الرعاية الأولية لتعطُّل تام في أحد البلدان، بينما شهدت 7 بلدان تعطلاً بنسبة ٪50 على الأقل. وكانت نسبة الخدمات الأساسية لمكافحة الأمراض غير السارية التي تعطلت تعطلاً كاملاً أعلى ما تكون في بلدان الشريحة الدنيا من الدخل المتوسط. وكانت الخدمات المتخصصة، ومنها فحص السرطان والعلاج الإشعاعي، أشد تضررًا، بينما ظلت خدمات غسيل الكلى تسير جيدًا نسبيًّا. وكانت أكثر أسباب التعطُّل ذكرًا هي الخوف من العدوى، ونقل الموظفين للتصدي لجائحة كوفيد-19، وعدم الحصول على الخدمات بسبب الإغلاق، وإلغاء الإجراءات الاختيارية. وتمثلت بعض تدابير التخفيف في استخدام التطبيب عن بُعد، والاستعانة بمتطوعين من المجتمع المحلي، وتوصيل الأدوية إلى المنازل.

الاستنتاجات: تسببت جائحة كوفيد-19 في تعطُّل خدمات مكافحة الأمراض غير السارية في إقليم شرق المتوسط، ولكن بعض البلدان اتخذت تدابير للتخفيف من حدة التعطُّل. ويوجد احتياج إلى استراتيجيات وطنية وإقليمية طويلة الأجل ومستدامة ومتكاملة ومُنسَّقة جيدًا، تكفل استمرار خدمات مكافحة الأمراض غير السارية في أثناء حالات الطوارئ والجوائح.

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Assessing violence in healthcare in the occupied Palestinian territories

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Abstract

Background: Violence in healthcare is a major challenge in fragile and conflict-affected countries such as the occupied Palestinian territories.

Aim: To analyse and compare violence in healthcare in the occupied Palestinian territories with other conflict-affected settings.

Methods: From the Safeguarding Health in Conflict Coalition database, we collected data for 2017 to 2021 on health workers killed, injured, kidnapped, assaulted, sexually abused, threatened, and arrested, and on the destruction and damage to health care facilities for 15 conflict-affected countries and the occupied Palestinian territories. We collected similar monthly data for September 2022 to July 2024 for the occupied Palestinian territories. Using mixed-effects negative binomial regression we compared data from the occupied Palestinian territories with the 15 countries. Using negative binomial models, we conducted a pre-post analysis of the data from the occupied Palestinian territories, using October 2023 as the reference point.

Results: Between 2017 and 2021, there were significantly higher rates of attacks on health workers [IRR = 20.75 (95% CI: 2.66, 161.60)] and of the total number of violence incidents (22.26 [2.17, 228.64]) in the occupied Palestinian territories than in the 15 countries, but no significant difference in the attacks on health facilities. Attacks on health workers [IRR = 110 (30, 413)] and health facilities [IRR = 150 (31, 751)], and total violence incidents [IRR = 73 (24, 220)], increased significantly after October 2023 in the occupied Palestinian territories.

Conclusion: There is a need for multinational, multisectoral support systems to enhance safety and security for health workers and health facilities and to enhance the resilience of health systems against current and future conflicts in the occupied Palestinian territories.

Keywords: violence in healthcare, conflict-affected country, attack on health, health system, healthcare resilience, Palestine

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Background

Workplace violence for healthcare workers (HCWs) refers to "incidents where staff is abused, threatened or assaulted in work-related circumstances, including commuting to and from work, involving an explicit or implicit challenge to their safety, well-being or health" (*1*). Globally, up to 63% of HCWs experience some form of violence (*2*). The psychosocial and physical effects of violence in healthcare (VIH) are well-documented, contributing to poor work performance, increased absenteeism and a reduced quality-of-life (*3*). Threats of violence and lack of security undermine efficiency and quality-of-care, jeopardizing health care delivery to patients, which in turn exert a considerable economic burden on the health sector (*4*). VIH has been identified as a key driver of the shortage of health care workers globally (*5*). It is not isolated and often reflects the systemic and structural violence in the broader society, due to multiple causes (*6*).

Fragile and conflict-affected countries often report high VIH incidents due to systemic issues like scarce medical supplies, high patient load, high disease burden, HCW shortage, and insufficient health financing, among others (*7,8*). During the past 8 years, over 2000 VIH incidents have been reported in the occupied Palestinian territories (oPt) (*9*). The WHO reported 432 attacks on healthcare in oPt in 2018 (*10*), and since the inception of the most recent Israel-Hamas war in October 2023, high incidence of attacks on HCWs and health care facilities (HCFs) in Gaza, have been reported. Of the 1825 attacks on health care reported globally between 7 October 2023 and 30 September 2024, 1146 occurred in oPt (*11*). OPt reported 978 of the total 1210 attacks on HCWs and 786 of the total 1134 deaths associated with the attacks on health care (*11,12*). Until 18 September 2024, 166 HCFs and 542 ambulances were attacked in oPt. VIH has caused the collapse of the healthcare system in oPt, endangering those in need of care (*13*).

VIH in oPt has received greater attention since October 2023 (*14,15*), however, several observers have noted that VIH is a persistent and systemic issue in oPt due to several conflicts in the past (*16,17*). Yet, very few assessments have been conducted to understand the magnitude of VIH in the territory.

This study was therefore conducted to compare VIH incidents in oPt with 15 conflict-affected countries for

2017 to 2021. We also conducted a pre-post analysis of the monthly changes in VIH incidents and attacks on HCFs and HCWs in oPt from September 2022 to July 2024, using October 2023 as the reference point.

Methods

Data sources and extraction

We extracted VIH incidence data for oPt and 15 countries, for 2017 to 2021, from the annual reports of Safeguarding Health in Conflict Coalition (SHCC) (*9*). Each incident had a unique identification. The countries/territories were identified by the World Bank as fragile and conflict-affected as of the financial year 2020 (*18*), based on the absolute number of conflict-related deaths, the presence of United Nations peacekeeping operations and patterns of population displacement (*19*). These included Afghanistan, Burkina Faso, Cameroon, Central Africa Republic, Democratic Republic of Congo, Iraq, Libya, Mali, Myanmar, Nigeria, occupied Palestinian territories, Sudan, Somalia, South Sudan, Syrian Arab Republic, and Yemen (*20*). We excluded Chad, Eritrea, Gambia, Guinea-Bissau, Haiti, Kosovo, Lebanon, Liberia, Niger, Papua New Guinea, Venezuela, and Zimbabwe because they did not have data for all the years studied (*18*). We extracted the data on incidents of HCWs killed, injured, kidnapped, assaulted, sexually abused, threatened, and arrested, and on the destruction of and damage to HCFs. We extracted all events that had a unique SHCC identification and conducted annual population counts from the World Bank data (*21*). We extracted similar incidence data for oPt for 1 September 2022 to 30 July 2024 (*22–24*).

Study design

We designed a panel of 80 country-years using oPt and the 15 countries for 5 years. A panel design allowed us to compare the VIH outcomes in oPt with the 15 countries, after adjusting for time and changes in VIH for 2017 to 2021, based on the data availability. Using data collated by SHCC in fragile and conflict-affected countries ensured that within-dataset comparisons were valid.

We also considered the monthly time series data of VIH outcomes for September 2022 to July 2024. We chose September 2022 because it was a year-long pre-period for the baseline. Because of the multiple previous conflicts in the oPt, data before September 2022 would not have provided a conflict-free baseline. We chose July 2024 for the endline because it was the last date with reliable data in the SHCC dataset. The SHCC time series was irregular and data were available for specific dates when incidents were reported. The daily, weekly and fortnightly data were not suitable for analysis, therefore, we chose the monthly data because it provided a consecutive time series. Aggregating the data by month also helped reduce the impact of autocorrelation, seasonality and lag to some extent. Using October 2023 as reference point for pre-post analysis was helpful in assessing if the current conflict has influenced VIH.

Statistical analysis

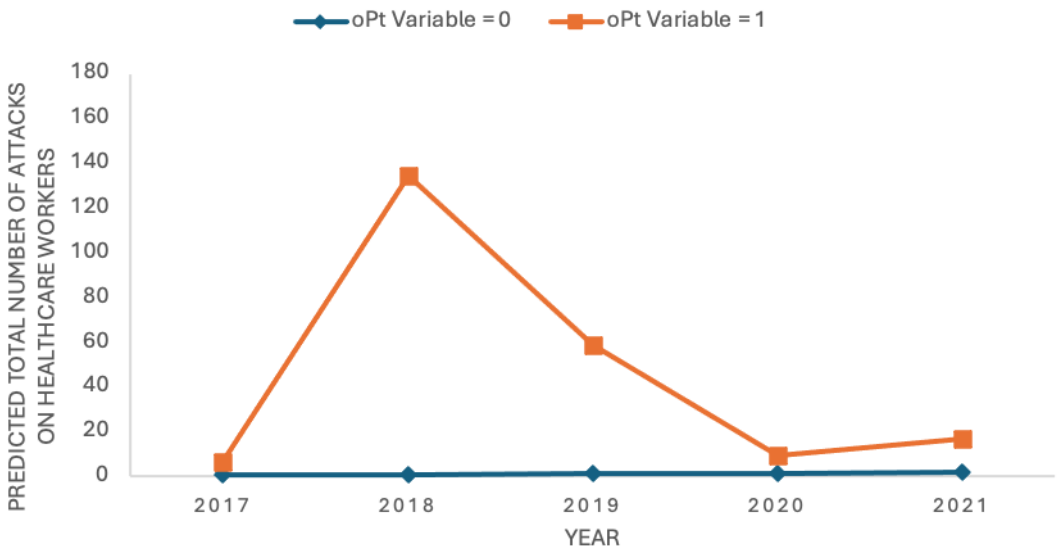
Data extraction, analyses and visualisation were conducted in Google Sheets and R version 4.4.3 accessed through RStudio version 2024.12.1+563.

For the 2 analyses, we considered 3 outcomes each. First, we calculated the total number of attacks on HCWs, which summed the unique incidents of killing, kidnapping, injury, assault, arrest, threat, and sexual abuse. Second, we calculated the total number of attacks on HCFs by adding the number of HCFs that were damaged or destroyed. Third, we summed up all the incidents with unique IDs regardless of whether they had further information on impact. The outcomes were then assessed for country-years and changes by months within oPt.

We used the mixed-effects negative binomial models because these models had better model fit than the Poisson and quasi-Poisson models. We modelled the count data on the 3 outcomes for a panel of 16 conflict-affected countries/territory for 2017 to 2021: the total number of attacks on HCWs, the total number of attacks on HCFs and the total number of violence incidents. The dichotomous variable for oPt ('1' for oPt and '0' for the 15 countries) was the primary exposure, while year and an interaction term for oPt*year served as covariates. We used population as the offset and individual countries as the random intercepts. For the model with attacks on HCFs as the outcome, we did not include the year and oPt*year terms because it caused convergence issues as there were no VIH incidents in some years for oPt. We report the measures of incidence rate ratio (IRR) as the exponentiated beta coefficients for the oPt variable, using 95% confidence intervals (CI).

We used the interrupted time series (ITS) design to estimate the intervention effect for oPt (*25*). In ITS, we assume that the pre-period trend is a valid counterfactual for the post-period trend, there is no time-varying confounding, and that there are no other competing shocks that may impact the outcome around the same time as the intervention. Essentially, the counterfactual in our analyses was the pre-period time series data for the outcomes. The method allows different lengths of pre- and post-intervention periods (i.e. no balance needed). In the primary analysis, our models included terms for intercept that represented the baseline (pre-period) rate, a continuous variable for time in months to mark the pre-period outcome trend, a dichotomous variable for marking the beginning of the conflict that captured the level change, and an interaction of time*conflict or time since the conflict that marked the slope change (i.e. trend change) in the post-period compared to the pre-period. The models in the primary analysis helped in investigating if the October 2023 conflict caused both a level change and a trend change, implying a sustained effect. Our main exposure of interest was the pre-post level change, noted by the 'conflict' variable coded as '0' during the pre-period and as '1' during the post-period. The pre-period was from September 2022 to September

Figure 1 Modeled year-wise differences between occupied Palestinian territories (oPt = 1) and 15 fragile and conflict-affected countries (oPt = 0) for the total number of (a) attacks on health care workers and (b) incidents of violence per million people, 2017–2021



*Models for attacks on HCWs and the total number of incidents were adjusted for year and the year*oPt interaction terms. All models use population as the offset and individual countries as random intercepts. Year-wise confidence intervals are not presented in the line charts for simplicity.*

2023, while the post-period was from October 2023 to July 2024.

We performed 2 sensitivity analyses. The first analysis included the time and level change terms, but not the interaction term. It investigated whether the conflict caused instant and permanent change in VIH outcomes, assuming that the trend remains the same. The second analysis used a dichotomous variable for marking the first 2 months of the conflict, i.e. the variable 'conflict' was coded as '1' for October and November 2023 and '0' for all other months in the study period. The model terms included this new conflict variable and time, but no interaction. Essentially, the analysis investigated if the first 2 months of the conflict caused a short-term deviation in VIH outcomes and eventually returned to baseline (e.g. a shock or temporary disruption).

The oPt analyses used negative binomial models because they accommodated over-dispersed count outcome data. Based on visualisations of outcomes/residuals, we did not find evidence of seasonality and temporal autocorrelation. There were no other VIH predictors that we could test because of the limited theory and the lack of data at the required temporal resolution. We did not use any offset because monthly population data were not available. We report measures of IRR as the exponentiated beta coefficients for the model terms, using 95% CI.

Ethics approval

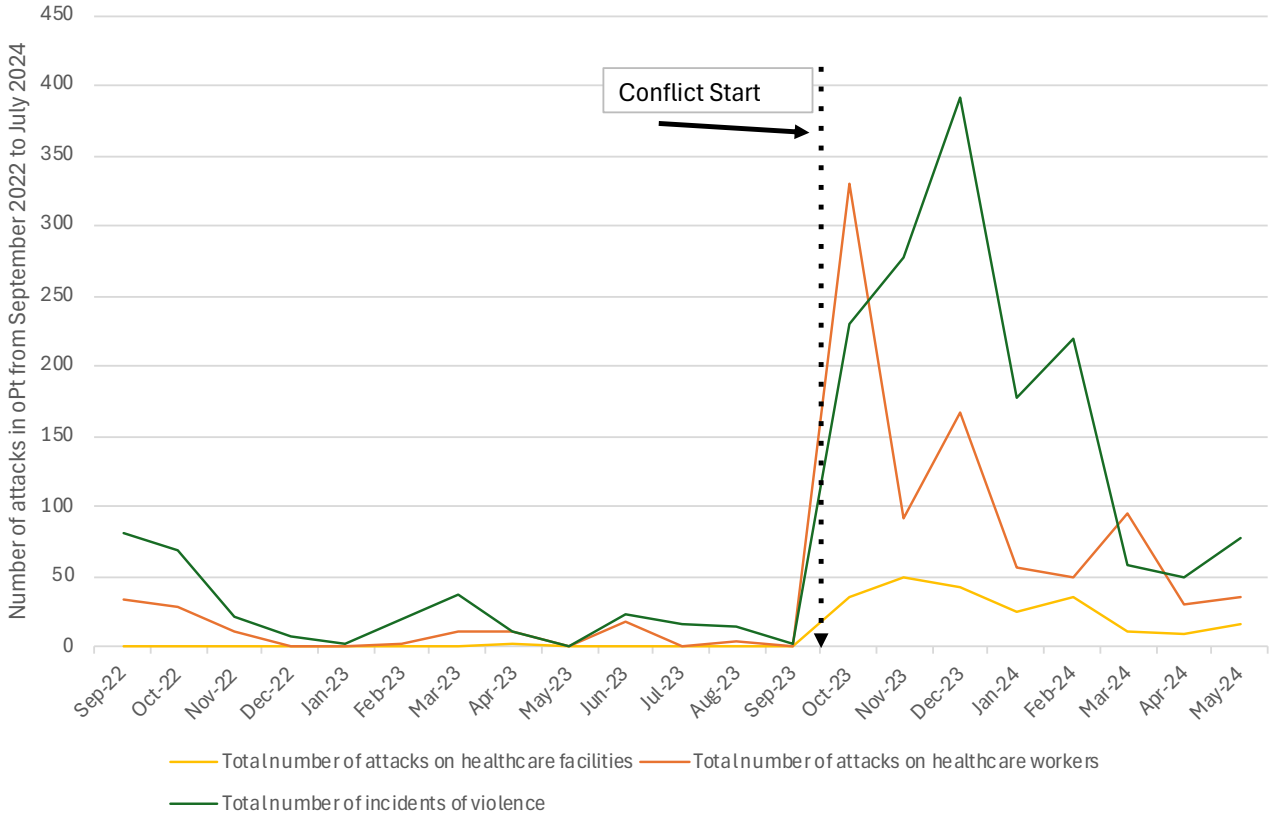
We used publicly available data and no patients were recruited for the study, therefore, there was no need to seek institutional review board approval.

Results

We found that oPt had significantly higher incidence than the 15 fragile and conflict-affected countries during 2017–2022, of the total number of attacks on HCWs [IRR = 21.28 (95%CI: 2.89, 156.74)] and total number of violence incidents [IRR = 23.73 (2.38, 236.67)], but the difference was not significant for attacks on HCFs (Table 1, Figures 1a & 1b).

From September 2022 to July 2024, VIH incidence became higher after October 2023 (Figure 2). Before October 2023, and in the absence of conflict, the baseline expected count of total attacks on HCWs was 25 (95% CI: 10, 59) events per month (Table 2). Each month, the expected count decreased by 15% (4%, 24%), and the decrease was statistically significant. At the beginning of the conflict, there was an immediate and statistically significant increase in VIH incidence: the expected count of the total number of attacks on HCWs was 110 times (30 times, 413 times) higher than before the conflict. After the conflict began, the trend decreased by 15% per month, relative to the pre-conflict trend; however, this

Figure 2 Number of attacks on health care workers and facilities and total number of incidents of violence in the occupied Palestinian territories, September 2022 to July 2024



October 7, 2023 (vertical grey line) marks the point of change in the time series as it was the start of the ongoing conflict impacting oPt – largely Gaza.

decrease was not statistically significant. Overall, there were large and statistically significant increases in the levels of total attacks on HCWs [IRR = 110 (30, 413)], total attacks on HCFs [IRR = 150 (31, 751)] and the total number of violence incidents [IRR = 73 (24, 220)] after October 2023, compared to the previous year (Table 2). There were decreases in post-conflict trends but the decreases were not statistically significant and they were much smaller than the level increases.

Sensitivity analysis of the level change without the trend change showed large and statistically significant level increases in all the 3 VIH outcomes during the post-period (Table 2). Sensitivity analysis of the short-term impact (i.e. temporary disruption) for the first 2 months of the conflict showed statistically significant level increases for the total number of attacks on HCWs and HCFs. The point estimate of the level change for the total number of violence incidents was positive. However, the 95% confidence interval was not significant.

Discussion

We found over 20-fold higher incidence rates of attacks on health care workers and violence incidents in oPt than the 15 fragile and conflict-affected countries for 2017 to 2021. This indicates a persistently high number of violence incidents in oPt. There were 110 times level changes for attacks on health care workers, 150 times for attacks on health care facilities and 73 times for the total number of violence incidents since October 2023, compared to the year before. The sensitivity analyses ensured that the findings were robust even if we looked at level changes alone and short-term changes in the first 2 months after the onset of the conflict. These findings however have multiple limitations (Table 3).

Our findings show that VIH in oPt is not comparable to other fragile and conflict-affected settings even before the October 2023 conflict. This thus supports our choice of pre-period outcomes as the only possible valid comparison for constructing the counterfactual to investigate the impact of the conflict on VIH outcomes. These findings suggest that VIH is persistent in oPt and has only worsened during the current conflict, significantly impacting health care delivery.

Our findings agree with other literature reporting that the recent conflict has exacerbated the health care crisis in oPt (*26*). As of 29 September 2024, only 17 of 36 hospitals in Gaza were partially functional (*27*). VIH directly impacts vulnerable patients seeking care in hospitals. Mortality and morbidity among care-seeking patients and their caregivers have been reported during the current conflict in Gaza (*28*). Attacks on HCWs and

Table 1 Statistical analysis of the total number of attacks on health care workers, healthcare facilities, and incidents of violence in oPt compared to 15 fragile and conflict-affected countries, 2017–2021

Outcome	Incident rate ratio (95% CI)	*P*
Total number of attacks on health care workers	21.28 (2.89, 156.74)	0.003
Total number of attacks on health care facilities	9.11 (0.82, 101.21)	0.072
Total number of incidents of violence	23.73 (2.38, 236.67)	0.007

*Negative binomial models for attacks on HCWs and the total number of incidents were adjusted for year and the year*oPt interaction terms, while that for attacks on HCFs only had the oPt term. All models used population as the offset and individual countries as random intercepts. CI = confidence intervals.*

Table 2 Pre-post analysis of total number of attacks on health care workers, health care facilities, and incidents of violence using interrupted time series design and negative binomial models, September 2022 to July 2024 (IRR; 95% CI)

	Primary analysis	Sensitivity analysis I - level change only (October 2023)	Sensitivity analysis II - short-term level change (October-November 2023) with no slope change
Total number of attacks on healthcare workers			
Baseline (pre-October)	25 (10, 59)*	36 (15, 86)*	11 (4, 28)*
Time	0.85 (0.76, 0.96)+	0.81 (0.73, 0.90)*	1.10 (1.00, 1.15)^
Level change	110 (30, 413)*	91 (25, 325)*	7.20 (1.29, 40)^
Trend change	0.85 (0.70, 1.04)	–	–
Total number of attacks on healthcare facilities			
Baseline (pre-October)	0.46 (0.08, 2.60)	1.50 (0.62, 3.67)	0.14 (0.03, 0.75)^
Time	1.00 (0.80, 1.24)	0.81 (0.75, 0.88)*	1.30 (1.16, 1.44)*
Level change	150 (31, 751)*	600 (160, 2290)*	7.30 (1.42, 37.10)^
Trend change	0.79 (0.63, 1)	–	–
Total number of incidents of violence			
Baseline (pre-October)	58 (29, 119)*	76 (37, 153)*	27 (11, 65)*
Time	0.86 (0.78, 0.94)+	0.83 (0.76, 0.90)*	1.10 (1.00, 1.14)^
Level change	73 (24, 220)*	56 (20, 160)*	3.60 (0.76, 17.50)
Trend change	0.88 (0.74, 1.04)	–	–

IRR notes incidence rate ratio, while CI depicts confidence intervals.
**P < 0.001; +P < 0.01; ^P < 0.05*

HCFs disrupts service delivery, thus limiting access to care and reducing the quality-of-care. Poor health care provision in an active conflict with the increased burden of injury, trauma, mortality, etc. further exacts burdens on the health system, resulting in significant reductions in services and reducing the chances of survival (*29*). VIH violates the Geneva Conventions that prohibit attacks on HCWs and HCFs at all times, including during conflicts (*30*). Upholding the Geneva Conventions and other international humanitarian laws is essential to protect and rebuild the health system in oPt (*31*).

Since October 2023, violence incidents have been several times higher when compared to the previous year. A recent modelling exercise projecting cause-specific mortality from 7 February to 6 August 2024 found that a ceasefire could have averted 55 000 deaths (*32*). Together, these findings call for a permanent ceasefire and other interventions. Emerging literature, especially from conflict settings, have noted several effective approaches. First, establishing support systems for health care workers, including psychotherapeutic and peer support, could be helpful in building resilience (*33*). Second, strategic negotiations for the security of health workers and health facilities are essential, with international organizations such as the Red Cross, Doctors Without Borders and others playing a key role (*34*). Third, safety measures, including blast protection (tempering films to the glass of buildings and ambulances), bunkers and sandbag fortification could help prevent physical damage to facilities and harm to health workers, patients and facilities (*34*).

Future research should incorporate the experiences of health workers, systematically studied using mixed methods. However, research in conflict settings is challenging and may require a mix of in-person and remote approaches. Remote research should be conducted with careful planning and appropriate methodologies alongside online engagement among the target population, and in compliance with international and local ethics standards (*33*). Future research should be tailored to the specific context of the conflict.

Study limitations

This study has some limitations. Our analyses relied solely on the SHCC data, which may vary from other sources due to differences in the definition of violence, incidents covered and reporting mechanisms. This is an

inherent limitation of the data source, which may not be the case with other data sources. Our analyses were on oPt as a whole and was not disaggregated by Gaza and the West Bank. Better surveillance data can help overcome this limitation in the future. Due to the aggregation of incidents over months, there may have been aggregation bias. However, due to our sensitivity analyses, the aggregation bias would not have qualitatively changed the direction of the effect. The absence of a control group in the pre-post ITS analysis limits our ability to make more robust causal inferences. We have presented multiple reasons why the pre-period comparison was the only possible and valid comparison here. Future research should consider better models that can distinguish between the short-term level changes and subsequent decline in violence. We acknowledge that some incidents could be attributed to interpersonal violence between visitors at health care facilities and the HCWs. We did not have enough information to exclude such incidents. However, these are likely to be a minority, and the inclusion of such incidents would be similar between oPt and other conflict-affected and fragile settings used for the comparisons.

Reflexivity and positionality

As global health researchers working on violence in healthcare for the past few years, we acknowledge the limitations of our perspective. We primarily adopted an epidemiologic perspective to investigate violence in healthcare settings in the oPt. In our previous work, we had noticed higher rates of such violence in oPt, which got us concerned about the conflict and motivated us to pursue further investigation of the issue. We recognise our lack of lived experience in the context and that we do not possess the first-hand knowledge or the social and geopolitical insights essential for a comprehensive understanding. Our expertise lies in technical knowledge about data collection and analysis, which we hope reflects the harsh realities faced by health workers and patients in conflict-affected areas, including oPt. Consequently, our positioning as external researchers may have made us to overlook the complex socio-political dimensions of this issue. Therefore, we have consciously limited our discussion in this paper to the epidemiologic aspects of violence in healthcare. We declare that this work is investigator-initiated and does not reflect the views of the authors' employers or any affiliations they may hold.

Conclusion

Our findings have revealed alarming high rates of violence in healthcare in oPt when compared to other fragile and conflict-affected settings, and the situation has worsened since October 2023. To protect healthcare and the lives of vulnerable patients, there is a dire need for collective efforts to protect health workers and health facilities during conflicts and to secure lasting ceasefire early.

Évaluation de la violence liée aux soins de santé dans le Territoire palestinien occupé

Résumé

Contexte : La violence dans le domaine des soins de santé est un problème majeur dans les pays en situation de fragilité et touchés par des conflits tels que le Territoire palestinien occupé.

Objectifs : Analyser et comparer la violence dans le domaine des soins de santé dans le Territoire palestinien occupé avec celle observée dans d'autres contextes touchés par des conflits.

Méthodes : À partir de la base de données de la Coalition de protection de la santé dans les conflits, appelée en anglais « Safeguarding Health in Conflict Coalition », nous avons recueilli des données couvrant la période 2017-2021 sur les agents de santé tués, blessés, kidnappés, agressés, victimes de violence sexuelle, menacés et arrêtés, ainsi que sur la destruction et les dommages subis par les établissements de santé dans 15 pays touchés par des conflits et dans le Territoire palestinien occupé. Nous avons collecté des données mensuelles similaires pour la période allant de septembre 2022 à juillet 2024 pour le Territoire palestinien occupé. À l'aide d'une régression binomiale négative à effets mixtes, nous avons comparé ces données avec celles des 15 pays. Nous avons réalisé une analyse avant/après des données provenant du Territoire palestinien occupé en utilisant des modèles binomiaux négatifs, avec octobre 2023 comme point de référence.

Résultats : Entre 2017 et 2021, les taux d'attaques contre les personnels de santé étaient significativement plus élevés [rapport du taux d'incidence (IRR) = 20,75 (IC à 95 % : 2,66-161,60)], tout comme le nombre total d'incidents violents [22,26 (2,17-228,64)] dans le Territoire palestinien occupé par rapport aux 15 pays. Cependant, aucune différence significative n'a été observée concernant les attaques contre les établissements de santé. Les attaques contre les agents de santé [IRR = 110 (30-413)] et contre les établissements de santé [IRR = 150 (31-751)], ainsi que le nombre total d'incidents violents [IRR = 73 (24-220)], ont augmenté de manière significative après octobre 2023 dans le Territoire palestinien occupé.

Conclusion : Des systèmes d'appui multinationaux et multisectoriels sont nécessaires pour renforcer la sûreté et la sécurité des agents de santé et des établissements de santé, ainsi que la résilience des systèmes de santé face aux conflits actuels et futurs dans le Territoire palestinien occupé.

تقييم العنف في الرعاية الصحية بالأراضي الفلسطينية المحتلة

أوما جوبتا، سيديش زادي

الخلاصة

الخلفية: يمثل العنف في الرعاية الصحية تحديًا كبيرًا في البلدان الهشة والمتضررة من النزاعات، مثل الأراضي الفلسطينية المحتلة.

الأهداف: هدفت هذه الدراسة الى تحليل العنف في الرعاية الصحية بالأراضي الفلسطينية المحتلة، ومقارنته بأماكن أخرى متضررة من النزاعات.

طرق البحث: من قاعدة بيانات "ائتلاف الحفاظ على الصحة أثناء النزاعات" جمعنا بيانات عن العاملين الصحيين الذين قُتلوا أو أُصيبوا أو اختُطفوا أو اعتُدي عليهم أو تعرضوا للاعتداء الجنسي أو للتهديد أو للاعتقال، وعن تدمير مرافق الرعاية الصحية وإتلافها في 15 بلدًا من البلدان المتضررة من النزاعات وفي الأراضي الفلسطينية المحتلة، وذلك خلال المدة من عام 2017 إلى عام 2021. وجمعنا بيانات شهرية مماثلة عن الأراضي الفلسطينية المحتلة في الفترة من سبتمبر/ أيلول2022 إلى يوليو/ تموز2024. وباستخدام الانحدار الثنائي السلبي ذي الآثار المختلطة، قارنّا البيانات الواردة من الأراضي الفلسطينية المحتلة مع بيانات 15 بلدًا. وباستخدام النماذج الثنائية السلبية، أجرينا تحليلاً قَبْليًّا وبَعديًّا للبيانات الواردة من الأراضي الفلسطينية المحتلة، مع اتخاذ شهر أكتوبر / تشرين الأول 2023 كنقطة مرجعية.

النتائج: بين عامَي 2017 و2021، كانت معدلات الهجمات على العاملين الصحيين [نسبة معدل الوقوع = 20.75 (95٪ فاصل الثقة: 2.66، 161.60)] وإجمالي عدد حوادث العنف (228.64، 2.17] 22.26]) في الأراضي الفلسطينية المحتلة أعلى كثيرًا مقارنةً بالبلدان الخمسة عشر، ولكن لم يكن هناك فرق كبير في الهجمات على المرافق الصحية. وشهدت الهجمات على العاملين الصحيين [نسبة معدل الوقوع = 413 (30، 110)] وعلى المرافق الصحية [نسبة معدل الوقوع = 751 (31، 150)]، وإجمالي حوادث العنف [نسبة معدل الوقوع = 220 (24، 73)]، زيادةً كبيرةً بعد أكتوبر/ تشرين الأول 2023 في الأراضي الفلسطينية المحتلة.

الاستنتاجات: يوجد احتياج إلى نُظُم دعم متعددة الجنسيات ومتعددة القطاعات لتعزيز سلامة وأمن العاملين الصحيين والمرافق الصحية، ولزيادة قدرة النُّظُم الصحية على الصمود في وجه الصراعات الحالية والمستقبلية في الأراضي الفلسطينية المحتلة.

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Epidemiologic analysis of pedestrian crashes in Türkiye

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Abstract

Background: Pedestrian crashes have become a major concern in Türkiye, accounting for 22% of traffic-related fatalities.

Aim: To examine the major risk factors increasing the fatality of pedestrian crashes in southern Türkiye.

Methods: We collected and analysed crash data for 2018–2023 in 3 cities along Türkiye's Mediterranean coast from the General Directorate of Security, and demographic data from the Turkish Statistical Institute. We used skewed logistic regression to identify major factors affecting the severity of pedestrian injuries. A total of 14 893 pedestrian crashes involving 15 116 injuries were included in the analysis.

Results: In total, 831 pedestrians were killed and 15 116 were injured. The main causes of the crashes were over-speeding (24%), failure to give way to pedestrians (14%) and pedestrians crossing the road carelessly (13%). Most crashes (96%) occurred in urban areas and male drivers were involved in 90% of the crashes. Fatality rate was higher among males than females. Fatality risk increased with pedestrian age and was higher in rural areas, at locations without street lighting, after midnight, and at ≥50 km/h speed.

Conclusion: Our findings show that over-speeding, poor lighting, large vehicles, as well as poor driver and pedestrian behaviours increased the risk of pedestrian fatalities. To improve pedestrian safety in Türkiye, speed limits should be enforced alongside better street lighting. Public awareness campaigns are needed to educate pedestrians and drivers about road safety, including special programmes for the elderly.

Keywords: pedestrian crash, pedestrian injury, pedestrian crossing, traffic safety, traffic crash, fatality risk, over-speeding, Türkiye

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Introduction

In modern life, walking is promoted as a healthy and sustainable mode of transportation, benefiting both physical and mental wellbeing (*1,2*). Regular walking is crucial for preventing chronic diseases such as obesity and cardiovascular disease, while also contributing to the strengthening of social bonds and the overall health of the community (*3,4*). However, urbanisation and increasing motor vehicle traffic have compromised pedestrian safety, because city planning often prioritizes vehicle movement over pedestrian-friendly infrastructure (*5*). The lack of safe walking spaces has resulted in an increase in pedestrian crashes, making pedestrian safety an increasing concern worldwide (*6*). Since pedestrians are more vulnerable in collisions, these crashes frequently result in severe injuries, disabilities or deaths (*7*).

Pedestrians constitute 21% of all traffic-related fatalities (*8*). They constitute 19% in the European Union and 18% in the highly motorised United States of America (*9,10*). The situation is better in Great Britain and Australia, where the rates are 15% and 12%, respectively (*11,12*). Pedestrian crashes cause injuries and fatalities as well as high economic costs, indicating the need for safer pedestrian infrastructure (*13*). Effective road safety strategies require an understanding of the key risk factors contributing to pedestrian crashes.

Türkiye, a middle-income country in the European Region, has a population of a little over 85 million, which is increasing at a rate of 1.1% per year (*14*). Traffic accident is one of the most important social and economic problems in the country. In 2023, there were around 1.3 million crashes, leading to 6548 deaths and more than 350 000 injuries. Pedestrians made up 22% of these deaths (*15*). In the last 10 years, the number of traffic crashes in Türkiye has been increasing steadily, partly due to the increasing rate of car ownership. Enhancing traffic safety and reducing the number of crashes is a primary objective of Türkiye's transportation policies. A significant action taken in this regard focuses on raising public awareness about pedestrian safety and reducing pedestrian crashes. The Ministry of Interior declared 2019 as the "Year of Pedestrian Priority" with the slogan "Priority is Life, Priority is Pedestrians". However, pedestrian crashes and related fatalities continue to increase. In 2023, there was a 14% increase in the number of pedestrians killed, compared to 2019 (*15*).

This study analysed pedestrian crashes in 3 major cities along the Mediterranean Coast of Türkiye between 2018 and 2023. It examined the distribution of pedestrian crashes and identified key risk factors influencing the severity of pedestrian injury. The findings provide valuable insights for improving pedestrian safety.

Methods

This study was conducted in 3 provinces located along the Mediterranean coastal strip in southern Türkiye: Antalya, Mersin and Adana. As of 2024, the combined population of these provinces was 6.9 million. On average, there were 0.20 cars per person in the provinces, which is almost the same with the national average of 0.19. In 2023, deaths due to pedestrian crashes accounted for 23% of all traffic-related deaths in these provinces, compared to the national average of 22%. Sixty-nine percent of the population in these provinces resides in urban areas, closely aligning with the national average of 68% (*14–16*). These figures indicate that the selected provinces are representative of Türkiye's broader traffic patterns and pedestrian crash characteristics, while also reflecting specific regional characteristics that make them relevant for studying pedestrian crashes.

We used data on 15 144 pedestrian crashes from Antalya, Mersin and Adana from the General Directorate of Security (GDS) for 2018–2023, which contains detailed information about each reported pedestrian crash. To ensure the quality and consistency of the dataset, we applied a series of basic data cleaning procedures prior to analysis. These included plausibility checks (e.g. verifying that pedestrian and driver age values were within realistic ranges), the removal of incomplete or inconsistent records (e.g. cases with missing crash location, time or land use), and the verification of variable coding to ensure compatibility with the modelling framework. After these exclusions, 14 893 pedestrian crashes, involving 15 947 pedestrians, were included in the analysis. Some incidents involved more than one pedestrian.

The data obtained did not include any personal information such as names, surnames or other identifiable details, ensuring confidentiality and anonymity of the dataset. Obtained variables included pedestrian and driver characteristics (gender, age, injury severity), road characteristics (road system, road type), crash characteristics (date, time, vehicles, location), driving behaviour (speeding), and environmental conditions. The GDS uses 30-day post-crash data to describe the injury classification of each pedestrian as injured or killed.

To better understand the patterns of pedestrian crashes, various crash attributes were examined. Pedestrian crash and fatality frequencies were analysed by age group and gender, while crash and fatality rates per 100 000 population were calculated using demographic data from the Turkish Statistical Institute (TurkStat). Additionally, the temporal distribution of pedestrian crashes and fatalities was investigated at different hours of the day and months of the year.

Significant factors affecting the severity of pedestrian injuries (injured or killed) were identified. Typically, binary logistic regression is used when the dependent variable has 2 classes. However, when these classes have an asymmetrical distribution (e.g. 95% injured and 5%, as shown in Table 1), binary logistic regression may produce biased estimates of marginal effects. Skewed logistic regression overcomes this problem and was therefore used in this study:

$$Y_i = \mu + \beta X_i \quad (1)$$

where Xi represents a vector of explanatory variables for person i, β represents a vector of parameters to be estimated and μ represents a random disturbance term which has a Burr-10 distribution (*17*). The findings from both the descriptive analyses of crash patterns and the skewed logistic regression model are discussed in detail in the next section.

Results

Crash and fatality patterns

In total, 831 pedestrians were killed and 15 116 were injured (Table 1). The main causes of fatal crashes included over-speeding (24%), failure to yield to pedestrians (14%) and pedestrians crossing carelessly (13%). Most crashes (96%) occurred in urban areas and male drivers were involved in 90% of the crashes, highlighting a significant gender disparity in driver-related pedestrian crashes (Table 1).

Males accounted for 52% of pedestrians involved in the crashes and the median age was 30 years. Among them, 37% were ≤19 years while 20% were ≥60. Fatality rates remained low among younger pedestrians and increased sharply with age (Figure 1). Among seniors aged ≥60 years, 6.9 pedestrians per 100 000 population died in the crashes. This figure increased to 10 for the 70–79 years age group and 13.1 for pedestrians aged ≥80, indicating a substantial increase in fatality risk with age. The probability of being killed increased gradually across age groups. On average, 1 in every 19 pedestrians involved in a crash was killed. Among younger pedestrians (0–19 years old), this ratio was one in 46, while for adults (20–39 years), it was 1 in 26. The fatality likelihood was 1 in 18 for middle-aged pedestrians (40–59 years), and 1 in 8 for seniors aged ≥60 years, confirming that older pedestrians face a disproportionately higher fatality risk.

There were significant differences between male and female pedestrians. Although men and women were equally involved in the crashes, the men had higher fatality rates in every age group. The difference was more pronounced among older pedestrians, where more male than female pedestrians were likely to be killed in the crashes.

Figure 2 shows the monthly distribution of pedestrian crashes and the percentage of fatalities for each year. The number of crashes remained relatively stable throughout the year, but there were seasonal variations. Crashes were more frequent during the spring and fall months and lower during winter, particularly in January and February. The percentage fatality among involved pedestrians generally peaked during late summer and fall, with variations across years. The lowest percentages were typically observed during winter, especially in February.

Table 1 **Pedestrian crashes in southern Türkiye, 2018–2023 (*continued*)**

Variables	Levels	Frequency	
		n	%
Pedestrian			
Severity	Injured	15 116	94.8
	Killed	831	5.2
Gender	Female	7591	47.6
	Male	8356	52.4
Age (years)	<18	5318	33.4
	18–24	1669	10.5
	25–54	4964	31.1
	55–64	1,566	9.8
	≥65	2430	15.2
Pedestrian at fault	Yes	8947	56.1
	No	7000	43.9
Driver			
Gender	Female	1901	12.8
	Male	12,992	87.2
Age (years)	<18	1258	8.4
	18–24	2740	18.4
	25–64	10 201	68.5
	≥65	694	4.7
Driver at-fault	Yes	7089	47.6
	No	7804	52.4
Over-speeding	Yes	3598	24.2
	No	11 295	75.8
Temporal			
Time	12 am–6 am	418	2.8
	6 am–12 am	2892	19.4
	12 pm–6 pm	7364	49.4
	6 pm–12 pm	4219	28.3
Season	Spring	3886	26.1
	Summer	3669	24.6
	Fall	4051	27.2
	Winter	3287	22.1
Crash			
Intersection	Yes	7636	51.3
	No	7257	48.7
Crossing	Yes	1817	12.2
	No	13 076	87.8
Speed limit (km/h)	≤30	797	5.4
	31–50	10 182	68.4
	51–70	3239	21.7
	71–90	268	1.8
	91–110	340	2.3
	>110	67	0.4
Vehicle	Bicycle/Scooter	745	5.0
	Bus	991	6.7
	Motorcycle	2269	15.2
	Pick Up/Truck	3033	20.4
	Automobile	7855	52.7

Table 1 Pedestrian crashes in southern Türkiye, 2018–2023 (*concluded*)

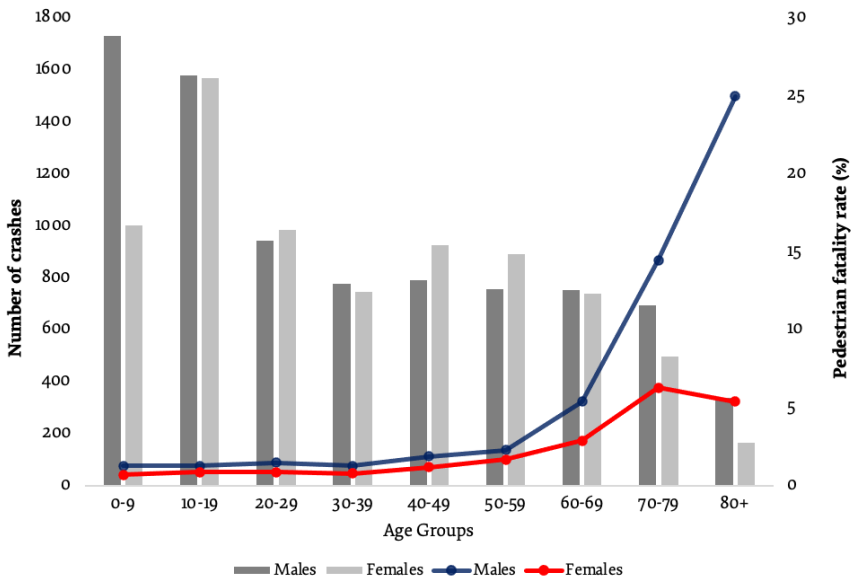
Variables	Levels	Frequency	
		n	%
Environmental			
Land use	Urban	14 326	96.2
	Rural	567	3.8
Streetlight	Yes	10 701	71.9
	No	4192	28.1
Weather	Clear	13 408	90.0
	Foggy	450	3.0
	Rainy	1 035	6.9
Light condition	Daylight	9881	66.3
	Dark	4569	30.7
	Twilight	443	3.0
Road surface	Dry	13 513	90.7
	Wet	1 380	9.3

Figure 3 presents the hourly and monthly distribution of pedestrian crashes and fatalities. Crashes were highly concentrated between 12 pm and 6 pm, accounting for 50% of all crashes, with a peak between 4 pm and 5 pm. However, fatal pedestrian crashes were more frequent between 6 pm and 10 pm, making up 40% of all fatalities. This suggests that although most crashes happened during the day, crashes occurring in the evening were more likely to be fatal. The seasonal pattern also varied. During fall and winter, most fatalities occurred between 6 pm and 10 pm, while during summer, the peak shifted between 9 pm and 12 am.

Modelling results

Table 2 presents the results of the skewed logistic regression, identifying significant factors affecting the severity of pedestrian injuries. Variables that were not statistically significant at the 5% level were excluded. The analysis confirmed that pedestrian gender and age, pedestrian fault in the crash, over-speeding, vehicle type, land use, lighting, and crash time significantly impacted the risk of fatality. Other parameters listed in Table 1, such as driver gender and age, driver fault in the crash, crash season, whether the crash occurred at an intersection or a pedestrian crossing, as well as weather, light and road surface conditions at the time of the crash

Figure 1 Age and gender distribution of pedestrians involved in crashes and fatality rates per 100 000 population, 2018–2023



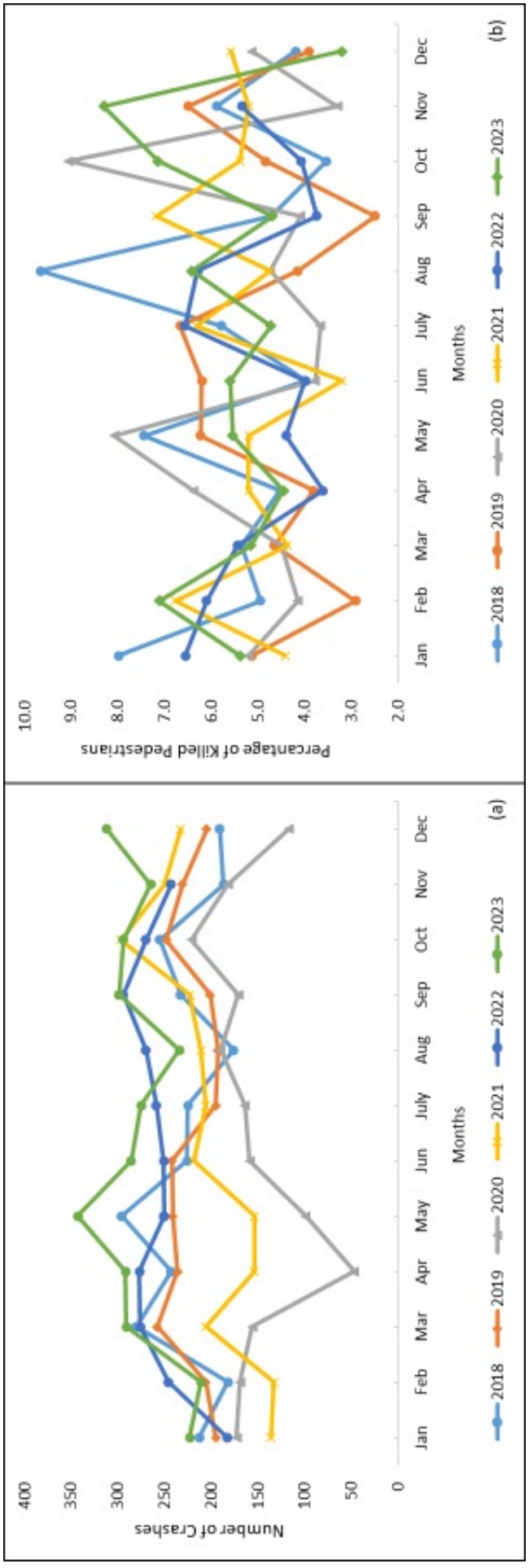


Figure 2 Monthly variation in pedestrian crash frequency and percentage of fatalities, 2018–2023

were not found to have significant effects on the severity of injuries.

The gender and age effects align with previous findings. Men were 1.24 times more likely to be killed in a crash than women (OR = 1/0.807). Compared to the 25–54-year age group, pedestrians aged <18 years had a lower risk of fatality, while those aged 55–64 and ≥65 years faced significantly higher risks. Specifically, pedestrians aged ≥65 years were 4.110 times more likely to be killed than those aged 25–54 years. Pedestrian faults in crashes increased the risk of fatality by 1.4 times compared to cases where pedestrians were not at fault.

Speed limit was a major determinant of fatality risk. There was no significant difference in pedestrian fatality risk between speed limits below 30 km/h and between 30 and 50 km/h. However, speed limits of 50 km/h more than doubled the risk of pedestrian fatality, while the likelihood of fatality was more than 6 times higher at speed limits of 110 km/h. Over-speeding increased the risk of pedestrian fatality by 2.251 times.

Vehicle type played a significant role in the crashes. Pedestrians hit by bicycles, scooters or motorcycles were significantly less likely to be killed than those hit by cars. In contrast, being hit by a pickup, truck, or a bus dramatically increased the risk of being killed. For example, pedestrians hit by bicycles or scooters were 8.265 times less likely to be killed than those hit by a car (OR = 1/0.121).

Environmental and land use factors were also critical. Crashes occurring in rural areas were 2.429 times more likely to result in fatalities than those in urban areas. Locations without street lighting increased the likelihood of a pedestrian being killed by 1.5 times (OR = 1/0.667). The likelihood of a fatal injury was higher during all time periods than in the afternoon (12 pm–6 pm). The highest increase was observed after midnight, when the risk increased 3.712 times.

Discussion

This study provides a comprehensive analysis of pedestrian crashes in 3 major cities along Türkiye's Mediterranean coast between 2018 and 2023. The findings highlight key risk factors influencing pedestrian fatality, including pedestrian age and gender, vehicle type, speed limits, land use, lighting conditions, and crash time. These results offer critical insights into pedestrian safety and contribute to a broader understanding of pedestrian crash patterns.

Figure 3 **Hourly and monthly distribution of pedestrian crashes (a) and fatalities (b), 2018–2023.**

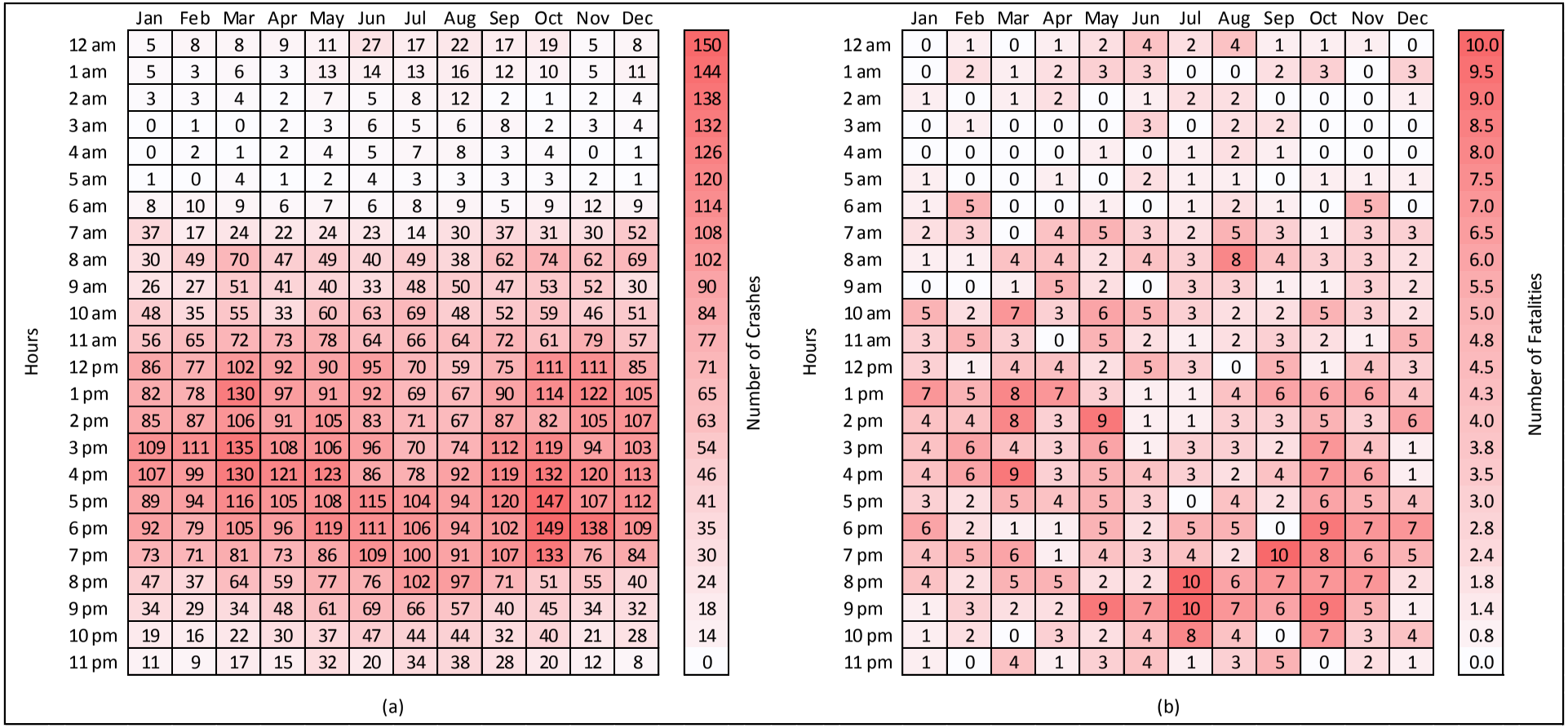


Table 2 Estimated coefficients and odds ratios from the skewed logistic regression model on severity of pedestrian injuries

Variables	Classes	Coeff.	SE	Sig.	OR
Pedestrian					
Gender					
	Male*				
	Female	-0.215	0.080	0.007	0.807
Age					
	25–54*				
	<18	-0.480	0.124	0.000	0.619
	55-64	0.641	0.125	0.000	1.899
	65+	1.413	0.099	0.000	4.110
Pedestrian fault					
	No*				
	Yes	0.337	0.080	0.000	1.400
Driver					
Over-speeding					
	No*				
	Yes	0.811	0.102	0.000	2.251
Crash					
Speed limit (km/hour)					
	≤30*				
	51–70	0.786	0.197	0.000	2.194
	71–90	1.138	0.298	0.000	3.121
	91–110	0.778	0.291	0.007	2.178
	>110	1.828	0.341	0.000	6.222
Vehicle					
	Automobile*				
	Bicycle/Scooter	-2.110	0.506	0.000	0.121
	Motorcycle	-0.563	0.139	0.000	0.570
	Pick Up/Truck	0.368	0.090	0.000	1.445
	Bus	0.584	0.131	0.000	1.793
Environmental					
Land use					
	Urban*				
	Rural	0.888	0.191	0.000	2.429
Streetlight					
	No*				
	Yes	-0.405	0.083	0.000	0.667
Temporal					
Time					
	12 pm–6 pm*				
	6 am–12 am	0.235	0.102	0.021	1.264
	6 pm–12 pm	0.579	0.092	0.000	1.784
	12 am–6 am	1.312	0.164	0.000	3.712
Observations			15.947		
Degrees of freedom			22		
Log-likelihood			5483.153		
Constant			-3.914 (P = 0.000 < 0.05)		

**Base category; SE = standard error; OR = odds ratio*

Most pedestrian crashes occurred in urban areas, where pedestrian activity is higher. In this study, 96% of crashes happened in urban regions, similar to reports from the United States of America, where most pedestrian deaths occur in cities. However, in the European Union, only about half of pedestrian deaths happen in urban areas, suggesting a different urban-rural distribution (*9*,*11*). Although fewer crashes happened in rural areas, the risk of fatality was higher. Studies suggest that this is due to higher vehicle speeds and longer emergency response time in rural locations (*18*). These findings indicate that although urban areas require better pedestrian safety measures due to higher exposure, rural roads demand stricter speed control and improved emergency response systems to reduce the risk of fatality.

Pedestrian age was a key factor for fatality risk. Although younger pedestrians were involved in more crashes, they were less likely to be killed. In contrast, older pedestrians, especially those aged ≥65, faced a higher risk of fatality. This pattern has been observed in different

countries, showing that aging increases vulnerability in traffic crashes. A study in California found that younger individuals were more frequently involved in crashes (*19*), while studies in Ethiopia (*20*) and the United States of America (*21*) confirmed that injury severity increases with age. The higher fatality risk among older pedestrians can be attributed to their slower movement, weaker physical resistance and reduced ability to evaluate crash risk. These results highlight the need for age-friendly infrastructure, such as longer pedestrian crossing time at traffic lights and improved visibility at intersections, to better protect elderly pedestrians.

Gender differences were also evident, with male pedestrians being more likely to be killed in crashes than female pedestrians. This finding may be because men take more risks when crossing the streets, while women are more cautious. However, the relationship between gender and pedestrian fatality risk is not consistent across different regions. For example, researchers in Hong Kong and South Korea found that female pedestrians had a higher fatality risk (*22*,*23*). These differences suggest that pedestrian behaviour, cultural factors and road infrastructure influence safety outcomes.

Our modelling results showed that pedestrians being at fault increased the likelihood of fatality, similar to a study in China (*24*). On the other hand, only driver fault did not significantly affect pedestrian fatality risk, however, over-speeding increased the severity of pedestrian injuries. Speed limits above 50 km/h were associated with a higher probability of pedestrian fatalities. Given that 96% of crashes occurred in urban areas, speed limit in cities is crucial for pedestrian safety. Numerous studies have reported the impact of speed on the severity of pedestrian crashes, therefore, reducing speed limits in pedestrian-dense areas is widely recommended (*25*).

Driver age was not found to be a significant factor in this study. However, it should be noted that the legal age to obtain a driver's license in Türkiye is 18. Research in other countries has indicated that driver age can influence the outcomes of pedestrian crashes (*26*,*27*).

Vehicle type was an important factor in fatality risk. Pedestrians hit by larger vehicles were more likely to suffer severe injuries or be killed. Studies have shown that SUVs, pickups and heavy-duty vehicles constitute more danger for pedestrians and cyclists because of their height, weight and hard front-end design (*28*). Although these vehicles are riskier, more people prefer using them, and SUV sales are breaking records worldwide every year (*29*). In 2024, SUVs made up more than half of all car sales in Türkiye, which could make pedestrian safety a bigger problem in the future (*30*). One issue in Türkiye is that SUVs are recorded as regular passenger cars in crash reports, which makes it difficult to study their exact effect on pedestrian safety. A better classification system could help experts understand how different vehicles affect pedestrian injuries and deaths.

Crashes that occurred in areas without street lighting were associated with a higher risk of pedestrian fatality. This finding is supported by earlier studies. Ferenchak et al (*31*) found that pedestrians in unlit areas were 2.4 times more likely to suffer fatal injuries. In our study, the highest fatality risk was observed between 12 am and 6 am, which matches reports from China showing that severe pedestrian injuries were most common during the early morning hours (*32*). This higher risk may be due to poor visibility, lower driver alertness and reduced pedestrian awareness at night. For this reason, improving street lighting in dangerous areas should be a priority for city planners. Better lighting can help pedestrians see clearly and make it easier for drivers to notice them, which may reduce fatal crashes. In contrast, the lowest fatality risk was recorded between 12 pm and 6 pm, similar to a report from Ohio (*26*), where crashes between 10 am and 4 pm showed lower injury severity.

Conclusion

Pedestrian crashes are a serious issue worldwide, but most of the available research studies on the issue focus on high-income countries. This is mainly because these countries have better crash reporting and more detailed data systems. Pedestrian crash risks and factors influencing them may be different in middle-income countries because of the differences in infrastructure, law enforcement and road user behaviours. Understanding these differences is important for developing effective safety policies. The findings of this study show that speeding, poor lighting and large vehicles increase the risk of pedestrian fatalities. To improve pedestrian safety, lower speed limits should be enforced in urban areas, especially in places with high pedestrian activities. Strict enforcement of speed limits can also help reduce the number of crashes. Better street lighting is needed, particularly at crosswalks and high-risk areas, to improve visibility at night. Since older pedestrians are more at risk, local transport authorities should consider longer crossing time at traffic lights and safer intersections. Public awareness campaigns can help educate pedestrians and drivers about road safety. Large vehicles like SUVs and pickups are more dangerous for pedestrians, so promoting the use of smaller, safer vehicles and improving vehicle design could help prevent severe injuries.

The findings of this study would be useful to the General Directorate of Security and other relevant agencies in in Türkiye in identifying high-risk periods and in developing targeted interventions. More research on pedestrian crashes is needed, especially in middle-income countries, to develop better policies and interventions. Future studies should explore the interaction between crash timing, monthly trends, and rural-urban differences in pedestrian crashes, to support more targeted and more effective safety strategies.

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Competing interests: None declared.

Analyse épidémiologique des accidents de piétons en Türkiye

Résumé

Contexte : Les accidents de piétons sont devenus une préoccupation majeure en Türkiye, représentant 22 % des décès liés à la circulation.

Objectif : Examiner les principaux facteurs de risque augmentant la mortalité liée aux accidents de piétons dans le sud de la Türkiye.

Méthodes : Nous avons recueilli et analysé des données sur les accidents survenus entre 2018 et 2023 dans trois villes situées le long de la côte méditerranéenne de Türkiye obtenues auprès de la Direction générale de la sécurité, ainsi que des données démographiques de l'Institut turc de la statistique. Nous avons utilisé une régression logistique prenant en compte des données déséquilibrées afin d'identifier les principaux facteurs influençant la gravité des blessures des piétons. L'analyse a porté sur 14 893 accidents de piétons impliquant 15 116 blessés.

Résultats : Au total, 831 piétons ont été tués et 15 116 blessés. Parmi les principales causes des accidents figurent la vitesse excessive (24 %), le non-respect de la priorité aux piétons (14 %) et la traversée imprudente des piétons (13 %). La plupart des accidents (96 %) se sont produits en milieu urbain, et les conducteurs masculins étaient impliqués dans 90 % des cas. Le taux de mortalité était plus élevé chez les hommes que chez les femmes. Le risque de décès augmentait avec l'âge des piétons et était plus élevé en milieu rural, sur des sites dépourvus d'éclairage, après minuit et à des vitesses supérieures ou égales à 50 km/h.

Conclusion : Nos résultats indiquent que la vitesse excessive, l'éclairage insuffisant, les véhicules volumineux, ainsi que les comportements inadéquats des conducteurs et des piétons, augmentent le risque de décès des piétons. Pour renforcer la sécurité des piétons en Türkiye, il convient de faire respecter les limitations de vitesse et d'améliorer l'éclairage public. Des campagnes de sensibilisation sont nécessaires pour informer les piétons et les conducteurs sur la sécurité routière, y compris des programmes spécifiques pour les personnes âgées.

تحليل وبائي لحوادث التصادم مع المشاة في تركيا

مراد أوزين، نهاد كان كارابولوت

الخلاصة

الخلفية: أصبحت حوادث التصادم مع المشاة مصدر قلق بالغ في تركيا، إذ تتسبب في ٪22 من الوفيات الناجمة عن حوادث المرور.

الأهداف: هدفت هذه الدراسة الى دراسة عوامل الخطر الرئيسية التي تزيد الوفيات الناجمة على حوادث التصادم مع المشاة في جنوب تركيا.

طرق البحث: جمعنا وحللنا بيانات من مديرية الأمن العام عن التصادمات التي وقعت في المدة من عام 2018 إلى عام 2023 في 3 مدن على طول ساحل تركيا على البحر الأبيض المتوسط، وبيانات سكانية من معهد الإحصاء التركي. واستخدمنا انحدارًا لوجستيًّا مائلاً لتحديد العوامل الرئيسية التي تؤثر في شدة إصابات المشاة. وشمل التحليلُ ما مجموعه 14893 حادث تصادم مع المشاة، وقد أسفرت تلك الحوادث عن 15116 إصابة.

النتائج: بلغ إجمالي عدد الوفيات من المشاة 831، وبلغ إجمالي عدد المصابين 15116. وكانت الأسباب الرئيسية للتصادمات هي تجاوز السرعة (٪24)، وعدم إفساح الطريق للمشاة (٪14)، وعبور المشاة للطريق باستهتار (٪13). ووقعت معظم التصادمات (٪96) في المناطق الحضرية، وكان السائقون من الذكور في ٪90 من التصادمات. وكان معدل الوفيات أعلى بين الذكور منه بين الإناث. وكانت احتمالية الوفاة تزيد مع تقدم المشاة في السن، كما كانت أعلى في المناطق الريفية، وفي المواقع التي تخلو شوارعها من إضاءة، وبعد منتصف الليل، وعند بلوغ السرعة 50 كم/ ساعة أو أعلى.

الاستنتاجات: تشير نتائجنا إلى أن تجاوز السرعة، وسوء الإضاءة، وكبر حجم المركبات، فضلاً عن السلوكيات السيئة للسائقين والمشاة، تزيد خطرَ تعرُّض المشاة للوفاة. ولزيادة الحفاظ على سلامة المشاة في تركيا، يجب تطبيق حدود السرعة، إلى جانب تحسين إنارة الشوارع. ويلزم تنفيذ حملات توعية عامة لتثقيف المشاة والسائقين بشأن السلامة على الطرق، ومنها برامج خاصة للمسنين.

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Agenda-setting analysis for antimicrobial restriction policy in Islamic Republic of Iran

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Abstract

Background: Antimicrobial resistance is a serious threat to healthcare globally and antimicrobial stewardship is fundamental in combating it.

Aim: To analyse the agenda-setting process for the development of an antimicrobial restriction policy in Islamic Republic of Iran using Kingdon's Multiple Streams Framework.

Methods: We conducted key informant interviews with 21 experts who were involved in agenda-setting for an antimicrobial restriction policy in Islamic Republic of Iran and reviewed relevant documents relating to the development of the policy. We analysed the data using Kingdon's Multiple Streams Framework.

Results: In 2019, Islamic Republic of Iran officially announced its antimicrobial restriction policy. Although national surveillance data were limited, multiple proxy indicators showed excessive use of antimicrobials and an increase in antimicrobial resistance in Islamic Republic of Iran. Based on available data, stakeholders made a compelling case for urgent policy actions to minimize irrational prescription and use of antimicrobials in the country. To balance antimicrobial stewardship with clinical needs, the antimicrobial restriction policy mandates infectious disease specialists to conduct laboratory and clinical assessment of patients, after taking the first antimicrobial dose, prior to treatment continuation.

Conclusion: In addition to evidence, demonstrating the clinical, economic and public health benefits can help improve system responsiveness to antimicrobial stewardship policy and programme development.

Keywords: antimicrobial stewardship, antimicrobial resistance, health policy, health reform, Iran

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Introduction

The widespread use of antimicrobials has added nearly 2 decades to life expectancy by enabling advances in cancer therapy, organ transplant and surgery (*1*). However, inappropriate use of antimicrobials remains a major driver of antimicrobial resistance (AMR), which is now considered one of the most serious threats to health globally (*2*). In response, WHO has facilitated the development of a global action plan to combat AMR, which focuses on raising awareness, enhancing knowledge, emphasizing infection prevention and control (IPC), and promoting the judicious use of antimicrobials (*2,3*).

Antimicrobial stewardship (AMS) is a major global strategy to preserve the effectiveness of existing antimicrobials (*4*). The main goal of AMS is to optimise antimicrobial therapy—selecting the right drug, dose, route, and duration—to ensure efficacy while limiting resistance (*5*).

AMR in Islamic Republic of Iran is driven by complex sociocultural and behavioural factors, necessitating context-sensitive, evidence-informed policymaking (*6*). In recent years, AMR has emerged as a critical public health challenge in Islamic Republic of Iran, prompting various national-level responses and policy initiatives. The country has implemented a range of strategies to combat AMR, including establishment of the National Committee for Rational Drug Use, setting up hospital infection control committees, developing a surveillance system for nosocomial infections, drafting a national action plan, and launching multiple public education and awareness campaigns (*7,8*). The Ministry of Health and Medical Education (MOHME) introduced an antimicrobial restriction policy aimed at enhancing accountability and stewardship in outpatient and inpatient treatments (*9*).

Islamic Republic of Iran has reported high resistance rates among bacteria of international concern such as *Escherichia coli* [resistance to third-generation cephalosporins (41%) or fluoroquinolones (54%)] and *Klebsiella pneumoniae* [resistance to third-generation cephalosporins (48%) or carbapenems (54%)] (*10*). Antibiotic consumption increased dramatically from 33.6 defined daily doses (DDD) per 1000 inhabitants per day (DID) in 2000 to 60.6 DID in 2021 (*11*). Subgroup analyses have revealed a concerning increase in the consumption

of third-generation cephalosporins, which accounted for 43.7% of overall antibiotic use. Other notable increases in antibiotic consumption were observed in macrolides (58.6%), beta-lactamase inhibitor-penicillin combinations (56.8%) and fluoroquinolones (39.2%) (*12*). A study reported irrational antibiotic prescriptions in 42.7% of outpatient cases (*13*), while another study reported excessive antibiotic use among COVID-19 patients, even without confirmed bacterial co-infections (*14*). These indicate the urgent need for AMS initiatives in Iran.

Although many countries have implemented AMS strategies, most literature focuses on terminology, definitions and the development and implementation of interventions (*5*,*15*,*16*), as well as their economic and clinical implications (*5*,*17*–*19*). Little has been reported about how AMS policies were formulated, especially in low- and middle-income countries (LMICs).

Agenda setting is a crucial step in policymaking, which involves the prioritization of specific issues from a broader set of potential concerns for inclusion in the policy (*20*). Given the limited number of agenda-setting studies in LMICs, this study analysed the agenda-setting process for antimicrobial restriction policy in Islamic Republic of Iran using Kingdon's Multiple Streams Framework (MSF). The aim was to provide insights that would help strengthen the scale-up of AMS policies in Islamic Republic of Iran and promote rational antimicrobial use nationally and possibly in other LMICs.

Conceptual framework

This study used MSF to analyse how antimicrobial restriction policy in Islamic Republic of Iran was included in the policy agenda. MSF is widely used to analyse how issues gain political attention (*21*). When the MSF streams converge simultaneously, "windows of opportunity" are created, allowing the issues to be included in the policy agenda (*22*). MSF is particularly relevant to LMICs, where complexities in governance and resource constraints affect health policymaking (*23*).

The problem stream indicators highlight the magnitude and importance of an issue, the political stream reflects the political dynamics such as changes in public opinion, elections, government, advocacy campaigns, and social movements. The policy stream consists of potential solutions proposed by experts, policymakers, bureaucrats, and interest groups. These streams generally operate independently until they converge during a window of opportunity.

Methods

Data collection

In this qualitative study, we conducted in-depth interviews with AMR experts who were involved in the development of the antimicrobial restriction policy in Islamic Republic of Iran, using a semi-structured questionnaire and the consolidated criteria for reporting qualitative research (COREQ) guidelines and based on the MSF components (*24*). The participants were selected using purposive and snowball sampling method. Relevant policy documents, including meeting minutes and draft policy papers, were reviewed to identify and validate key stakeholders involved in the policy formulation. This approach ensured diversity in institutional affiliation, job role and policy influence.

All interviews were conducted in-person, one-on-one. The interviews continued until data saturation was achieved with 21 key informants (Table 1). Each interview lasted 45–60 minutes. With consent of the participants, the interviews were audio-recorded and transcribed verbatim, and the transcribed copies were anonymized to maintain confidentiality. The mean age of participants was 43.3 years (SD = 8.7).

Data management and analysis

Thematic analysis of the data was guided by Kingdon's framework (*25*). The data were coded and categorised by 2 researchers independently, using MAXQDA 11 to ensure inter-coder reliability. Using thematic mapping, emerging themes were mapped to the problem, policy and politics streams. These were then triangulated and validated using the policy documents and the national antimicrobial restriction strategy reports.

Data analysis was conducted concurrently with data collection. Initial codes were assigned after familiarization and preliminary review of the interviews. Duplicate codes were removed and the remaining codes were categorised according to Kingdon's framework (problem, policy and politics streams—windows of opportunity). Transcribed copies of the interviews were sent to the respondents via email for validation,

Table 1 Characteristics of the study participants

Characteristic	N (%)
Gender	
Male	11 (52.4)
Female	10 (47.6)
Institution	
Food and Drug Administration	6 (28.6)
Iranian Society of Infection Disease and Tropical Medicine	4 (19.0)
Deputy of Health (Coordinating Center for Antimicrobial Resistance)	4 (19.0)
Deputy of Curative Affairs	4 (19.0)
Health Insurance Organization	2 (9.5)
Iranian Society of Microbiology	1 (4.8)

allowing them to confirm the coherence, integrity and comprehensiveness of the content. The initial coding process was inductive, allowing themes to emerge freely from the data. Subsequently, these themes were deductively mapped with Kingdon's streams (problem, policy and politics) based on conceptual alignment. Two researchers independently assigned themes to the streams and discussed any discrepancies until consensus was reached. This combination of inductive and deductive logic enhanced the theoretical rigour of the analysis.

Ethics considerations

The study was approved by the Ethical Committee of TUMS as part of a PhD thesis (code IR.TUMS.REC.1397.173). Written informed consent was obtained from the participants after explaining the purpose of the study to them. They were informed of their right to withdraw from the research at any time.

Results

Three key streams emerged from the analysis (Table 2).

Problem stream

Antimicrobial overuse indicators

Although national surveillance data were limited, multiple proxy indicators showed excessive antimicrobial use in Islamic Republic of Iran. The Food and Drug Administration annual report on antimicrobial sales, alongside prescription rates from studies and the National Committee on Rational Drug Use, revealed concerning prescription patterns, which attracted the attention of health system decision-makers. One informant noted:

> *"Nationwide, about 48% of our prescriptions include antibiotics; this means that 48% of patients who visit a doctor receive antibiotics. This practice is irrational and excessively high, particularly in the context of infectious and epidemiologic diseases in Iran."*

President Rouhani criticised the irrational use of antibiotics during the 14th Shahid Raja'i National Festival in 2016:

> *"Why is so much antibiotic consumed in our country? Simple diseases are treated with antibiotics. Our self-treatment often involves antibiotics, any visit to the pharmacist results in the dispensing of antibiotics, and doctors try their best to fill prescriptions with antibiotics."*

Increased antimicrobial resistance

Initial findings from the 2014 national AMR surveillance, and studies from medical universities and hospital-based research centres provided strong evidence of increasing AMR prevalence. Subsequent reports consistently confirmed the high levels of resistant organisms, contributing to increased mortality in Islamic Republic of Iran. Some of the Ministry of Health senior officials were also practicing clinicians; they understood the AMR challenges, and this contributed to better informed decision-making. One participant said:

> *"These reports over the years have emphasized the significance of addressing AMR and the irrational use of antimicrobials."*

International attention to the antimicrobial resistance problem

Increasing international attention through scientific literature, conference presentations and recommendations influenced the antimicrobial restriction policy priorities in Islamic Republic of Iran. One participant noted:

> *"Perhaps our professors didn't emphasise AMR, nosocomial infections and rational prescriptions as much before, but the new generation is increasingly concerned. At international conferences and in scientific texts, managers and experts engage effectively, drawing deserved attention to the problem. WHO has urged developing countries to rationalise antimicrobial use."*

Framing antimicrobial overuse as a costly phenomenon

Participants highlighted the dual health and economic impact of AMR. This concern is reflected in the title of the pre-authorization guidelines for selected antibiotics at the inpatient departments, which is titled "Instruction for rational prescription of costly antibiotics". In addition,

Table 2 Streams and drivers of antimicrobial resistance

Theme	Sub-theme
Problem stream	• Antimicrobial overuse indicators
	• Increased antimicrobial resistance
	• International attention to the problem
	• Framing antimicrobial overuse as a costly phenomenon
Policy stream	• Policy entrepreneurs
	• Preparing the first draft of the policy
	• Pilot implementation of the antimicrobial restriction policy within inpatient sectors
	• Considering implementation requirements
Political stream	• International calls for the policy
	• Sanctions and depletion of health sector resources
	• Managerial changes

the guidelines on controlling the use of outpatient antibiotics highlights the escalating financial burden of antimicrobial medications as a major rationale for introducing antimicrobial stewardship measures. One participant said:

> *"Among the list of the 20 most expensive drugs in the country, 4 are antibiotics. I have reported this to other managers in the Food and Drug Administration and the Deputy of Curative Affairs."*

Policy stream

Policy advocates

Certain administrators within the Food and Drug Administration and members of the Infectious Disease Society played pivotal roles in advocating for the policy agenda-setting. The Society, particularly, with the support of its chief executive officer, supported lobbying and networking for this purpose. One respondent said:

> *"The infectious disease specialists had serious concerns about this issue. One of the doctors and her colleagues were instrumental in raising these concerns and engaging in consultations and persistent advocacy with various departments in the ministry."*

Preparing the first draft of the policy

The Infectious Disease Society developed 2 key programmes to: (1) limit the prescription of 130 antimicrobials by general practitioners in the outpatient departments and (2) require pre-authorization for the prescription of 8 antimicrobials at inpatient departments. The list of restricted antimicrobials was subsequently shared with provincial experts at medical universities across the country. Their feedback was incorporated into the draft policy, leading to improvements in the applicability and acceptability of the list. However, implementation was stalled due to insufficient prioritisation by health ministry executives.

Pilot implementation of the antimicrobials restriction policy at inpatient departments

Infectious disease specialists introduced antimicrobial pre-authorization at inpatient wards and educated health systems managers, using available evidence, about its effectiveness in improving clinical outcomes and reducing costs. One respondent explained:

> *"We piloted the programme in a ward at Imam Khomeini Hospital, where certain antimicrobials—such as carbapenems—could be prescribed freely for 72 hours, after which only infectious disease specialists could authorize continuation. This saved 40 million toman and significantly reduced antimicrobial consumption and costs. Following these results, the programme was expanded to other hospitals and presented to the Deputy of Curative Affairs."*

Implementation requirements

To balance stewardship with clinical needs, the policy mandates infectious disease specialists to conduct laboratory and clinical assessment for patients who complete their first dose of antimicrobials before allowing them to continue treatment. Challenges with implementation were addressed through linkages to insurance reimbursement to enforce compliance, and integration of the stewardship programme with hospital accreditation standards by the Deputy of Curative Affairs. To enhance feasibility, potential shortages of infectious disease specialists were also considered. When consultation with a specialist was not possible, a trusted internal medicine physician could authorise the required form as necessary. One respondent noted:

> *"To prevent the programme from being just paper-based, it was tied to insurance reimbursements and added to hospital accreditation standards—this way hospitals had a reason to take it seriously."*

Political stream

International calls for the policy

The national action plan was developed in alignment with the global action plan to combat AMR, and it was unveiled at an international summit by the Minister of Health and the Regional Director of the WHO Regional Office for the Eastern Mediterranean. In accordance with the fourth strategic goal, Islamic Republic of Iran committed to rationalising the use of antimicrobials. One respondent noted:

> *"Antimicrobial use in our country has been high since the establishment of the National Prescription Review Committee 22 years ago. But since the announcement of AMR as a theme for World Health Day in 2011 and the formulation of the national action plan, rational prescription programmes have been pursued with greater seriousness."*

International sanctions and depletion of health sector resources

Despite resource constraints due to the international sanctions, the antimicrobial restriction policy gained traction due to its cost-saving potential. The economic pressure paradoxically facilitated acceptance of antimicrobial stewardship measures as part of broader resource optimisation efforts. One respondent explained:

> *"I think when the sanctions were imposed, officials began to consider not only antibiotics but also all other medications and medical equipment. We were constrained by the sanctions and this caused many difficulties in securing resources, marking a period of financial abstention."*

Leadership changes

Concurrent with the broader health system reforms, structural reorganisation within the Deputy of Curative Affairs and the Food and Drug Administration created new opportunities for antimicrobial stewardship policies. Leadership transitions led to cost containment priorities and paved the way to overcome previous implementation barriers, and this enabled policy advocates to advance previously stalled initiatives. One respondent described:

> *"We developed the outpatient antibiotic programme 2 years ago. A manager in the deputy's office mentioned that the programme was sitting on his desk drawer due to a lack of necessary infrastructure. Fortunately,*

he left, and after consulting with the universities, the programme was revived and announced."

Opening the window of opportunity for agenda-setting

Available data on AMR and antimicrobial use provided evidence for urgent action to address the persistent problem of irrational prescriptions of antimicrobials. Advocacy by the Infectious Diseases Society and Food and Drug Administration, combined with international pressure, leadership changes and economic constraints, created a compelling case for reform. Policy advocates demonstrated the clinical and economic value of antimicrobial stewardship, which enabled its adoption by the Deputy of Curative Affairs. The stakeholder consultations involving the Food and Drug Administration, the Deputy of Curative Affairs, the Infectious Diseases Society, the Clinical Pharmacists Association, the Medical Council, and insurers provided an excellent platform for refining the policy framework. Ultimately, in 2019, the policy was officially announced under the titles: "Controlling the Use of Outpatient Antibiotics" and "Instruction for Rational Prescription of Costly Antibiotics".

Discussion

This study examined the development of antimicrobial restriction policy in Islamic Republic of Iran using Kingdon's MSF. The Infectious Diseases Society has traditionally played an active role in advancing and implementing antimicrobial stewardship interventions (*5,16*) in Islamic Republic of Iran. It played a key role in placing this policy on the health agenda. Despite limited available data on antimicrobial use, proxy indicators—such as sales and prescription rates—effectively highlighted the issue of antimicrobial overuse. In settings lacking precise information, policy advocates can use such surrogate measures to capture the attention of policymakers and drive action. Strengthening surveillance of antimicrobial use and resistance can generate robust evidence for advocacy and guide evidence-based policymaking.

The findings underscore major barriers to prioritising antimicrobial resistance policies in Islamic Republic of Iran, including fragmented governance, weak enforcement and limited stakeholder engagement. These challenges are common in many LMICs where policy implementation is constrained by structural and financial limitations (*26*). Similar barriers have been reported in India and South Africa, where weak surveillance and competing health priorities limited progress (*27,28*). A major obstacle to advancing antimicrobial restriction policies is insufficient evidence to inform policymakers (*29*). In Thailand, antimicrobial restriction was once a marginal issue within pharmaceutical policies, hindered by weak coordination, limited surveillance and low public awareness. The establishment of comprehensive monitoring systems helped generate evidence on the scale and impact of AMR, drawing strong attention to the need for relevant policy. This culminated in the development of the 2016 National Action Plan on Antimicrobial Resistance, guided by a high-level steering committee chaired by the Deputy Prime Minister. Thailand's experience illustrates how evidence-informed policymaking, strong political commitment and multisectoral coordination can drive effective national response to AMR (*30,31*).

Islamic Republic of Iran could draw on best practices from the Eastern Mediterranean Region. For instance, in Lebanon, a physician-led post-prescription review and feedback AMS programme at a tertiary hospital reduced days of therapy per 1000 patient-days from 11.46 to 8.64 (*32*). More broadly, a systematic review of the Middle Eastern countries and territories, including Jordan, Lebanon, Qatar, Saudi Arabia, United Arab Emirates, and the State of Palestine, found that AMS practices, such as prospective audit-and-feedback, pre-authorisation, restriction policies, and provider education were associated with improved prescription behaviour and more rational antimicrobial use (*33*).

Until date, public engagement in Islamic Republic of Iran has been largely passive, with the media missing opportunities for meaningful discourse on antimicrobial overuse. Leveraging social media could transform the public from passive consumers into active advocates for antimicrobial stewardship policies. To capitalize on this potential, decision-makers should integrate public engagement into stewardship initiatives, through social media campaigns, community education and stakeholder dialogues, thereby empowering citizens as informed advocates for responsible antimicrobial use.

Well-designed studies are essential to evaluate these interventions, as significant reductions in antibiotic use can improve patient satisfaction by lowering costs and minimising long-term disability (*19*). In the short- and medium-term, patients' expectations may be negatively impacted by antibiotic stewardship efforts (*34,35*). Emphasizing the positive outcomes of stewardship interventions through effective communication and active patient engagement is essential to foster public support and maintain trust during implementation.

Study limitations

Participants in this research may have been influenced by social desirability bias, which we sought to mitigate through data triangulation. We acknowledge the limitation of Kingdon's theory regarding the assumed rationality and independence of the 3 streams (*23,36*). Our analysis focused solely on the agenda-setting phase; therefore, examining other policy stages could provide a more comprehensive understanding. Another limitation is potential elite bias, because the sample primarily included key informants from official institutions. While appropriate for studying national-level agenda-setting, this may have excluded perspectives from general practitioners, pharmacists, patients, or civil

society. Future research should consider a broader range of stakeholders to capture these bottom-up viewpoints.

Conclusion

Findings from this study show that evidence alone may not be sufficient to place health issues on the policy agenda in developing countries. Policy advocates, including staff of the Infectious Diseases Society, leveraged the economic challenges, such as sanctions, to advance antimicrobial stewardship policies in Islamic Republic of Iran, which may otherwise have been overlooked. Persistent antimicrobial overuse became a focal issue when there was a need to optimise resource use due to the prevailing financial constraints. By piloting antimicrobial restriction initiatives and demonstrating their tangible benefits, the policy advocates effectively demonstrated how to use evidence on the impact of economic challenges to advocate for health system reforms that would improve efficiency, quality and implementation of antimicrobial stewardship programmes.

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Analyse de la définition des enjeux prioritaires pour élaborer une politique de restriction des antimicrobiens en République islamique d'Iran

Résumé

Contexte : La résistance aux antimicrobiens (RAM) constitue une grave menace pour les soins de santé à l'échelle mondiale. Une bonne gestion des antimicrobiens est essentielle pour y faire face.

Objectif : Analyser le processus de définition des enjeux prioritaires pour l'élaboration d'une politique de restriction des antimicrobiens en République islamique d'Iran à l'aide du modèle des flux multiples de Kingdon.

Méthodes : Nous avons mené des entretiens informateurs clés auprès de 21 experts qui ont participé à la mise en place d'un programme visant à élaborer une politique de restriction des antimicrobiens en République islamique d'Iran. Nous avons également examiné les documents pertinents relatifs au développement de cette politique. Les données ont été analysées au moyen du modèle des flux multiples de Kingdon.

Résultats : En 2019, la République islamique d'Iran a officiellement annoncé sa politique de restriction des antimicrobiens. Bien que les données de surveillance nationales soient limitées, plusieurs indicateurs indirects ont montré une utilisation excessive des antimicrobiens ainsi qu'une augmentation de la RAM. Sur la base des données disponibles, les parties prenantes ont présenté des arguments convaincants en faveur de la mise en place de mesures politiques urgentes visant à limiter la prescription et l'utilisation irrationnelles des antimicrobiens dans le pays. Afin de concilier la bonne gestion des antimicrobiens avec les besoins cliniques, ces mesures imposent aux spécialistes des maladies infectieuses de réaliser une évaluation clinique et biologique des patients, après l'administration de la première dose d'antimicrobien, avant de poursuivre le traitement.

Conclusion : Outre les données probantes, la mise en évidence des avantages cliniques, économiques et de santé publique peut contribuer à améliorer la réceptivité des systèmes à l'égard de l'élaboration des politiques et des programmes de gestion des antimicrobiens.

وضع برنامج عمل لسياسة تقييد استخدام مضادات الميكروبات في جمهورية إيران الإسلامية

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الخلاصة

الخلفية: تُمثِّل مقاومة مضادات الميكروبات تهديدًا خطيرًا للرعاية الصحية على الصعيد العالمي، والإشراف على مضادات الميكروبات عامل أساسي في مكافحتها.

الأهداف: تحليل عملية وضع برنامج عمل لإعداد سياسة تقييد استخدام مضادات الميكروبات في جمهورية إيران الإسلامية باستخدام إطار عمل كينغدون للتيارات المتعددة.

طرق البحث: أجرينا مقابلات مع 21 خبيرًا شاركوا في وضع برنامج العمل لسياسة تقييد استخدام مضادات الميكروبات في جمهورية إيران الإسلامية، بوصف هؤلاء الخبراء مصادر المعلومات الرئيسية، واستعرضنا الوثائق ذات الصلة المتعلقة بإعداد السياسة. ثم حللنا البيانات بإطار كينغدون للتيارات المتعددة

النتائج: في عام 2019، أعلنت جمهورية إيران الإسلامية رسميًّا عن سياستها لتقييد استخدام مضادات الميكروبات. وعلى الرغم من محدودية بيانات الترصد الوطنية، فإن عدة مؤشرات غير مباشرة أظهرت الإفراط في استخدام مضادات الميكروبات وزيادة في مقاومة مضادات الميكروبات في جمهورية إيران الإسلامية. واستنادًا إلى البيانات المتاحة، ساق أصحاب المصلحة حُججًا مقنعة لاتخاذ إجراءات عاجلة تقوم على السياسات، للتقليل إلى أدنى حد ممكن من وصف مضادات الميكروبات واستعمالها على نحو غير رشيد في البلد. وللموازنة بين الإشراف على مضادات الميكروبات والاحتياجات السريرية، تلزم سياسة تقييد استخدام مضادات الميكروبات اختصاصي الأمراض المعدية بإجراء تقييم مختبري وسريري للمريض بعد تناوله الجرعة الأولى من مضادات الميكروبات، قبل استمرار العلاج.

الاستنتاجات: إضافةً إلى البيِّنات، فإن إظهار الفوائد السريرية والاقتصادية وفوائد الصحة العامة يمكن أن يساعد على تحسين تجاوب النظام مع سياسة الإشراف على مضادات الميكروبات ووضع برنامج العمل.

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Ten-year analysis of the epidemiologic characteristics of whooping cough in Kyrgyzstan

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Abstract

Background: Although whooping cough is vaccine-preventable, its incidence is increasing globally, including in Kyrgyzstan.

Aim: To investigate the epidemiologic characteristics of whooping cough among children in Bishkek, Kyrgyzstan.

Methods: We collected and analysed data on 802 children aged 0–14 years, clinically diagnosed with whooping cough, and admitted at the Republican Clinical Infectious Diseases Hospital, Bishkek, Kyrgyzstan, from February 2014 to February 2024.

Results: Polymerase chain reaction test of the respiratory samples confirmed all the children positive for *Bordetella pertussis*. There was no case of *Bordetella parapertussis*. We observed a distinct cyclical pattern of the incidence of whooping cough during the 10-year period, with a significant peak in 2018. Between 2021 and 2023, the majority (60.0%) of cases occurred among infants <1 year old. Among the children, 58.7% were not vaccinated, while 41.3% had incomplete diphtheria, tetanus and polio vaccination. Severe cases were common among infants with comorbidities such as anaemia and hypoxia.

Conclusions: Our findings show that whooping cough incidence is increasing among children in Bishkek. There is therefore a need to strengthen prevention efforts, including public awareness and education, childhood immunisation and maternal vaccination, and intensify detection, diagnosis and isolation to reduce transmission.

Keywords: pertussis, whooping cough, vaccination, immunisation, children, infant, Kyrgyzstan

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Introduction

Pertussis (whooping cough) is a highly contagious acute respiratory infection that causes severe illness in children and persistent cough in adolescents and adults. It is most commonly caused by *Bordetella pertussis* or *Bordetella parapertussis* and spreads through airborne droplets (*1*,*2*). Whooping cough remains a serious health concern globally and a significant cause of childhood mortality, especially in low-resource settings (*2*). It affects millions annually, causing high mortality among unvaccinated infants and children (*3*–*5*). Global incidence remains high and case fatality rate among infants may reach 4.0% in low-income countries (*6*,*7*).

Pertussis spreads through droplets and presents with progressive cough, inspiratory whoop and post-tussive vomiting. It remains contagious during the catarrhal phase and for up to 3 weeks after the onset of paroxysmal cough, indicating the need for strict isolation (*1*). In infants, it may first present with apnoea or cyanosis (*8*). Mothers are often identified as the source of infection in newborns who have not completed their vaccination (*1*). Early antibiotics intake can reduce disease progression (*6*).

Laboratory confirmation is typically achieved through nasopharyngeal culture or polymerase chain reaction (PCR) (*1*). The Pertussis Severity Score (PSS) helps assess clinical severity by combining objective and clinical parameters. The maximum score is 15 and it accounts for the duration of hospitalisation, oxygen need and complications (*9*,*10*).

In Kyrgyzstan, diphtheria, tetanus and polio (DTP) immunisation is scheduled for early infancy, with a booster at 2 years (*27*). However, despite routine vaccination, the United Stated Centres for Diseases Control and Prevention (CDC) has reported an increase in pertussis cases among vaccinated and unvaccinated individuals (attributed to waning immunity) (*13*). Re-emergence has been observed globally. Recent reports from Russia and China indicate increasing incidence and decreasing immunity (*15-18*). A cross-sectional study in Islamic Republic of Iran found significant waning immunity among children and adolescents, reinforcing the need for booster doses (*28*). In Kyrgyzstan, the incidence has increased sharply, up to 9-fold since 2021 (*19*).

This study was conducted to investigate the increasing pertussis burden in Bishkek, Kyrgyzstan.

Materials and methods

This descriptive, observational study investigated trends and factors contributing to the increasing pertussis incidence in Bishkek, Kyrgyzstan. Data for February 2014 to February 2024 were retrospectively collected from the medical records of 802 confirmed whooping cough cases at Republican Clinical Infectious Diseases Hospital. Inclusion was based on predefined criteria and consent was obtained from the parents or guardians of the children. Disease progression and hospital courses during treatment were documented. Whooping cough diagnosis was confirmed using PCR or bacteriological culture.

Inclusion and exclusion criteria

Children aged 0–14 years were included in the study. Age groupings were based on clinical relevance and observed disease severity patterns. Infants <1 year represented a high-risk group if they had incomplete primary DTP vaccination. Vaccination status was not used as a criterion for inclusion or exclusion. However, it was recorded for each patient from their medical records and later analysed to evaluate its relationship with disease incidence and severity. Children with similar symptom presentations and children with bronchial obstruction syndrome were excluded.

Statistical analysis

We performed descriptive statistical analysis using SPSS version 17 for Windows. The annual whooping cough case trends were calculated by dividing the number of confirmed hospital admissions due to pertussis by the total paediatric admissions at the Republican Clinical Infectious Diseases Hospital for each year. This approach helped identify temporal patterns and fluctuations in disease frequency over the 10-year study period.

Results

PCR test confirmed all the children positive for *Bordetella pertussis*. No case of *Bordetella parapertussis* was detected. We observed a distinct cyclical pattern in the incidence of whooping cough, with notable peaks at 2–3-year intervals (Figure 1). A significant peak occurred in 2018, with the number of cases considerably higher than 2015 and 2017. This peak was followed by a sharp decrease in 2019 and 2020, during which incidence remained relatively low. However, there was a resurgence in reported cases in 2023, with 437 cases registered. As of February 2024, 312 new cases had been reported, 8 times higher than the entire 2023.

Further analysis for 2021 and 2023 showed that the majority of cases (60.0%) occurred among infants <1 year old, and 40.0% among children aged 1–14 years. Among infants, the highest incidence was seen among those aged 0–3 months, who had not received the primary DTP vaccine. The majority (70.7%) of children aged >1 year were 1–3 years old and 29.3% were 4–14 years old. There were more females (57%) than males (43%) (Table 1). Of the children, 58.7% were unvaccinated and 41.3% had incomplete DTP vaccination, which likely contributed to the occurrence and severity of the disease.

Vaccination status by age group

The majority (72.0%) of infants aged <1 year were unvaccinated, 62.0% of children aged 1–14 years had

Figure 1 Annual number of whooping cough cases in Bishkek, Kyrgyzstan, 2014–2024

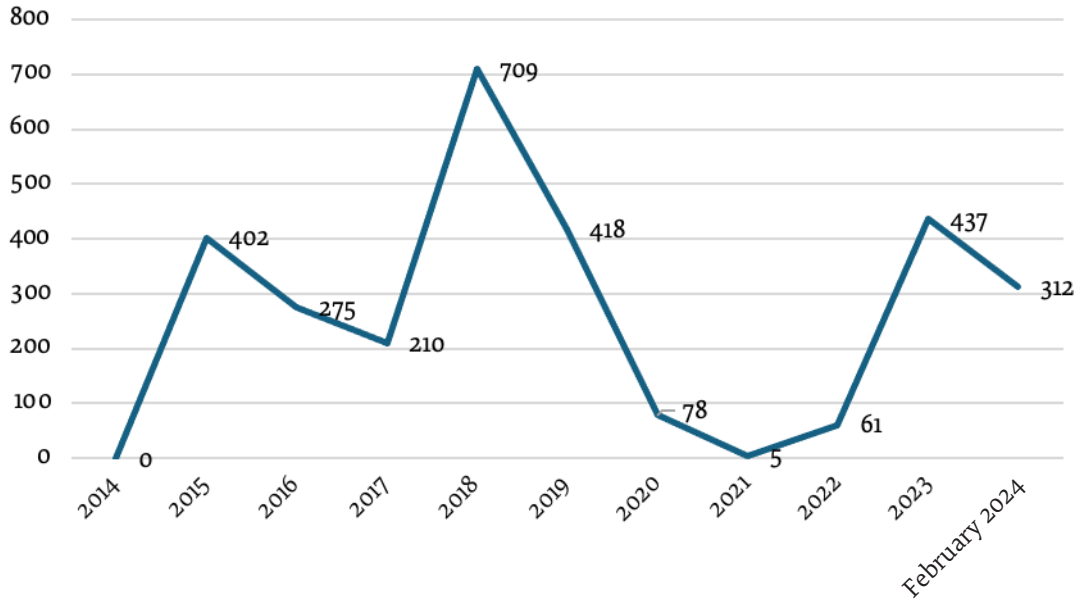

Table 1 Sociodemographic and epidemiologic characteristics of the study participants, Bishkek, Kyrgyzstan, 2014–2024

Characteristics	Study population (*n* = 802)	
	n	%
Gender		
Male	345	43.0
Female	457	57.0
Age at admission (years)		
<1	485	60.0
1–14	318	40.0
Vaccination status		
Unvaccinated	470	58.7
Incomplete	331	41.3
Complete	0	0
Associated factors		
Mother vaccinated during pregnancy	57	7.0
Family members with respiratory issues	457	57.0
Associated pathologies		
Anaemia	401	50.0
Hypoxia	200	25.0
Initial diagnosis (at admission)		
Whooping cough	449	56.0
Acute viral respiratory infection	160	20.0
Measles	188	23.5
Day of admission after onset of cough		
1st day	0	0
3rd day	115	14.3
5th day	229	28.6
7th day	344	42.9
9th day	115	14.3
Severity of disease (based on PSS score)		
Severe	476	59.4
Moderate	326	40.6
Mild	0	0
Complications in infants		
Pneumonia	402/485	83.0
Pertussis encephalopathy	83/485	17.0
Complications in school-age children		
Scleral haemorrhages	32/318	10.0
Otitis media	16/318	5.0
Pulmonary atelectasis	13/318	4.0
Children without complications	257/318	81.0
Length of hospital stay (Mean SD)	7± 2.3	

incomplete DTP vaccination, and none had received a booster dose. The incomplete immunisation in both age groups appears to be a significant contributor to disease incidence and severity.

The majority (57.0%) of infections were transmitted through adults who had prolonged cough symptoms, while in 43.0% of cases the source of infection remained unidentified. Several factors influencing the severity of the disease were identified. Notably, 50.0% of the children had anaemia and 25.0% of those aged <1 year presented with hypoxia.

Regarding the initial diagnosis, 56.5% of the patients were referred to the hospital with a confirmed diagnosis of whooping cough, 20.0% were initially diagnosed with acute respiratory viral infection (ARVI) and 23.5% were mistakenly diagnosed with measles before developing whooping cough (nosocomial infection).

No child was admitted on the first day of cough onset, but the number of hospital admissions significantly increased by the third day. The highest (42.9%) hospital admission was on the seventh day of illness, suggesting that many patients had developed severe symptoms by this time.

In terms of disease severity, 59.4% of the children presented with severe forms of whooping cough and 40.6% had moderate forms. The common complications in infants were pneumonia (83.0%) and *Pertussis encephalopathy* (17.0%). Among the school-aged children, 81.0% presented without complications; however, 10.0% developed scleral haemorrhage, 5.0% suffered from otitis media and 4.0% experienced pulmonary atelectasis.

On average, the children were hospitalized for 7 days (±2.3 days). The majority (67.0%) of children experienced severe disease, which resulted in longer hospital stay. The average hospital stay was shorter for children without complications (33.0%).

Discussion

Our findings reveal a cyclical pattern in whooping cough incidence in Bishkek, with peaks occurring every 2–3 years. A notable shift was observed in the age distribution, with an increase in the number of cases among preschool and school-aged children. Compared to earlier studies from 2010–2013, the proportion of older children affected increased significantly by 2023 (40.0%, $P < 0.0001$). This trend aligns with studies by Masseria et al and Winter et al, which highlight a resurgence in whooping cough among older children, likely due to waning post-vaccination immunity (*20*,*21*).

Infants remained the most vulnerable group, consistent with previous data. However, the increasing incidence among older children and adults may have contributed to the increased transmission to unimmunized infants. In our cohort, 57.0% of infections were linked to adults with persistent cough. This highlights the need for enhanced awareness among caregivers and health workers about the importance of maternal and adult vaccination. Maternal immunisation, as supported by Andrea et al, has proven effective in protecting infants during their early months of life (*22*).

Table 2 Length of hospital stay for children with whooping cough

Length of hospital stay in days		
In infants	With pneumonia	9.0 ± 2.3
	With encephalopathy	9.5 ± 2.3
In children 1–14 years	With pulmonary atelectasis	7.5 ± 2.5
	With otitis media	6.5 ± 2.7
	With scleral haemorrhages	5.5 ± 2.3
In children 1–14 years	Without complications	4.5 ± 2.0

Vaccination coverage remains a key concern. Over half (58.7%) of the hospitalised children were unvaccinated, and 41.3% had incomplete immunisation. Disruptions during the COVID-19 pandemic further contributed to these immunisation gaps, particularly in Bishkek, which reported the majority of cases. Similar post-pandemic surges in whooping cough have been documented in Italy and other places (*14,23*). These findings support the need to reinforce immunisation programmes and expand booster vaccination coverage, especially among older children and adults (*30*).

Booster vaccinations have shown promise in enhancing long-term immunity. Studies have shown that natural infections and booster doses strengthen immune memory, potentially curbing resurgence (*23,24*). Integrating booster shots into national schedules could help restore herd immunity and protect infants.

Clinical severity was higher among infants, particularly those with comorbidities such as anaemia and hypoxia. Among these, 59.4% had severe disease, with complications like pneumonia (83.0%) and encephalopathy (17.0%). Similar findings have been reported by Heda et al, where delayed diagnosis in hypoxic infants led to respiratory failure (*25*).

Hospital stay duration correlated with disease severity and complications. Infants with pneumonia and encephalopathy required longer admissions, whereas children without complications had significantly shorter stays. These trends support early clinical diagnosis and targeted care for improving treatment outcomes. Previous studies have noted improved prognosis with timely intervention, particularly in the youngest age groups, following the introduction of prenatal vaccination (*20*).

In summary, our findings underscore the urgent need for renewed vaccination strategies, public health awareness, and timely clinical response to mitigate the rising burden of pertussis in Kyrgyzstan.

Study limitations

This retrospective study lacked immunological data, limiting insights into underlying susceptibility. It relied on hospital records, which may have omitted relevant clinical variables. Although age groupings were clinically appropriate, future studies should consider stratification based on key DTP milestones, such as 5 months and 2 years, and include immune profiling to enhance analysis.

Conclusion

Whooping cough incidence in Bishkek, Kyrgyzstan, is increasing among infants and school-aged children. Strengthening immunisation—particularly timely administration of primary and booster doses—is vital to control outbreaks. Maternal vaccination and early infant immunisation remain crucial. Prompt detection, diagnosis, isolation and public awareness can help reduce transmission. Public campaigns and digital outreaches should emphasize booster dose compliance. A combined approach involving vaccination, early medical attention and education is essential to protect high-risk groups, especially infants.

Analyse décennale des caractéristiques épidémiologiques de la coqueluche au Kirghizistan

Résumé

Contexte : Bien que la coqueluche soit une maladie évitable par la vaccination, son incidence augmente dans le monde entier, y compris au Kirghizistan.

Objectif : Étudier les caractéristiques épidémiologiques de la coqueluche chez les enfants à Bichkek (Kirghizistan). **Méthodes :** Nous avons collecté et analysé les données concernant 802 enfants âgés de 0 à 14 ans, diagnostiqués cliniquement avec la coqueluche et hospitalisés à l'Hôpital républicain des maladies infectieuses de Bichkek entre février 2014 et février 2024.

Résultats : Le test d'amplification en chaîne par polymérase des échantillons respiratoires a confirmé que tous les enfants étaient positifs pour *Bordetella pertussis*. Aucun cas de *Bordetella parapertussis* n'a été détecté. Nous avons observé une tendance cyclique distincte de l'incidence de la coqueluche au cours de cette période de 10 ans, avec un pic significatif en 2018. Entre 2021 et 2023, la majorité des cas (60 %) concernaient des nourrissons âgés de moins d'un an. Parmi les enfants, 58,7 % n'étaient pas vaccinés et 41,3 % avaient une vaccination incomplète contre la diphtérie, le tétanos et la poliomyélite. Les formes sévères étaient fréquentes chez les nourrissons présentant des comorbidités telles que l'anémie et l'hypoxie.

Conclusion : Nos résultats montrent que l'incidence de la coqueluche augmente chez les enfants à Bichkek. Il est donc nécessaire de renforcer les efforts de prévention, notamment la sensibilisation et l'éducation du public, la vaccination des enfants et des mères, ainsi que d'intensifier la détection, le diagnostic et l'isolement afin de réduire la transmission.

تحليل الخصائص الوبائية للسعال الديكي (الشاهوق) في قيرغيزستان

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الخلاصة

الخلفية: على الرغم من إمكانية الوقاية من السعال الديكي باللقاحات، فإن معدل الإصابة به في ازدياد على مستوى العالم، وكذلك في قيرغيزستان.

الأهداف: هدفت هذه الدراسة الى استقصاء الخصائص الوبائية للسعال الديكي لدى الأطفال في بيشكيك، قيرغيزستان.

طرق البحث: جمعنا وحللنا بيانات عن 802 طفلا من سن الولادة حتى سن 14 عامًا من الأطفال الذي شُخِّصوا سريريًّا بالسعال الديكي، وأدخلوا المستشفى الجمهوري للأمراض المعدية السريرية، في بيشكيك بقيرغيزستان، خلال الفترة من فبراير/ شباط 2014 إلى فبراير/ شباط 2024.

النتائج: أكد اختبار تفاعل البوليميراز المتسلسل (PCR) لعينات الجهاز التنفسي أن جميع الأطفال مصابون بالبُورْديتيلَة الشَّاهوقِيَّة. ولم توجد أي حالة بُورْديتيلَة نَظيرَة الشَّاهوقِيَّة. ولاحظنا نمطًا دوريًّا واضحًا لمعدل الإصابة بالسعال الديكي خلال السنوات العشر، مع بلوغ ذروة كبيرة في عام 2018. وبين عامَي 2021 و2023، حدثت غالبية الحالات (60٪) في صفوف الرضع الذين تقل أعمارهم عن عام واحد. وكانت نسبة الأطفال غير المُلقَّحين 58.7٪، بينما كانت نسبة الذين لم يُكملوا تلقيحهم ضد الدفتيريا والتيتانوس وشلل الأطفال 41.3٪. وكانت الحالات الشديدة شائعة بين الرُّضع المصابين بأمراض مصاحبة، مثل فقر الدم ونقص التأكسج.

الاستنتاجات: تشير نتائجنا إلى أن معدل الإصابة بالسعال الديكي في ازدياد بين الأطفال في بيشكيك. ولذلك يلزم تعزيز جهود الوقاية، ومنها التوعية العامة والتثقيف، وتحصين الأطفال وتلقيح الأمهات، وتكثيف الكشف والتشخيص والعزل للحد من انتقال العدوى.

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