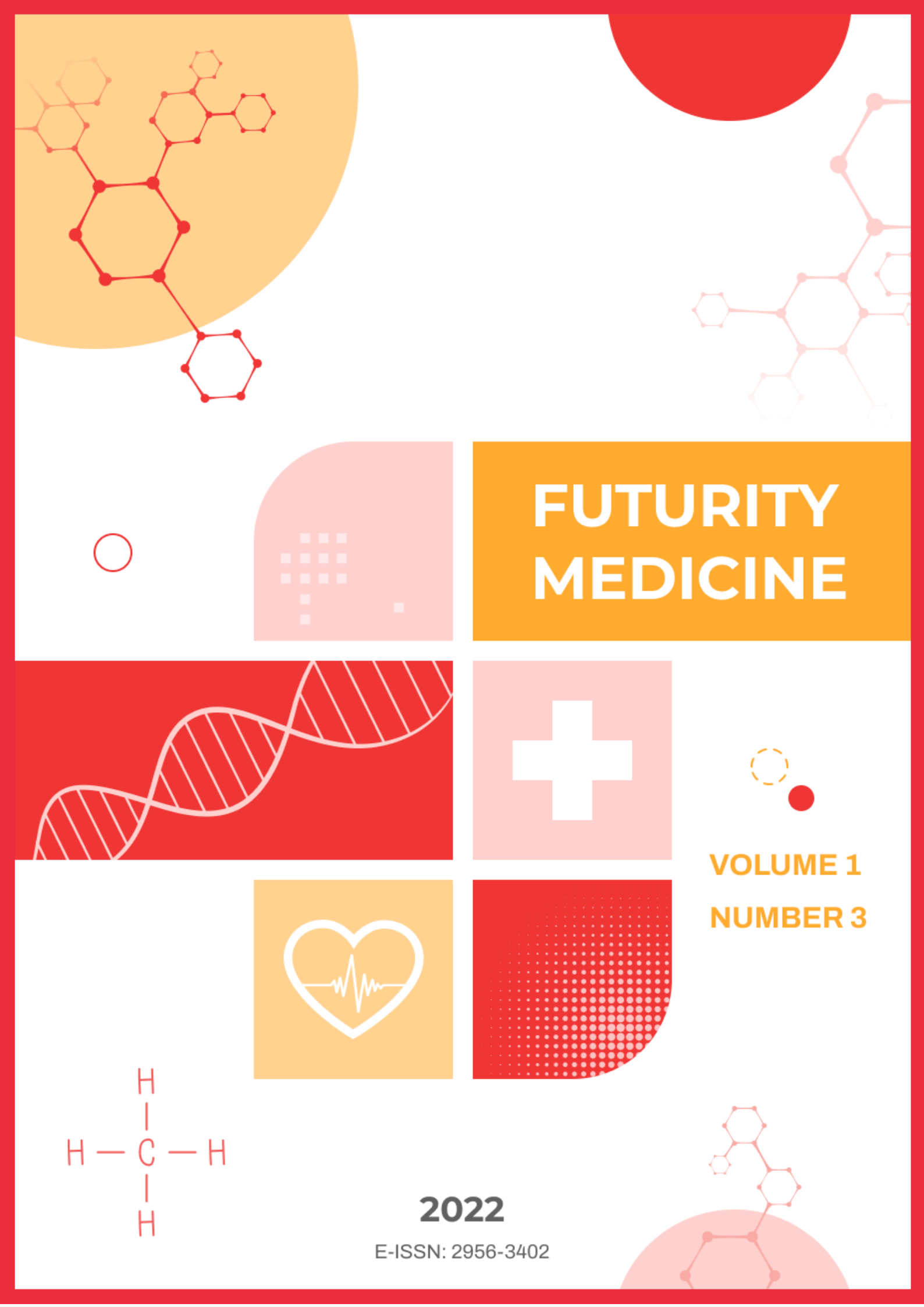
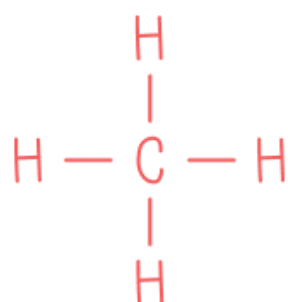




FUTURITY MEDICINE

VOLUME 1
NUMBER 3



2022

E-ISSN: 2956-3402

Futurity Medicine

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Futurity Medicine is multidisciplinary double-blind peer-reviewed open-access medical journal publishing articles in the fields of general medicine. Futurity Medicine encourages submissions from all authors throughout the world. The goal is to advance science and the scientific knowledge base in medicine.

<http://futurity-medicine.com/index.php/fm/about>

Publisher:

Futurity Research Publishing, Poland,
Lodz, STEFANA ŻEROMSKIEGO
street53, 90-625.
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Publication schedule

Futurity Medicine is published four times a year, on March 30, June 30, September 30 and December 30.

Type of publication: electronic

Country of publication: Poland

Date of Number: September 30, 2022

Futurity Medicine

Volume 1 number 3 2022

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Citation article: Sukhostavets N. Psycho-rehabilitation adaptation of pregnant women and mothers in the postpartum period who experienced traumatic events during the war. *Futur Med [Internet]*. 2022;1(3):4-11. Available from: <https://doi.org/10.57125/FEM.2022.09.30.01>

Psycho-rehabilitation adaptation of pregnant women and mothers in the postpartum period who experienced traumatic events during the war

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Abstract

Background: Primary care and mental health services for pregnant and postpartum moms are facing increased difficulties as a result of the war in Ukraine.

Objective: To review and identify the available literature and conduct a study in order to determine psychological rehabilitation adaptation of pregnant women and mothers in the postpartum period who experienced traumatic events during the war in Ukraine

Methodology: In order to assess the effects of this condition, data was gathered. The existence of risk factors, such as a change in lifestyle associated with being a refugee and rehabilitation, is the most important factor associated with PTSD in pregnant and postpartum moms.

Results: Observational studies suggest that the symptoms of PTSD may be improved by coping self-efficacy therapies.

Conclusion: Further study is required to examine these components in greater detail and to suggest additional rehabilitation strategies.

Keywords: war in Ukraine; pregnant women, new mothers, post-traumatic stress disorder.

Received: April 23, 2022

Revised: May 17, 2022

Accepted: July 8, 2022

Published: September 30, 2022

Introduction

Those who survive the horrors of war, or the abuse have an increased likelihood of developing trauma-spectrum conditions such as post-traumatic stress disorder or PTSD. Particularly, traumatic stress can contribute to abnormalities in the neuroendocrine system as well as the immunological system, which increases the likelihood of developing physical disorders. It's possible that traumatic events can have an influence not only on psychological but also on physiological aspects of the following generation; in other words, acute stress may have transgenerational repercussions [1]. Since the commencement of Russia's war against Ukraine on February 24, 2022, the majority of immigrants are women and children from all throughout Ukraine. The exact number of pregnant and postpartum women who are war refugees is still unclear. According to the UN Population Fund, around 265,000 Ukrainian women were expecting babies at the point of the war and 80,000 pregnant were expected to give birth during the next three months. There were 293,400 babies born in Ukraine in 2020 [2]. The

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DOI: <https://doi.org/10.57125/FEM.2022.03.25.04>

time from gestation to one year after giving birth is known as the perinatal period, and it is a delicate time. It is estimated that 1 in 5 women may have a perinatal mental illness [3, 4], with depression, emotional problems, and PTSD as the major diagnoses. The onset and recurring of psychological illnesses are high. The war trauma, along with the accompanying stress, worry, and instability, may have a variety of adverse reactions. Some of them may be long-lasting, for both women and their newborn children. According to the research conducted by Monk et al. [5], postpartum and pregnant women who are experiencing distress (which can be defined in regards to perceived anxiety, life situations, distress, and nervousness) have a greater likelihood of having an effect on the development of infant and fetal brain function. According to the research published by Marcos-Nájera et al. in 2020 and Monk et al. in 2019, maternal anxiety and high levels of maternal depression appear to raise the risk of probable mental illnesses even in children [5, 6]. In light of this justification, it is essential to increase the knowledge and comprehension of the factors that would contribute to meet the requirements of war refugee women in terms of their mental health throughout the pregnant and postpartum periods. The Riseup-PPD project is a Cost Action (18138) that was established by the Horizon 2020 Framework Program of the European Union. It was created with the intention of promoting guiding principles in the mental health of mothers during challenging circumstances. Despite the fact that Riseup-PDD was first designed for this reason, the program is still interested in exploring the needs and problems that women face during the per partum period, particularly in the face of unfavorable situations. This is the situation for Ukrainian women who are currently suffering as a direct result of the conflict in their country. As a consequence of this, Riseup-PDD has come together once more to provide their support to the aforementioned narrative review and to further the cause of promoting highly recommendable in perinatal psychological health [7].

Research Problem

Women who are pregnant and have been forced to leave their country exhibit a lot of reactive and personal worry. Responsive anxiety was 3.3 times greater and individual anxiety was 2.6 times higher in domestically displaced pregnant women compared to pregnant and postpartum moms who were not forcibly displaced [8]. According to the research, those who have experienced war are more likely to experience responsive and individual anxiety, depressive symptoms, postural instability, sleeplessness, and preterm labor [9]. Therefore this problem has been a sole focus of this project.

Research Focus

The purpose of this study is to provide an in-depth analysis of the most recent concerns and problems about prenatal psychological health in refugee women.

Research Aim

On the basis of this narrative review, the purpose of this project is to present a consensus regarding the main lines of action related to the assessment, intervention, and acclimatization of pregnant women and mothers in the postpartum period who suffered significant trauma during the war in Ukraine.

Research Questions

1. Which variables, both risk and preventive, have an effect on the mental health of pregnant women and new mothers during times of war?
2. What happens during labor and delivery, particularly, any potentially stressful incidents that may occur?
3. How are perinatal women's requirements for support and psychological rehabilitation services now being met in Ukraine and the host countries?

Research Methodology

General Background

The basic objectives of this narrative review are to firstly offer the author and the reader with a comprehensive overview of the topic and secondly to call attention to significant regions of study that have been conducted on the issue. Narrative reviews are useful tools for identifying issues with a study, as well as for helping to enhance and determine new areas for research. A narrative synthesis might give a first step in conducting an in-depth, methodical analysis of the data as well as organising it all in the appropriate mode. During the protocol stage, it was necessary to provide an explanation of the methods that were utilized in the process of carrying out the narrative synthesis. This is due to the fact that a narrative synthesis will be used to some degree, whether it be a significant or insignificant one, in an evaluation.

Instrument and Procedures

Methodical Approach to the Search engines

The literature search was conducted by using a variety of databases (for example, Medline, PubMed, and Google Scholar) with a combination of broad search terms, such as post-traumatic stress disorder OR prepartum ptsd symptoms OR post birth severe anxiety disorder AND treatment OR psychological rehabilitation AND refugee mothers AND forced to relocate pregnant women AND psychological health of refugee such as new mothers/ pregnant women AND support and services for refugees.

Inclusion and Exclusion Criteria

Only studies that fulfilled all of the parameters indicates below were taken into consideration for inclusion: 1) an examination of the pregnant women who have escaped Ukraine as refugees; 2) studies of immigrants who were randomly assigned to receive treatment for PTSD; 3) whole content presented in English language; 4) the disclosure of these risk factors has an influence on the psychological health of pregnant and postpartum moms; 5) the requirements of perinatal women for assistance and psychological rehabilitation.

Data Analysis

The method of performing the analysis of the data began with the screening of the relevant details as the first stage. The next phase was the organization of the information that was collected into a table, which was then followed by the conclusion of the study. The articles that had been chosen for further consideration were then analysed one at a time in order to determine the overall concept that most successfully shows the relevance of the research subject.

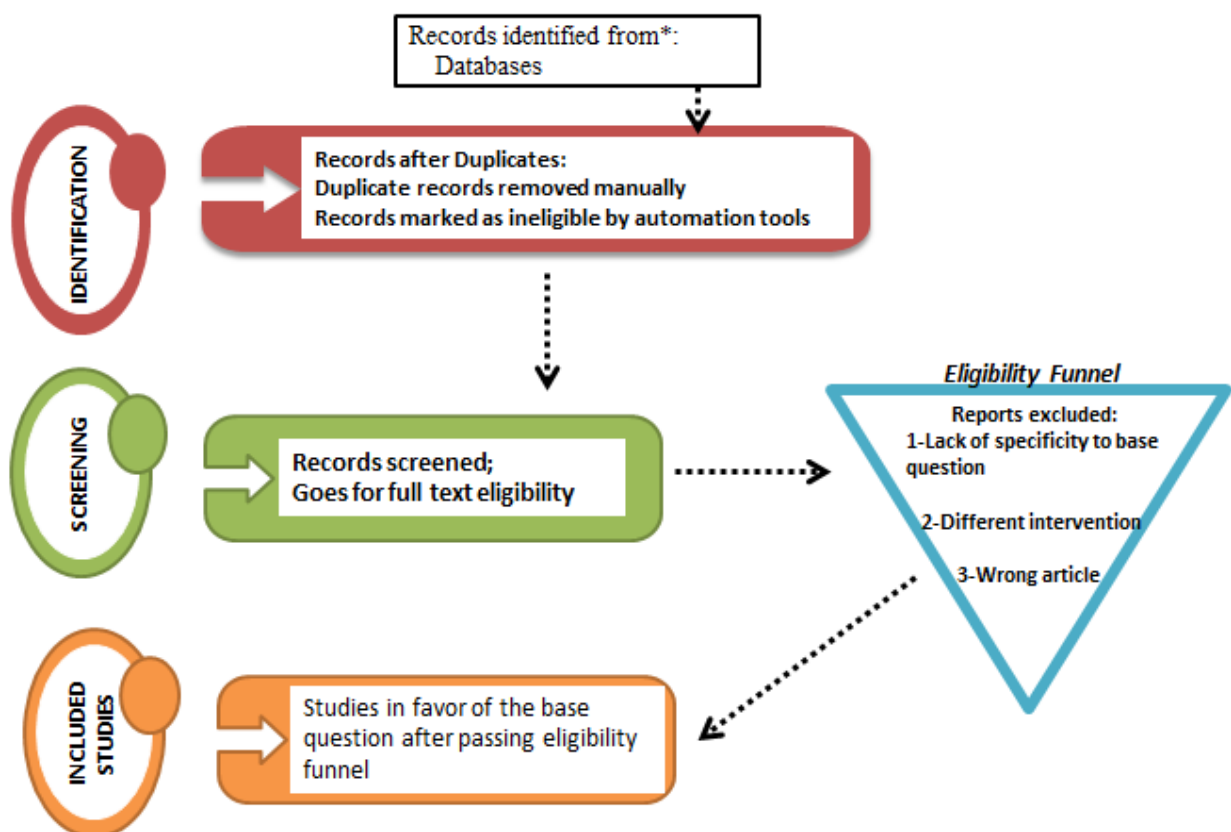


Figure 1. Graphical representation of extraction of information

Literature overview

The experience of war has a negative impact on maternal health due to stress levels and mental health. It is a factor that increases the likelihood of unfavourable outcomes during pregnancy and after delivery [10, 11]. There is a correlation between being exposed to war and having prematurely born babies and with a lower birth weight

[12, 13]. Yet, direct exposure to the war is directly correlated to an increased risk of premature delivery, stillbirth, and early termination of pregnancy. During times of war, for instance, exposure to harmful substances such as chemicals, radioactivity, exhaust fumes, tainted water, or food can frequently lead to undesirable results [10]. In addition, the availability of health care facilities and medicines may be severely restricted in a conflict zone. It can make it exceedingly challenging for pregnant women to keep their follow-up medical visits. In addition, it may be difficult to locate a physician or midwife in the host nation and to keep up with the necessary number of medical appointments. In general, emigration and status as a refugee are additional risk factors for clinical depression during pregnancy and after delivery [14]. According to the findings of a comprehensive study, the incidence of postpartum depression is significantly greater among migrant women, with rates that are 1.5 to 2 times higher compared to the overall population. Several earlier research [15, 16] also highlight additional major psychological issues such as post-traumatic stress disorders, depression, and psychosis as being more likely in immigrant and refugee women. The use of foreign methods, a lack of comprehension of available birthing alternatives, a lack of familiarity with technology, and difficulties communicating all contribute to the anxiety that refugee women experience during childbirth [17].

The prevalence of post-traumatic stress disorder (PTSD) was found to be 34.8% among pregnant women who had been forcibly displaced as a consequence of war in Ukraine [8], according to a study that was carried out in 2016 on a sample of pregnant women who had been displaced as a result of these operations. These women exhibited heightened indications of both responsive and personalized anxiety, as well as depressive symptoms, autonomic dysfunction, and sleeplessness [9]. According to the findings of a number of researchers [18], anxious and neurotic states are distinguished by high levels of both personal and reactive anxiety. The responsive anxiety is found to be 3.3 times more prevalent in pregnant women who've been internally displaced compared to pregnant women that weren't internally displaced, and individual anxiety is found to be 2.6 times more prevalent in pregnant women who were internally displaced compared to pregnant women that weren't forcibly displaced. For women who fell into this categorisation [9], the probability of having a pregnancy end prematurely and a greater specific weight of a variety of various somatic disorders were definitely factors that contributed to the difficult path that pregnancy and delivery took. Not just among communities who have been exposed to war may pregnancy and delivery provoke a recurrence of previously established mental health disorders or symptoms associated to previous traumatic experiences. For instance, Atzl et al. (2019) [19] found that early childhood trauma is connected with greater PTSD symptoms throughout pregnancy and after giving birth. This was found to be the case. Women who are refugees and have a history of experiencing trauma may already be carrying an additional weight. Existing mental health conditions are a risk factor for developing postpartum post-traumatic stress disorder (PTSD). According to the findings of a study carried out by van der Kolk (2014), persons who suffer from PTSD frequently do not seek therapy in order to shield themselves from upsetting memories [20]. According to the findings of other research [21], immigrant and refugee women have a difficult time obtaining the mental healthcare services they require. Although though everyone has access to medical care, these people frequently do not receive the treatment they require. Nevertheless, displaced Ukrainian war refugees face additional risk factors such as the loss of their previous way of life and their sense of safety, the separation from their partner or husband, the requirement to adapt to a new country and the possible difficulties that come along with it, the socioeconomic disadvantage, difficulties with communication due to language (for example, in the eastern part of Ukraine the Russian language was pervasive, whereas in the western part of Ukraine the most prevalent spoken language is Ukrainian), and fear regarding the future. The forced migration caused by the conflict may be distressing in many different ways, even for those who are not directly touched by it [7].

Research Results

When the inclusion criteria were taken into consideration, a total of 17 studies were found. Some studies shed light on the precarious situation that pregnant women find themselves in while they are migrants [22-26], while others emphasise the risk factors that are connected with it [11,27-33]. In the context of psychological rehabilitation and adaptation for pregnant women and new moms, a number of research have proposed the application of social cognitive theory in order to adjust the participants' behaviour in the event of a dispute [34-38]. (Table 1). But, in the future, there will need to be more research of this kind that are randomized and controlled to determine the requirements of pregnant women and mothers and to give the appropriate treatment for their emotional discomfort.

Table 1. The extracted information from screened studies

Highlight of the review	Extracted information from Analysis	References
As Vulnerable migrants	Every five women may acquire a mental problem during their pregnancy	[22, 23]

	Combat and relocation can damage mental health over time. Capacity for empathy and intuitive parenting can be weakened	[24, 25]
	28.2% are at an increased risk for postpartum depression	[26]
Risk factors of developing PTSD	Difficult pregnancy and delivery and bad birthing experiences	[11, 27]
	Armed warfare can also cause preterm birth and premature delivery	[11-13]
	Lack of medical professionals	[28]
	Adjustment to new lifestyle leads to elevated psychological distress.	[31-33]
	Perinatal consequences such as psychological health, maternal deaths, preterm delivery, and congenital anomalies are often more severe among migrant mothers	[29, 30]
Psychological rehabilitation adaptation	Social cognitive theory offers a helpful theoretical framework for analyzing psychological adaptability in people who have been exposed to traumatic experiences	[35]
	Subjective experience able to cope with exposure to possibly traumatic events	[36,37]
	Coping self-efficacy (CSE) works on individual behaviour	[36]
	Measurement of psychological adaptability for maintaining quality of life	[38]

Discussion

As Vulnerable migrants

Even in times when there is no active conflict, the perinatal period (which spans the time from pregnancy to the first year after the infant is delivered) is an especially precarious time. It is anticipated that one in every five women may acquire a mental problem during their pregnancy, which indicates that the risk of developing or experiencing a repeat of mental health issues during this time is rather significant [22, 23]. According to the research conducted by Chrzan-Dtko et al., 2022, the most common diagnoses are anxiety, posttraumatic stress disorder (PTSD), and depression. The effects of conflict and migration may be very harmful, especially for new mothers and their young children. According to a number of studies, stressful events like as war or relocating to an unfamiliar location can have long-term harmful consequences on mental health, leading to an increased risk of depression as well as post-traumatic stress disorder (PTSD) [24, 25].

Pregnant and postpartum moms have been identified as particularly vulnerable members of the migrant community by mental health professionals who specialise in working with refugees. This is because pregnant women and recent mothers are "in a precarious situation in a foreign country, when the sense of inner homelessness can easily develop, and the capacity for empathy and intuitive parenting can be weakened," according to the aforementioned professionals. For instance, according to a study that was conducted in Syria during the conflict revealed that a significant proportion of mothers (28.2%) are at an increased risk for postpartum depression [26].

Risk factors of developing PTSD

Difficult Pregnancy

It's also crucial to understand that conflict might raise the likelihood of a difficult pregnancy and delivery and bad birthing experiences [11, 27]. Armed warfare can also cause preterm birth and premature delivery [11-13]. Yet, direct combat exposure raises the risk of preterm births, infant deaths, and miscarriages. For contrast, being exposed to a hazardous environment with pollution, radiation, exhaust fumes, or war-contaminated water or food

might have harmful impacts [27]. Emerging studies have discovered that women who escaped from the war in Ukraine face significant modifications in their social position, including a loss of a choice of lifestyle, routine interaction with relatives and friends, economic difficulties, changes in perinatal healthcare coverage due to a lack of healthcare options, and having trouble finding a doctor or midwife who meets all their health needs [7]. These women also lack social support (friends, family) and are isolated as a result of their status as an immigrant (foreign refugee), which research has shown is a risk factor for numerous mental diseases during the postpartum period [28].

Adjustment in new lifestyle

The individual's ability to adjust to their new life within host nation is another aspect that might pose a threat to their mental health. According to Heslehurst et al. (2018), immigrants and undocumented immigrants in the host nation confront everyday challenges. Not understanding the native dialect and being inexperienced with the local way of life and health practices might cause additional burdens and hazards for mental and physical health. According to systematic reviews, perinatal consequences such as psychological health, maternal deaths, preterm delivery, and congenital anomalies are often more severe among migrant mothers [29, 30]. According to the findings of a research conducted in Germany, 87.4% of the pre- and postpartum migrants experienced medical difficulties or high-risk conceptions [31-33].

Psychological rehabilitation adaptation

It is imperative that measures be taken in order to protect and monitor prenatal mental health in reaction to the current war in Ukraine [34]. The social cognitive theory offers a helpful theoretical framework for analysing psychological adaptability in people who have been exposed to traumatic experiences [35]. The idea of coping self-efficacy (CSE), that refers to an individuals' behavioural capacity to deal successfully with obstacles in life, is ingrained in this theoretical framework. CSE refers to an individual's perceived capacity for dealing efficiently with life's obstacles [36]. The term "trauma-related cognitive and social adaptation" is used in the context of traumatic stress to refer to a subjective experience that they are able to cope with exposure to possibly traumatic events. This involves the handling of the event itself, of post - traumatic stress living difficulties, and of distress diagnoses, as well as the ability to resume one's regular life [36, 37]. The hypothesis proposes that trauma-related CSE may be used as a measurement of psychological adaptability, especially an individual's capacity for self-regulation and goal-directing [36]. It has been demonstrated that exposure to trauma related CSE is associated with decreased incidence of PTSD symptoms both immediately after an emotional event [35] and for up to ten years after a disaster [34, 38].

An eye to future

Primary care and psychological hospitals across Europe are facing additional difficulties because of the war in Ukraine. Creating a thorough characterization of psychological distress in this target population should be the first essential step. The most common mental illnesses in the perinatal period are depression and anxiety, but PTSD is a significant issue connected to the effects of war and migration as well [39, 40, 4]. It is imperative to carry out further study on the occurrence and treatment of mental health issues during the perinatal period. It would be beneficial to undertake preventative strategies to help expectant moms, but it may also have a very favourable effect on the children [41]. According to Tuovinen et al. (2020), a rise in inflammatory markers in the pregnant woman is substantially correlated with maternal sadness and anxiety. There is a larger chance of neurodevelopmental delay in the progeny because of these more biomarkers. It is true that mothers and new-borns are interrelated and that taking good care of one necessitates taking care of the other, even if the fetal programming concept is still being researched and the results are conflicting [42].

Conclusions and Implications

According to the findings of this research:

- 1- Any fifth woman may experience a mental health issue while pregnant.
- 2- Over time, relocation and war can harm mental health.
- 3- Difficult labour and delivery, as well as negative childbirth experiences can leads to PSTD.
- 4- Preterm birth and premature delivery can both result from war is the risk factor of PSTD.
- 5- Another risk factor of PSTD is the absence of medical personnel.
- 6- Elevated psychological anguish results from lifestyle changes that need adjustment.
- 7- In migrant mothers, perinatal effects like mental health, maternal mortality, premature birth, and foetal defects are frequently more severe.
- 8- A useful theoretical framework for examining psychological adaptation in individuals who have been exposed to traumatic situations is provided by social cognitive theory.

- 9- The ability of the subject to handle experience to potential war.
- 10- CSE (coping self-efficacy) influences personal conduct.
- 11- Psychological adaptation is a needed assessment for preserving the life quality.

Declarations

Author contributions: All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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Citation article: Kusainov A. Optimising anesthesia support during operations on the abdominal aorta and its branches. *Futur Med [Internet]*. 2022;1(3):13-24. Available from: <https://doi.org/10.57125/FEM.2022.09.30.02>

Optimising anesthesia support during operations on the abdominal aorta and its branches

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Abstract

Background: Pathology of the aorta includes aortic aneurysms, coarctation, dissection, atherosclerotic disease, and aortitis. The only two evidence-based treatment options for abdominal aortic repair are endovascular and open surgery. The anesthetic approach and medications may impact the outcomes of the surgical repair of the abdominal aorta and its branches.

Aim: to evaluate the use of various analgesic regimens and local, regional, or general anesthesia in "optimising" surgical outcomes in patients undergoing surgical repair of the abdominal aorta and its branches.

Methods: In this review, English studies from common databases such as Pubmed/MEDLINE, Google Scholar, Web of Science, Scopus, and the Cochrane Library with the keywords "Abdominal aorta," "operations," "aortic branches," combined with keywords, involving "anesthesia were involved." The end date for this review was November 2022.

Scientific novelty: Recent scientific studies have focused on the use of advanced monitoring technologies such as cerebral oximetry and microdialysis to improve the safety and efficacy of anesthesia management in aortic surgery. These technologies provide more accurate and real-time information about cerebral perfusion and metabolism, allowing the anesthesiologist to identify and manage potential complications such as cerebral ischemia more effectively. Additionally, the use of pharmacological agents such as dexmedetomidine and remifentanyl has been shown to reduce the risk of postoperative delirium and cognitive dysfunction, further improving patient outcomes.

Conclusion: Aortic surgery is a complex and high-risk procedure that requires careful management of anesthesia to ensure patient safety and optimal outcomes. With ongoing advances in anesthesia techniques and monitoring technologies, there is reason to be optimistic about the future of aortic surgery and the prospects for improved patient outcomes. The anesthesiologist plays a critical role in this process, working closely with the surgical team to provide safe and effective anesthesia throughout the procedure and ensuring that the patient receives appropriate pain management and other supportive care in the postoperative period

Keywords: aorta, abdominal aorta, aneurism, anesthesia, surgical repair.

Received: May 16, 2022

Revised: June 2, 2022

Accepted: August 18, 2022

Published: September 30, 2022

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DOI: <https://doi.org/10.57125/FEM.2022.09.30.02>

Introduction

The abdominal and thoracic parts of the aorta are often separated from one another. As the abdominal aorta connects the diaphragm to the aortic bifurcation, the thoracic aorta divides into the ascending, aortic arch, and descending types [1]. Abdominal aortic disease is more likely in people with particular conditions and genetic factors, such as polycystic kidney disease, Turner's syndrome, bicuspid aortic valve, Ehlers-Danlos syndrome, and Marfan syndrome [2,3]. The caudal half of the body and important abdominal organs depend on the integrity of the abdominal aorta, a significant circulatory structure, to survive and function. The end organs may exhibit either an acute or chronic disease when there is a subtle irregularity in the abdominal aorta and its branches [4–6]. Many disorders can affect the abdominal aorta; some more prevalent ones are atherosclerosis, dissections, aneurysms, and aorto-arteritis.

An abdominal aortic repair is a primary surgical treatment used to treat an aortic condition [7]. While the endovascular placement of an aortic stent graft is graded as an intermediate-risk intervention with a cardiac risk between 1% and 5%, the open aortic repair was classified as a high-risk intervention (defined as carrying a risk of cardiovascular death or myocardial infarction of 5% or more within 30 days) [8–10]. The most prevalent complications associated with surgical repair of the abdominal aorta are bleeding, ischemic colitis, acute renal failure, thrombosis of Vein Grafts, distal embolisation, pseudoaneurysm formation, infection, neurologic deficits, aortocaval and aorto-enteric fistulae, sexual dysfunction, ureteral obstruction, perigraft seroma and chylous ascites [11,12]. So the surgical repair of abdominal aorta has so many risks and needs experienced surgeons, radiologists, and anesthesiologists. One of the key challenges in aortic surgery is maintaining hemodynamic stability during the procedure. This requires close monitoring of blood pressure, heart rate, and cardiac output and careful management of fluid and electrolyte balance. The anesthetic support and the type of anesthesia are important in reducing these risk factors and decreasing mortality and morbidity rates.

The main objectives of intraoperative anesthetic management are: (a) hemodynamic stability; preservation of perfusion to vital organs, such as the brain, heart, kidney, spinal cord, and splanchnic vessels; (b) avoidance of an imbalance in the oxygen supply and demand of the myocardium; (c) maintenance of intravascular volume; and (d) normothermia. Excellent surgical conditions are provided by general anesthesia combined with muscular relaxation and artificial ventilation [13,14]. All forms of spinal anesthesia are suitable for the endovascular placement of an aortic stent graft, including epidural, combination spinal and epidural, and continuous spinal.

Research focus

This review focuses on assessing the utilisation of general anesthesia and different regimens of analgesics to reduce the complications associated with the surgical repair of the abdominal aorta and its branches.

Research problem

Cardiovascular and pulmonary comorbidities are frequently present in patients undergoing operative repair of the abdominal aorta and its branches. It can enhance the severity and frequency of the complications above. Using anesthesia and analgesia as effectively as possible is crucial in the probability of complications decrease.

Research questions

1. What are the indications of surgical renovation of the abdominal aorta and its branches?
2. What are the complications of surgical reparation of the abdominal aorta and its branches?
3. What is the best way to use anesthesia to repair the abdominal aorta and its branches surgically?

Research aim

This review aims to evaluate the use of various analgesic regimens and local, regional, or general anesthesia in "optimising" surgical outcomes in patients undergoing surgical reparation of the abdominal aorta and its branches.

Research Methodology

General background

Patients with indications for abdominal aortic aneurysm (AAA) repair but unfavorable anatomy for endovascular aortic repair are treated with open aortic surgery. Even when the management of bleeding is initially achieved by an endovascular procedure, open aortic surgery is still required to manage aortic thrombosis or repair an aortic rupture for any reason (such as a traumatic rupture, ruptured AAA, or ruptured aortic dissection). The site of the cross-clamp application, the intravascular volume, the anesthetic approach and medications used, the surgical pathology, the preoperative myocardial function, and coronary circulation will all impact the hemodynamic effects of aortic cross-clamping. An abrupt aortic cross-clamping is expected to result in decreased velocity and shortening

of myocardial muscle fibers and increased afterload, reduced preload, and lowered impedance to ventricular ejection.

No anesthetic method or technique is suitable for all patients undergoing aortic vascular surgery. There is much debate about using inhalational versus opioid anesthesia, regional with general anesthesia, and isoflurane in patients with coronary artery disease. The anesthetic substances and procedures selected should guarantee a smooth induction of anesthesia, a positive cardiovascular dose-response relationship that protects the sensitive myocardial oxygen supply/demand balance, appropriate muscular relaxation with intra-operative analgesia, and amnesia. Nitrous oxide/oxygen with the incremental volatile agent or opiate supplementation; opiate-oxygen or an opiate-oxygen-volatile agent combination with or without regional anesthesia are the anesthetic technique options.

In our review, English studies from common databases such as Pubmed/MEDLINE, Google Scholar, Web of Science, Scopus, and the Cochrane Library with the keywords were involved "Abdominal aorta," "operations," "aortic branches," combined with keywords, involving "anesthesia." The end date for this review is November 2022. The studies using each set of keyword combinations were then pooled to create an impartial collection of publications. Studies and/or articles that weren't subjected to peer review, as well as proposals, procedures, letters, and opinions, were eliminated. The references include publications that were chosen because they are related to our topic. This paper focused on optimising anesthesia support during operations on the abdominal aorta and its branches.

Statistical analysis

In this review, the results of previous trials and retrospective studies that tried to evaluate the use of various analgesic regimens and local, regional, or general anesthesia in "optimising" surgical outcomes in patients undergoing surgical repair of the abdominal aorta and its branches were gathered and compared. So, any statistical analysis methods were not used, nonetheless conclusions were made by comparing these results.

Research Results | Literature review

The result of the search using the given search strategy was 6109 articles. These articles were screened to choose the articles related to the topic. A full-text screening of 347 articles after excluding the remaining article by title and abstract screening was accomplished. Finally, 52 articles were used in order to gather information about the topic and write this review (Figure 1).

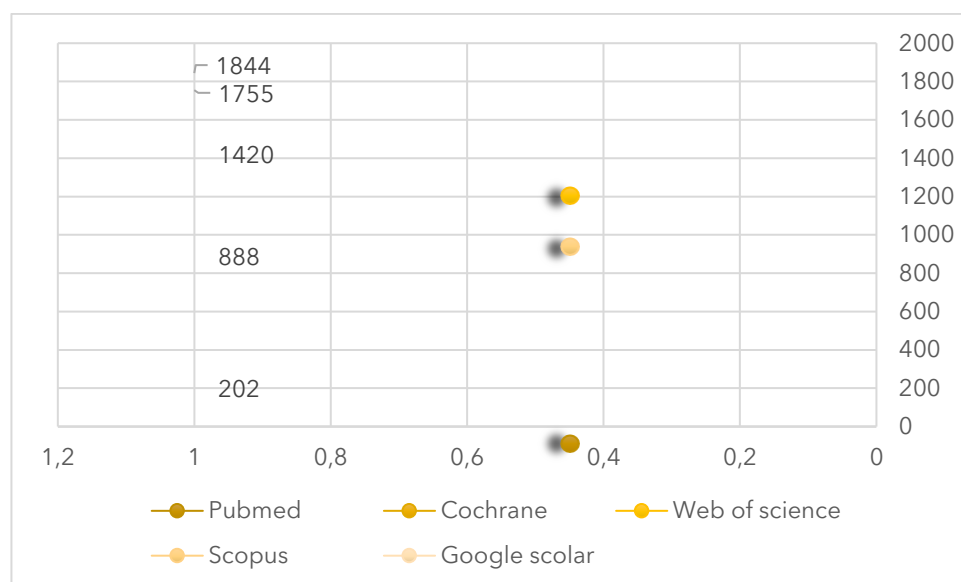


Figure 1. Research results

Abdominal aorta

The main artery in a person's body is the aorta. The ascending aorta is formed by a blood vessel that emerges from the heart's left ventricle. In order to create the aortic arch and the thoracic aorta, it loops inferiorly and passes through the thorax [15]. The abdominal aorta, which is appropriately named, finally divides into the common iliac arteries in the lower abdomen after crossing the diaphragm into the abdomen. The arterial branches that are

responsible for delivering oxygen-rich blood to all of the body's tissues are created along the route by the aorta. All of the body's arteries emerge from the aorta, which is the primary source of oxygenated blood before they proceed distally to their target tissues [16,17]. Major arterial branches from the aorta include the left and right coronary arteries, left common carotid, brachiocephalic, celiac trunk, left subclavian, left and right renal, superior mesenteric, inferior mesenteric, gonadal, right and left common iliac arteries, and median sacral [18] Figure 2.

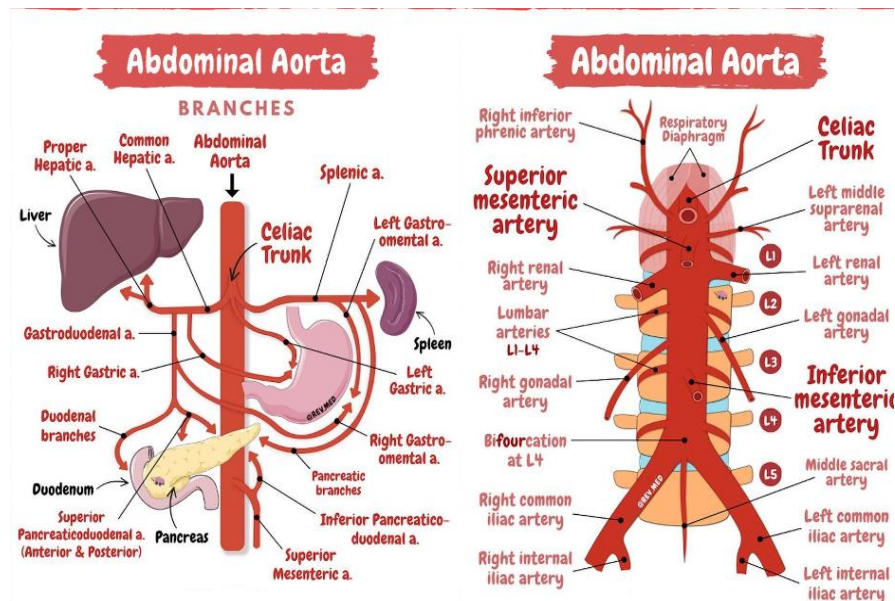


Figure 2. Anatomy of the abdominal aorta and its branches [25].

The inferior and superior mesenteric arteries supply the hindgut and midgut, respectively, while the celiac trunk mostly nourishes the foregut. The inferior phrenic, middle gonadal, suprarenal, median sacral, and lumbar arteries are a few other prominent abdominal aorta branches [19]. It's vital to remember that the inferior suprarenal arteries come from the renal arteries, whereas the superior suprarenal arteries come from the inferior phrenic arteries. The vasa vasorum, a system of small blood vessels, supplies the aorta [20]. Because of the increased oxidation and inflammation rates in the aortic walls caused by the decrease in vasa vasorum, the infrarenal abdominal aorta is more likely to develop an aneurysm. After vascular supply comes lymphatic drainage [21]. Most of the abdomen and lower extremities send lymphatics to the cisterna chyli, which is directly below the diaphragm's aortic hiatus. The thoracic duct then allows lymph to advance superiorly. The aorta is a very sensitive blood vessel following trauma or other sorts of medical problems because it receives so much blood. The aorta can lose most of the body's blood volume in a few minutes if it is separated or burst, resulting in death. The aorta, the largest blood vessel in the body, serves as a conduit for all blood leaving the heart that isn't headed directly for the heart. Blood is carried via the abdominal aorta to the legs and feet in addition to the organs in the abdominal cavity. The aorta also aids in blood pressure regulation by expanding and contracting as required. The autonomic nervous system's components are principally responsible for innervating the aorta. The parasympathetic and sympathetic nerves closely follow the aorta descent into the abdomen. These nerves group to form plexuses like the celiac, inferior, and superior mesenteric [22]. Vasoconstriction results from the activation of alpha-1 receptors in response to decreased blood pressure. Vasodilation results from the activation of beta-2 receptors. The tunica intima, tunica media, and tunica adventitia are the three layers that make up the wall of the aorta. The internal elastic lamina, which encircles the tunica intima's innermost layer, is lined by a single layer of endothelial cells [23]. The tunica media, which is the middle layer, comprises fibroblasts, collagen, elastin, and smooth muscle cells. These elements use signals from the autonomic nervous system to regulate vasoconstriction and vasodilation [24]. Tensile strength and resistance to the pulsatile character of the circulation are provided by elastin fibers found in the media of the aorta. The outer part of the adventitia is a thin layer of fibroblasts, vasa vasorum, and connective tissue.

Physiological variants

Medical professionals, especially radiologic and surgical professionals, must be aware of the anatomic diversity of the aorta and its branches. To help with care, the doctor should be able to identify the numerous physiological aorta variances on imaging and correlate them with clinical symptoms [26]. Although magnetic resonance imaging (MRI) is typically regarded as the optimum method for imaging the aortic arch and its arterial branching pattern, anomalies are frequently detectable on computed tomography (CT), particularly CT angiography. Right-sided

cardiac apex, also known as dextrocardia, is a condition [27]. In a solitary case of dextrocardia of embryonic arrest, the heart is simply positioned more to the right than is normal. The physiologic variation of the aortic arch that is most frequently found is a bovine arch [28]. A common origin between the left common carotid artery and the brachiocephalic artery causes it. When the right subclavian artery emerges distal to the left subclavian artery and hooks back to reach the right side, it forms an aberrant right subclavian artery known as arteria lusoria [29]. Innominate artery compression syndrome happens when the brachiocephalic trunk (innominate artery) is positioned anterior to the trachea and further to the left than usual, compressing the artery. Up to 45% to 65% of patients undergoing vascular ring repair have a double aortic arch (DAA) [30]. There are numerous subtypes, but all of them frequently cause compression because the ascending aorta divides into two vessels that pass on either side of the esophagus and trachea.

Diseases of the abdominal aorta

There are several diseases of the aorta that may require surgery, including:

Aortic aneurysm:

A bulge or swelling in the wall of the aorta that can rupture and cause life-threatening bleeding. Aortic aneurysm is a condition where the aorta, the largest artery in the body, becomes enlarged and weakened. This can lead to a potentially life-threatening rupture if left untreated. There are two main types of aortic aneurysms: abdominal aortic aneurysms (AAA) and thoracic aortic aneurysms (TAA) [31]. Abdominal aortic aneurysms occur in the lower part of the aorta, in the abdomen. They are more common in men over the age of 65 and in people who smoke or have high blood pressure. Thoracic aortic aneurysms occur in the upper part of the aorta, in the chest. They are less common than AAA but can be more dangerous because they are closer to the heart and can affect the blood supply to vital organs [32]. Symptoms of aortic aneurysm may not be present until the aneurysm has grown large enough to cause problems. Symptoms can include chest or back pain, shortness of breath, coughing, hoarseness, difficulty swallowing, and a pulsing sensation in the abdomen. If you experience any of these symptoms, it is important to seek medical attention immediately. The most common symptom of aortic aneurysm is a pulsating sensation in the abdomen or chest. This sensation may be accompanied by pain or discomfort in the affected area. In some cases, the pain may radiate to other parts of the body, such as the back or legs. The pain may be severe and sudden, or it may be dull and persistent. Other symptoms of aortic aneurysm may include: Swelling: Aortic aneurysm can cause swelling in the legs or feet. And Rapid heartbeat: The heart may beat faster than normal in response to the increased workload caused by the aneurysm.

The most common method of repairing an aortic aneurysm is through surgery. The type of used surgery depends on the location and size of the aneurysm [33]. For AAA, the most common surgical procedure is called an endovascular repair. This involves inserting a stent graft, a small metal mesh tube, into the aorta through a small incision in the groin. The stent graft is then guided up to the aneurysm and expanded, creating a new path for blood flow and relieving pressure on the weakened aortic wall. Endovascular repair has several advantages over open surgery such as shorter hospital stays, less pain, and faster recovery times. However, not all patients are suitable candidates for endovascular repair and the decision to undergo this procedure should be made in consultation with a vascular surgeon. For TAA, open surgery is often required. This involves making a large incision in the chest or abdomen to access the aneurysm. The weakened section of the aorta is then replaced with a synthetic graft. This procedure is more invasive than endovascular repair and requires a longer recovery time, but it may be necessary for larger or more complex aneurysms [34]. In some cases, aortic aneurysms may be monitored without surgery if they are small and not causing symptoms. This involves regular imaging tests to track the size and growth of the aneurysm. Lifestyle changes such as quitting smoking, managing blood pressure, and maintaining a healthy weight can also help slow the growth of an aneurysm and reduce the risk of rupture.

Both open surgery and endovascular repair have their advantages and disadvantages. Open surgery has been used for many years and has proven to be effective in managing aortic aneurysms. However, it is more invasive than endovascular repair and requires longer hospital stays and recovery times. The choice between open surgery and endovascular repair depends on several factors including age, overall health status, anatomy of the aneurysm, location of the aneurysm, and the patient's preference. A team of specialists including vascular surgeons, cardiologists, and radiologists will evaluate each patient's case and determine the best course of treatment. [35]. In conclusion, aortic aneurysm is a serious condition that requires prompt medical attention. Surgery is the most common method of repair, with endovascular repair being the preferred option for AAA and open surgery for TAA. Regular monitoring and lifestyle changes can also help manage the condition and reduce the risk of complications.

Aortic dissection

A tear in the inner layer of the aorta that can lead to a separation of the layers of the aortic wall, causing blood to flow between them and potentially leading to rupture. This can cause the aorta to weaken and potentially

rupture, leading to life-threatening complications. Aortic dissection is a medical emergency that requires prompt diagnosis and treatment [36]. Symptoms of aortic dissection can include sudden and severe chest or back pain, shortness of breath, sweating, nausea, vomiting, and fainting. These symptoms can be similar to those of a heart attack, so it is important to seek medical attention immediately if you experience any of them. The treatment of aortic dissection depends on the location and severity of the tear [37]. In some cases, medication may be used to control blood pressure and reduce the risk of further tearing. However, surgery is often required to repair the damaged aorta. The most common surgical procedure for aortic dissection is called aortic root replacement. This involves removing the damaged section of the aorta and replacing it with a synthetic graft. The procedure is performed under general anesthesia and requires a large incision in the chest or abdomen [38]. Recovery time can vary depending on the extent of the surgery and the patient's overall health. Another surgical option for aortic dissection is endovascular repair. This involves inserting a stent graft, a small metal mesh tube, into the aorta through a small incision in the groin. The stent graft is then guided up to the site of the tear and expanded, creating a new path for blood flow and relieving pressure on the weakened aortic wall [39]. Endovascular repair is less invasive than aortic root replacement and may be a better option for patients who are not good candidates for open surgery.

In some cases, a combination of surgical and medical treatment may be used to manage aortic dissection. This can include medication to control blood pressure and reduce the risk of further tearing, as well as surgery to repair the damaged aorta. In conclusion, aortic dissection is a serious medical condition that requires prompt diagnosis and treatment. Surgery is often required in order to repair the damaged aorta, with aortic root replacement and endovascular repair being the most common methods of repair [40]. A combination of surgical and medical treatment may be used to manage the condition and reduce the risk of complications. If you experience symptoms of aortic dissection, seek immediate medical attention.

Coarctation of the aorta

Coarctation of the aorta is a congenital heart defect that occurs when the aorta, the main artery that carries blood from the heart to the rest of the body, is narrowed or constricted. This narrowing can cause high blood pressure and other complications. Coarctation of the aorta is typically diagnosed in childhood, but it can also be diagnosed in adulthood [41]. Symptoms of coarctation of the aorta can include high blood pressure, headaches, chest pain, shortness of breath, and leg cramps. In some cases, there may be no symptoms at all.

The treatment of coarctation of the aorta depends on the severity of the narrowing and the age of the patient. In some cases, medication may be used to control blood pressure and reduce the risk of complications [42]. However, surgery is often required to repair the narrowed section of the aorta. The most common surgical procedure for coarctation of the aorta is called aortic coarctation repair. This involves removing the narrowed section of the aorta and reconnecting the two healthy ends of the artery. The procedure is typically performed under general anesthesia and requires a large incision in the chest or abdomen [43]. Recovery time can vary depending on the extent of the surgery and the patient's overall health.

Another surgical option for coarctation of the aorta is endovascular repair. This involves inserting a stent, a small metal mesh tube, into the narrowed section of the aorta through a small incision in the groin. The stent is then expanded, creating a new path for blood flow and relieving pressure on the narrowed section of the aorta. Endovascular repair is less invasive than aortic coarctation repair and may be a better option for some patients. In some cases, a combination of surgical and medical treatment may be used to manage coarctation of the aorta [44]. This can include medication to control blood pressure and reduce the risk of complications, as well as surgery to repair the narrowed section of the aorta.

In conclusion, coarctation of the aorta is a congenital heart defect that requires prompt diagnosis and treatment [45]. Surgery is often required to repair the narrowed section of the aorta, with aortic coarctation repair and endovascular repair being the most common methods of repair. A combination of surgical and medical treatment may be used to manage the condition and reduce the risk of complications. If you or your child experience symptoms of coarctation of the aorta, seek immediate medical attention.

Anesthetic implications of aortic surgery

Aortic surgery is a complex and high-risk procedure that requires careful management of anesthesia to ensure patient safety and optimal outcomes. In recent years, there have been significant advances in anesthesia techniques and monitoring technologies that have improved the safety and efficacy of aortic surgery.

One of the key challenges in aortic surgery is maintaining hemodynamic stability during the procedure. This requires close monitoring of blood pressure, heart rate, and cardiac output and careful management of fluid and

electrolyte balance. In addition, the use of advanced monitoring technologies such as transesophageal echocardiography (TEE) and near-infrared spectroscopy (NIRS) can help to identify and manage potential complications such as hypotension, hypoxia, and cerebral ischemia.

Another important consideration in aortic surgery is the choice of anesthesia technique. General anesthesia is typically used for aortic surgery, but there is ongoing debate about the relative merits of different approaches such as total intravenous anesthesia (TIVA) versus inhalational anesthesia [46,47]. TIVA has been shown to reduce the risk of postoperative delirium and cognitive dysfunction, but may be associated with longer recovery times and higher costs.

In addition to these technical considerations, there are also important ethical and legal issues to consider in aortic surgery. For example, the use of deep hypothermic circulatory arrest (DHCA) may be necessary in some cases to facilitate surgical repair of the aorta, but this technique carries significant risks of neurological injury and other complications [48]. As such, it is important for anesthesiologists to carefully weigh the risks and benefits of DHCA and other advanced techniques in consultation with the surgical team and the patient.

Looking to the future, there is ongoing research into new anesthesia techniques and monitoring technologies that may further improve the safety and efficacy of aortic surgery [49]. For example, the use of pharmacological agents such as dexmedetomidine and remifentanyl may help to reduce the risk of postoperative delirium and cognitive dysfunction, while new monitoring technologies such as cerebral oximetry and microdialysis may provide more accurate and real-time information about cerebral perfusion and metabolism.

In conclusion, anesthesia for aortic surgery is a complex and challenging area of practice that requires careful attention to technical, ethical, and legal considerations. With ongoing advances in anesthesia techniques and monitoring technologies, however, there is reason to be optimistic about the future of aortic surgery and the prospects for improved patient outcomes.

Discussion

The anaesthesia management in aortic surgery is complex and requires careful planning and execution. The anaesthesiologist must ensure that the patient is stable throughout the procedure and that the surgical team has adequate access to the aorta. The anaesthesiologist must also monitor the patient's vital signs and adjust the anaesthesia as needed to maintain the patient's comfort and safety. One of the primary concerns during aortic surgery is maintaining adequate blood pressure. The aorta is a large artery that carries a significant amount of blood flow. During surgery, the aorta may be clamped or partially occluded, which can cause a decrease in blood pressure. The anaesthesiologist must carefully monitor the patient's blood pressure and adjust the anaesthesia as needed to maintain adequate perfusion to vital organs. Another concern during aortic surgery is the risk of bleeding. The aorta is a highly vascular structure, and any injury to it can cause significant bleeding. The anaesthesiologist must ensure that the patient's blood clotting factors are normal and may need to administer blood products if bleeding occurs.

In addition to the blood pressure and bleeding monitoring, the anaesthesiologist must also consider other factors during aortic surgery. These may include the patient's medical history, medications, allergies, and any other medical conditions that may affect the patient's response to anaesthesia.

Tanaka et al. [50] investigated the anesthetic management of an abdominal aortic aneurysmorrhaphy in Klippel-Trenaunay-Weber syndrome. They described that the secure anaesthesia care should be provided to a patient with Klippel-Trenaunay-Weber syndrome who experienced an abdominal aortic aneurysm surgery. The aortic cross-clamping may not adequately stop the blood flow in these patients because there are so many aberrant collateral arteries. As a result, significant bleeding following aortic cross-clamping may occur, as in the current instance, necessitating a greater number of spaced blood transfusions than during a typical AAA treatment. Therefore, the management of anaesthesia by anesthesiologists should take this risk into account.

Gelzinis et al. [51] studied the postoperative anesthetic management for AAA. They stated that these patients often get postoperative management in the critical care unit, where the patient may be carefully observed. The treatment of these patients' hypertension by continuing preoperative antihypertensive regimens, which may include beta-blockers, optimising pulmonary function through the use of inhaled bronchodilators, incentive spirometry, and early extubation, providing analgesia either through regional or parenteral analgesia, and monitoring for bleeding, bowel, and renal dysfunction are all part of their management. Nephrotoxins should be avoided, and enough renal perfusion can be maintained by drinking plenty of fluids and using inotropic medications during endovascular Aneurysm Repair.

Kothandan et al. [52] studied the anesthetic considerations for endovascular abdominal aortic aneurysm repair (EVAR). They concluded that although EVAR was linked to a reduction in short-term mortality, these benefits did

not hold true during intermediate and long-term follow-ups. Major comorbidities are more common in patients receiving EVAR, hence full preoperative evaluation and optimisation should take place in multidisciplinary settings before the treatment. Simple infrarenal EVAR should be distinguished from complicated suprarenal EVAR, which has a greater perioperative risk. The process of getting ready for anaesthesia should be done with the knowledge that significant haemorrhage is a possibility and that switching to an open procedure might happen at any time.

Anaesthesia management in aortic surgery is a critical aspect of the overall patient care. Aortic surgery involves the aorta repair or replacement, which is the largest artery in the human body. The aorta carries oxygenated blood from the heart to the rest of the body. Aortic surgery can be performed for a variety of reasons, including aneurysms, dissections, and traumatic injuries. The anaesthesia management in aortic surgery is complex and requires careful planning and execution. The anaesthesiologist must ensure that the patient is stable throughout the procedure and that the surgical team has adequate access to the aorta. The anaesthesiologist must also monitor the patient's vital signs and adjust the anaesthesia as needed to maintain the patient's comfort and safety. One of the primary concerns during aortic surgery is maintaining adequate blood pressure. The aorta is a large artery that carries a significant amount of blood flow. During surgery, the aorta may be clamped or partially occluded, which can cause a decrease in the blood pressure. The anaesthesiologist must carefully monitor the patient's blood pressure and adjust the anaesthesia as needed to maintain adequate perfusion to vital organs. This is particularly important during the clamping and unclamping of the aorta, which can cause significant changes in the blood pressure. The anaesthesiologist must carefully titrate vasoactive drugs such as phenylephrine or nitroglycerin to maintain stable blood pressure levels while avoiding excessive vasoconstriction or vasodilation.

Another important consideration in anesthesia management during aortic surgery is ensuring adequate myocardial protection. The heart may be exposed to ischemia-reperfusion injury during periods of aortic cross-clamping or unclamping. To minimise this risk, the anesthesiologist may administer cardioprotective agents such as adenosine or lidocaine.

Another concern during aortic surgery is the risk of bleeding. The aorta is a highly vascular structure, and any injury to it can cause significant bleeding. The anaesthesiologist must ensure that the patient's blood clotting factors are normal and may need to administer blood products if bleeding occurs. In addition to monitoring blood pressure and bleeding, the anaesthesiologist must also consider other factors during aortic surgery. These may include the patient's medical history, medications, allergies, and any other medical conditions that may affect the patient's response to anaesthesia.

There are several different types of anaesthesia that may be used during aortic surgery. These may include general anaesthesia, regional anaesthesia, or a combination of both. General anaesthesia involves the use of medications in order to induce unconsciousness and prevent pain during the procedure. Regional anaesthesia involves the injection of medication near the nerves that supply the surgical site, which can provide pain relief without the need for general anaesthesia.

Conclusion

1. Aortic surgery is a complex and high-risk procedure that requires careful management of anesthesia to ensure patient safety and optimal outcomes.
2. The anesthesiologist plays a critical role in the management of aortic surgery, working closely with the surgical team to provide safe and effective anesthesia throughout the procedure.
3. Maintaining hemodynamic stability is a key challenge in aortic surgery, requiring close monitoring of blood pressure, heart rate, and cardiac output, as well as careful management of fluid and electrolyte balance.
4. Advanced monitoring technologies such as TEE and NIRS can help to identify and manage potential complications such as hypotension, hypoxia, and cerebral ischemia, allowing the anesthesiologist to intervene quickly and effectively to prevent further harm to the patient.
5. The choice of anesthesia technique is an important consideration in aortic surgery, with TIVA and inhalational anesthesia being the most commonly used approaches.
6. Ethical and legal issues must also be considered in aortic surgery, particularly with regard to the use of advanced techniques such as DHCA, which carries significant risks of neurological injury and other complications.
7. With ongoing advances in anesthesia techniques and monitoring technologies, there is reason to be optimistic about the future of aortic surgery and the prospects for improved patient outcomes. The anesthesiologist plays a critical role in this process, working closely with the surgical team in order to provide safe and effective anesthesia throughout the procedure and ensuring that the patient receives appropriate pain management and other supportive care in the postoperative period.

Declarations

Author contributions

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding

No funding source is reported for this study.

Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

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Citation article: Hussain N. The correlation between risk factors of COVID-19 and nervous system damage: Pakistan based Analysis. *Futur Med [Internet]*. 2022;1(3):25-34. Available from: <https://doi.org/10.57125/FEM.2022.09.30.03>

The correlation between risk factors of COVID-19 and nervous system damage: Pakistan based Analysis

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Abstract

Aims: This narrative review's main objectives are to give the idea thorough COVID-19 and neurological diseases overview as well as to request a significant attention to important research areas that are closely related to the topic.

Methodology: "Coronavirus SARS/ COVID-19/ SARS-CoV-2," "neurology," "mechanism," "neuroinvasion," "neuron damage," "myopathy," "neuromuscular," "central nervous system," and "CNS" were used to search Medline, PubMed, and Google Scholar.

Results: highlights a number of significant findings, some of which consist of the detection of SARS-CoV-2 genome RNA in the cerebrospinal fluid, a probability for immediate infection of the central nervous system, penetrating to the brain's cortex via the olfactory nerve, as well as the implication of the peripheral nervous system in neurological disorders that are associated with COVID-19. Pakistani studies that found substantial neurological adverse responses in 23% of COVID-19 participants, the most prevalent from them were headaches and insomnia.

Scientific Novelty: Provide a deep overview of previous researches in order to find the link between COVID-19 and neurological diseases.

Conclusion: The link between COVID-19 and nervous system symptoms development during the pandemic is supported by neurological manifestations, which in accordance with studies are addressing the cerebral involvement of SARS-CoV and MERS-CoV. It is probable that the presence of neurological disorders in COVID-19 instances may increase the probability of patients with symptoms connected to neuroscience receiving an inaccurate diagnosis. These neurological issues that have been reported highlight how vital it is to realise the link between the SARS-CoV-2 infection and neurological impairments, as well as its association with the severity of the disease and death. Healthcare establishments should educate customers about COVID-19's neurological issues and report adverse events. Media can spread these messages. Governments can support research to find methods of treatment, and trade systems can import foreign pharmaceuticals for best results.

Keywords: COVID-19; SARS-COV; neurological damage; Pakistan.

Received: June 12, 2022

Revised: July 1, 2022

Accepted: August 24, 2022

Published: September 30, 2022

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DOI: <https://doi.org/10.57125/FEM.2022.09.30.03>

Introduction

Coronavirus disease 2019/COVID-19, which was caused by an infection with coronavirus 2 associated with severe acute respiratory syndrome (SARS-CoV-2), first appeared in the Chinese city of Wuhan in December 2019 and quickly spread throughout the world. The virus made a significant impact on the health care industry, community relations, and the economy [1]. The World Health Organisation (WHO) estimates that as of September 1, 2020, there will be 25,327,098 documented cases of COVID-19 including 848,255 reported fatalities across 216 nations, regions, and territories. The "beta-coronaviruses/beta-CoVs" genus is most closely linked to the SARS-CoV-2. This genus is responsible for the majority of infections that affect the humans' respiratory system. The "Middle East Respiratory Syndrome Coronavirus" (MERS-CoV), the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), and SARS-CoV-2 are all examples of human beta-CoVs. They have a spike (S) protein that they are able to infect the host cells, and their genome is a single-stranded, positive-sense RNA [2, 3]. They are surrounded by a protective membrane and have a membrane envelope.

COVID-19 is a complicated multi-system illness that affects all body systems, including the cardiovascular, the respiratory system, the digestive tract, and the blood systems, in addition to the immune and nervous systems [4-6]. SARS-CoV-2 predominantly invades the lungs and results in COVID-19. COVID-19 is a disease that leads to COVID-19. COVID-19 causes a mild to moderate form of disease in the majority infected patients. On the other hand, individuals with severe illness manifest a variety of symptoms, including breathing problems and pneumonia, in addition to multiple organ failure and septic shock [7, 8]. According to clinical evidence, in addition to typical symptoms of breathing, neurological symptoms have been observed, notably in COVID-19-hospitalised individuals who have severe or critical diseases [9, 10]. This is because neurological manifestations are more likely to occur in patients who are already sick. There have been reports of neurological problems linked with SARS-CoV-2, which is consistent with the patterns seen with other coronaviruses. These difficulties are often connected to the central nervous system as well as to the peripheral nervous system (CNS and PNS, respectively), but the fundamental mechanism that causes damages is not well identified [11, 12].

Along with respiratory discomfort, patients diagnosed with COVID-19 have also been found to exhibit neurological symptoms, particularly those who are in a critical or severe condition. While the fundamental mechanisms have not yet been fully understood, there is evidence to suggest that the virus might induce neurological disorders that can impact both the central nervous system and the peripheral nervous system. The appearance of COVID-19 has brought to light the significance of international collaboration and prompt action in containing pandemics and reducing the negative effects they have. It is believed that continued attempts to create effective therapies and vaccines will lead to favourable results for afflicted people. These efforts are now underway. The COVID-19 pandemic, which was caused by SARS-CoV-2, has had a significant effect on the health of people all over the world, as well as on their social interactions and the economy. In addition to the primary impact on the respiratory system, the virus is also capable of causing neurological symptoms; many of them are not yet completely understood. There is, however a reason to be optimistic about the possibility of improved outcomes and a return to a more standard manner of life due to ongoing research and development.

Research Problem

The connection of COVID-19 with the development of nervous system symptoms during the pandemic is accompanied by neurological manifestations, which are in accordance with findings concerning the cerebral involvement of SARS-CoV and MERS-CoV. It is possible that the existence of neurological problems in COVID-19 cases may enhance the chance of patients with symptoms related to neuroscience receiving an incorrect diagnosis [15, 32]. In addition to this, it has been hypothesised that the possible recurrence of SARS-CoV-2 may be connected to the virus's latent state in the CNS [49]. These neurological difficulties that have been documented underline the importance of understanding the link between the SARS-CoV-2 infection and neurological impairments, as well as its association with the severity of the disease and death.

Research Focus

The purpose of this study is to provide an in-depth analysis of the risk factors co-relating COVID-19 and nervous system damage.

Research Aim and Research Questions

Based on this narrative review, the purpose of the project is to present a consensus regarding the main lines of action related to assessment, intervention, and acclimatisation of the risk factors co-relating COVID-19 and nervous system damage among Pakistani population.

1. What is the co-relation between COVID-19 and nervous system damage?

2. Which risk factors are associated with neurological damage in COVID patients?
3. What are the healthcare requirements for support and diagnosis of the problem in Pakistan?

Research Methodology

General Background

The primary goals of a narrative review are to provide the author and reader with a full overview of the topic at hand, and to draw attention to key areas of research that have been undertaken on the subject. Narrative reviews are excellent tools for detecting flaws in a study as well as for improving and identifying new areas for investigation. A summary of narratives might be the initial step toward undertaking an in-depth, rigorous investigation of the data and arranging it all in an acceptable manner. It is vital to explain the approaches that will be used in the process of conducting a narrative synthesis at the protocol stage. This is because a synthesis of narratives will be employed in an evaluation to some extent, whether substantial or trivial.

The literature search was carried out by using a number of different databases (for example, Medline, PubMed, and Google Scholar) with a combination of broad search terms, such as "Coronavirus SARS/ COVID-19/ SARS-CoV-2", "neurology", "mechanism", "neuro-invasion", "neuron damage", "myopathy", "neuromuscular", "central nervous system", and "CNS."

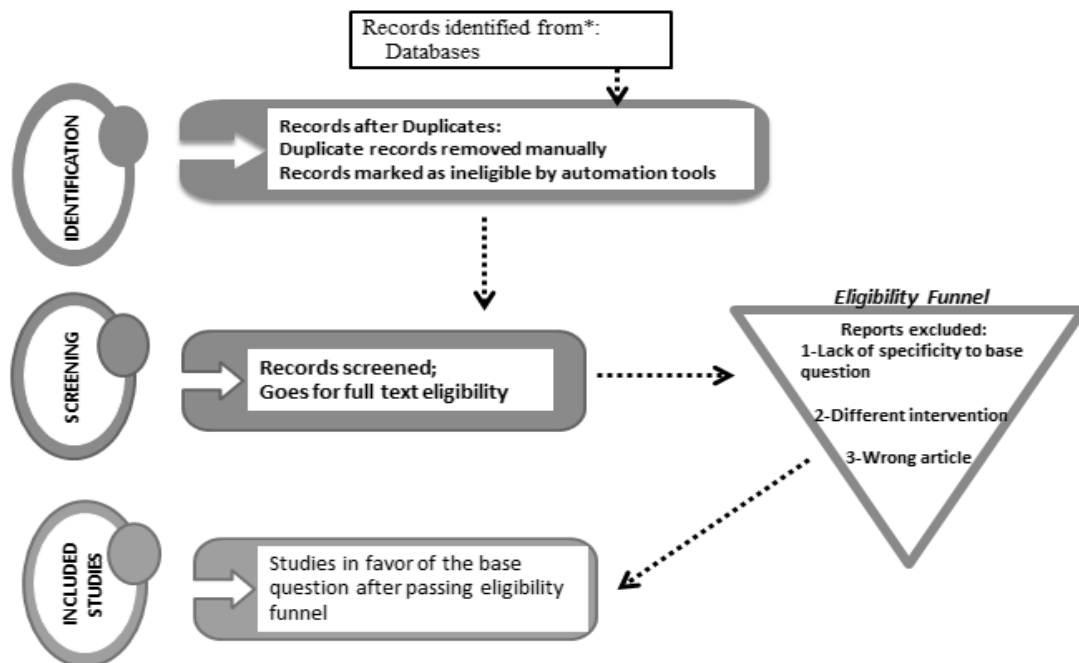


Figure 1. Graphical representation of extraction of information

Source: Author's own development

Data Analysis

The procedure for carrying out the analysis of the data started with the selection of the pertinent facts as the initial step of the process. The information that was gathered was first organised into a table, which was the second step in the process, which was followed by the drawing of conclusions about the study. After the articles that had been selected for further examination were reviewed one at a time, the overarching notion that most effectively demonstrates the relevance of the study issue was then determined.

Research Results

When the inclusion criteria were taken into consideration, a total of studies were found. (table 1). Nevertheless, in the perspective, there is a need for more concerned research that are randomised and controlled in order to determine the requirements of pregnant women and mothers and to give the appropriate treatment for their emotional discomfort.

Table 1. The extracted information from screened studies

Highlight of the review		Extracted information from Analysis	References
Direct Nervous System Infection		Detection of SARS-CoV-2 genome RNA in CSF of patients with COVID-19	[15, 27]
		aberrant cardiorespiratory center activity in the brain stem brought on by the neuro-invasive potential of SARS-CoV-2	[48]
		SARS-CoV-2 entry to the brain is possible, albeit infrequent	[49, 50]
		PNS offers easy entry points for this virus to the neurological system	[13, 51]
		SARS-CoV-2 could enter the brain via the olfactory nerve	[50]
		PNS parts, like neuromuscular junctions, might be involved in the neurological COVID-19 problem	[52, 53]
		Chronic neuro inflammation brought on by SARS-CoV-2 will eventually result in neurodegenerative disorders.	[53, 54]
		Increased likelihood of neurodegeneration distinctive of this illness	
		COVID-19-associated storm of cytokines may work in concert to worsen cognitive deterioration in AD patients	[55]
		SARS-CoV2 infection may result in de novo neurological effects like PD by accelerated aging in the brain tissue	[56]
Possible Long-Term Neurological Effects of COVID-19		Pakistani study, 23% of volunteers who contracted the new coronavirus had significant neurological side effects	[57]
		Neurological problems are frequently noted in COVID-19 patients from Pakistan	[58]
		COVID-19based patients shows neurological symptoms are common	[58]
		headache and insomnia are most likely the neurological impairment felt	[58, 59]
		Measurement of psychological adaptability for maintaining quality of life	[38]

Source: Author's own development

This table provides a summary of the information that was retrieved from the studies that were examined on the neurological impact of COVID-19. It highlights several important findings, some of which include the identification of SARS-CoV-2 genome RNA in the cerebrospinal fluid, or CSF, of COVID-19 patients, the potential for direct infection of the nervous system and entry to the cerebral cortex via the olfactory nerve, and the significance of the peripheral nervous system (PNS) in neurological disorders associated with COVID-19. The table also shows that persistent neuro inflammation caused by COVID-19 may lead to neurodegenerative illnesses, and that COVID-19-associated cytokine storms can accelerate cognitive deterioration in patients with Alzheimer's disease. Both of these hypotheses are supported by the data presented in the table. In addition, the table shows a Pakistani study that identified substantial neurological adverse reactions in 23% of COVID-19 participants, with headache and insomnia being the most common symptoms. In conclusion, the table refers to a study that proposes assessing psychological adaptation in COVID-19 patients who are experiencing neurological symptoms in order to keep their quality of life from deteriorating. The last column contains the references that can be used to support the material that was extracted.

Discussion

Direct Nervous System Infection

The idea that the SARS-CoV-2 has infected the CNS has been supported by the evidence of cerebral participation in other CoVs (such as SARS-CoV and MERS-CoV) and the detection of SARS-CoV-2 genome RNA in CSF of patients with COVID-19 [15, 27]. Additionally, it has been proposed that individuals with COVID-19 may experience respiratory failure as a result of aberrant cardiorespiratory center activity in the brain stem brought on by the neuro-

invasive potential of SARS-CoV-2 [48]. According to a recent study, COVID-19 patients' respiratory failure is distinct from that brought on by brain malfunction, albeit [49]. Due to the non-specific symptoms seen in COVID-19 patients, the SARS-CoV-2 entry to the brain is possible, albeit infrequent. Overall, SARS-CoV-2, like other CoVs, lacks sufficient evidence to support CNS entry, while it is hypothesised that previously established pathways for other infections may offer SARS-CoV-2 a route to the brain [49, 50]. One of the crucial channels for the entry of respiratory neurotropic viruses into the CNS is via neuronal retrograde paths [42]. In fact, the PNS offers easy entry points for this virus to the neurological system [13, 51]. Regarding this, it is conceivable that SARS-CoV-2 could enter the brain via the olfactory nerve. This notion is supported by the findings of an altered sense of smell (anosmia) [50]. Two crucial genes for SARS-CoV-2 invasion, ACE2 and TMPRSS2, did not express at olfactory neurons, according to bioinformatics analysis of mass and single-cell RNA-Seq records for SARS-CoV2 receptor gene expression at the system of olfactory receptors. Additionally, SARS-CoV-2-related proteins were found to be expressed in non-neuronal olfactory nerve cells, which are likely what causes anosmia after COVID-19 contamination, according to this study. However, additional PNS parts, like neuromuscular junctions, might be involved in the neurological COVID-19 problem. The concept that SARS-CoV-2 may attack the myelin or axon of muscle neurons is supported by elevated levels of CK and myalgia or weariness, which are seen in a sizeable percentage of hospitalisation COVID-19 patients [52, 53]. Evidence of other coronaviruses causing cerebral involvement as well as the finding of SARS-CoV-2 genome RNA in CSF both lend credence to the idea that SARS-CoV-2 could make its way into the central nervous system. However, there is not enough data supporting the idea that SARS-CoV-2 can enter the central nervous system. It is hypothesised that pre-existing routes in the brain that have been created for other infections may provide SARS-CoV-2 with a method to enter the brain. It's possible that the olfactory nerve is one of these pathways. A lack of a sense of smell is one of the symptoms of COVID-19, and proteins related to SARS-CoV-2 have been discovered to be produced in non-neuronal olfactory nerve cells. There is a possibility that neuromuscular connections are also implicated in the neurological issue caused by COVID-19. Elevated levels of CK and myalgia or fatigue are observed in a considerable percentage of hospitalised COVID-19 patients. These findings lend confidence to the hypothesis that SARS-CoV-2 may damage the myelin or axon of muscle neurons. In general, although there is not enough evidence to support SARS-CoV-2 entering the central nervous system (CNS), the virus may employ routes that have already been developed in order to enter the brain.

Possible Long-Term Neurological Effects of COVID-19

Insights into the involvement of the nervous system and signs of cognitive decline among COVID-19 patients are growing, and this information is troubling in that it points to potential delayed-onset neurological problems. Unexpected consequences of this illness could include worsening neurological problems that already existed or leading to a neurodegenerative condition in those who survived COVID-19. It is yet too soon to draw any firm conclusions about the probability that COVID-19 infection would have long-term neurological effects, but it is possible that chronic neuro inflammation brought on by SARS-CoV-2 will eventually result in neurodegenerative disorders. Additionally, the neuro-invasive properties of SARS-CoV-2 may lead to later neurodegenerative illnesses including multiple sclerosis (MS), Huntington's, Parkinson's, and Alzheimer's diseases (AD)[54]. The substantial likelihood of later neurological difficulties in COVID-19 survivors corresponds with other data showing that human CoVs can cause persistent CNS issues and latency in the nervous system. In other words, the chronic neuro inflammation as well as cytokine storm linked to COVID-19 severity, as well as the probable neuro-invasive aspect of SARS-CoV-2, highlight the potential increased likelihood of neurodegeneration distinctive of this illness [53]. The reports of COVID-19 infection in the CNS of individuals with PD, AD, and MS raise concerns regarding whether and how this neurodegenerative disease may be associated to COVID-19 infection [54]. For instance, the amyloid-stimulated interferon type I (IFN) response and the COVID-19-associated storm of cytokines may work in concert to worsen cognitive deterioration in AD patients. In AD patients who typically present with diarrhoea or tiredness due to COVID-19, it has been noted that significant systemic hypoxemia worsens the initial signs of dementia.[55] These varied clinical profiles may be related to various theories of age-related aetiology and how they affect individuals with pre-existing neurological disorders. SARS-CoV2 infection may result in de novo neurological effects like PD by accelerated aging in the brain tissue, which is a risk factor for both COVID-19 and neurodegenerative illnesses in older people [56]. There is mounting evidence that the nervous system is involved in COVID-19 individuals, including indicators of cognitive deterioration; this raises worries about the possibility of delayed-onset neurological issues. SARS-CoV-2 may raise the risk of developing neurological diseases because it causes persistent neuro inflammation and is neuro-invasive. Concerns have been raised regarding the possibility of correlations between COVID-19 infection and pre-existing neurological illnesses as a result of reports of COVID-19 infections in patients already suffering from these conditions. These varying clinical profiles may have a connection to the diverse hypotheses of age-related aetiology and how they affect people who already have neurological conditions. It is emphasises that it is still too early to draw solid conclusions regarding the long-term neurological

effects of COVID-19, but stresses the probable increased probability of neurodegeneration that is characteristic of this illness.

Pakistan based Analysis

According to a recent Pakistani study, 23% of volunteers who contracted the new coronavirus had significant neurological side effects [57]. Despite the fact that these symptoms occur quite frequently, there hasn't been much research done on the subject in Asia [60]. After conducting a cross-sectional investigation Karachi, Makda A. et al. concluded that neurological problems are frequently noted in COVID-19 patients from Pakistan, accompanied with dizziness as the most prevalent symptom [58]. On the other hand, Kumar J. et al. pointed out that headache and insomnia are the most common neurological impairments. These inconsistent results highlight the need for additional research and make it challenging to address the symptoms that are already being experienced [58, 59]. From April to July 2020, a different cross-sectional study was carried out at a public tertiary care teaching hospital in Karachi, Pakistan. Except for those with pre-existing neurological and mental problems, every individual with positive polymerase chain reaction (PCR) tests were enrolled in the study. The outcomes revealed In terms of neurological symptoms, headache (such as 15.7%) and dizziness (such as 17.5%) were the most prevalent. Three individuals (such as 2.6%) experienced a stroke. A further nine (such as 7.8%) subjects had a smell impairment, while nine (such as 7.8%) participants had a taste impairment. When the incidence of neurological manifestations in patients with severe and non-severe form of disease was evaluated, there was no discernible difference. In COVID-19, neurological symptoms are common. It is important to spot them right away. To stop the spread of the virus, COVID-19 should be anticipated in individuals who present neurological problems and should be considered in the differential diagnosis [58]. It is alarming that a recent study conducted in Pakistan found a significant prevalence of neurological adverse effects in COVID-19 patients. This is especially true when one considers the rareness of research conducted on the subject in Asia. The findings imply that neurological symptoms, such as dizziness, headache, sleeplessness, stroke, and loss of senses of smell and taste, are common in COVID-19 in Pakistani. Particularly, the data suggest that COVID-19 patients in Pakistan are more likely to be male. Having these symptoms is not a prerequisite for having a severe illness; in fact, they can appear in people who have never experienced any neurological or mental complications in the past. The inconsistencies in the findings that were reported by various studies on the particular neurological symptoms that were encountered by COVID-19 patients indicate that additional research is required to better understand the effects that the virus has on the nervous system. It is very important to not only to treat the symptoms, but also to determine any potential long-term consequences on the nervous system. It is also vitally important to acknowledge the significance of quickly identifying neurological signs in COVID-19 patients. Because neurological symptoms can arise even in the absence of breathing problems, it is important to keep an eye out for COVID-19 infection if you experience any of these symptoms. This would make it possible to effectuate a fast diagnosis, isolate the patients, and treat them; all of this could help stop the virus from the further spreading. In addition, because COVID-19 may have possible long-term consequences on the nervous system, it is absolutely necessary to carry out additional study in order to gain a deeper comprehension of the mechanisms that are responsible for these neurological symptoms. This would be helpful in identifying potential therapies and techniques that may be used in order to minimise the neurological effects of the viral infection and prevent long-term consequences.

In this review, a variety of studies on COVID-19 effects on the nervous system are analysed. The finding that SARS-CoV-2, the virus that causes COVID-19, may directly infect the nerve system is one of the most significant. However, the virus is able to enter the body through the olfactory nerve and other locations in the peripheral nervous system (PNS). The ability of the virus to enter the brain is uncommon. This conclusion is backed up by a number of researches, including the ones described in references 13, 48, 49, 50, 51, and 52. In the review is also mentioned that COVID-19 may be responsible for chronic neuro inflammation, which may ultimately result in neurodegenerative illnesses; this hypothesis is provided in references 52 and 53. In addition, the analysis states that COVID-19-associated cytokine storms can accelerate cognitive decline in patients with Alzheimer's disease, and that SARS-CoV-2 infection may result in neurological sequelae such as Parkinson's disease. Both of these points are brought up in the review. One Pakistani study, cited as reference 56, found that 23% of COVID-19 patients' encountered significant neural side effects, while another reference, cited as 57, notes that neurological manifestations are often observed in COVID-19 individuals from Pakistan, with headache and insomnia being the most common symptoms. However, there is some dissonance in the prevalence and specific manifestations of neurological effects. One Pakistani study found that 23% of COVID-19 patients encountered significant neurological side effects. This review, in its entirety, offers a detailed study of current knowledge of the impact that COVID-19 has on the neurological system, drawing on a variety of resources to support its results.

Conclusions and Implications

This Research's findings concluded that:

- 1- The detection of SARS-CoV-2 genome RNA has been observed in CSF of patients with COVID-19.
- 2- Aberrant cardiorespiratory center activity in the brain stem brought on by the neuroinvasive potential of SARS-CoV-2.
- 3- The PNS offers easy entry points for this virus to the neurological system.
- 4- The SARS-CoV-2 could enter the brain via the olfactory nerve.
- 5- Chronic neuroinflammation caused by SARS-CoV-2 will eventually result in neurodegenerative disorders.
- 6- The SARS-CoV2 infection may result in de novo neurological effects like PD by accelerated aging in the brain tissue.
- 7- In Pakistan based study, 23% of volunteers who contracted the new coronavirus had significant neurological side effects.
- 8- Neurological problems are frequently noted in COVID-19 patients from Pakistan.
- 9- COVID-19 based patients' neurological symptoms are common.

Author contributions

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding

No funding source is reported for this study.

Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

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Citation article: Ilina-Stohniienko V., Malets M. Regarding the modernisation of medical care system for victims of armed conflicts (Ukrainian experience). *Futur Med* [Internet]. 2022;1(3):35-49. Available from: <https://doi.org/10.57125/FEM.2022.09.30.04>

Regarding the modernisation of medical care system for victims of armed conflicts (Ukrainian experience)

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Abstract

This article focuses on "Regarding the modernisation of medical care system for victims of armed conflicts (Ukrainian experience)".

Aims: The purpose of the study concerning the modernisation of medical treatment system for victims of armed conflicts is to examine the existing status, challenges and barriers for an effective medical care system, to explore innovative approaches and technologies, policy and regulatory frameworks as well as to propose strategies and highlight the ethical implications of modernising medical care for victims of armed conflict in Ukraine.

Study design: Descriptive cross-sectional study.

Place and Duration of Study: Most of the studies were conducted on patients, professionals' healthcare establishment and policy maker stakeholders.

Methodology: In order to collect secondary data from literature a questionnaire was used.

Results: 4,094 assaults and threats against the health care system were found. Harmed 1,524 healthcare personnel. 681 health professionals died. 401 health professionals were abducted. 978 occurrences involved destroyed or damaged medical facilities. The results showed the limitations and needs of the health system, obstacles in providing and obtaining health care, collaboration with neighbouring states, sustainability and development transitions conflict related policy and its implementation. Statistics show that no communicable illnesses have replaced communicable diseases as the main causes of sickness and death. Cardiovascular disease, diabetes, cancer, chronic respiratory illnesses, and mental disorders account for up to 84% of all morbidity. Antibiotic resistance has also increased as a result of the fight. They developed telemedicine, developed mobile medical facilities, and provided counselling and rehabilitation services. Academic s may help improve data quality and analysis alongside governmental and humanitarian players in Ukraine.

Conclusion: To protect healthcare in places afflicted by violence, coordinated actions across states, international organisations, and humanitarian groups are essential. The accessibility guarantee and security of health services for everyone, proactive measures, respect to international law, and ongoing healthcare expenditures are required.

Keywords: modernization, system, medical care, victims, armed conflicts, Ukrainian experience.

Received: June 6, 2022

Revised: June 24, 2022

Accepted: September 3, 2022

Published: September 30, 2022

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DOI: <https://doi.org/10.57125/FEM.2022.09.30.04>

Introduction

Whether they are internal or external, armed conflicts have a terrible effect on the health and happiness of people and communities and conflict victims often have wounds, trauma, and other health issues, need immediate and specialised medical attention. But there are several obstacles that often make it difficult to provide quality healthcare in conflict-affected communities, including a broken healthcare infrastructure, a lack of resources, poor legislative frameworks, and ethical issues. Reducing the frequency and intensity of armed conflicts is one of the explicit aims and recurring themes of the 2030 Sustainable Development aims. The destructive character of armed warfare creates persistent barriers to the development and prosperity of human civilisation [1-2].

Armed warfare may cause serious bodily and psychological harm, including wounds from gunshots, explosions, shelling, and other violent acts. There have been a big amount of fatalities in Ukraine as a consequence of the battle in the east, which started in 2014. These casualties have included civilians, soldiers, and fighters. The country's healthcare system has been faced with serious difficulties as a result, demanding the modernisation of the system of medical treatment for war casualties [3].

The challenges encountered in obtaining high-quality medical care differ according to the circumstance, the kind of battle, the participants, the healthcare system in place, and the humanitarian resources available. The challenges may be related to health system, including infrastructure breakdown, shortages of medicines and medical supplies or it may be related to Insecurity and Instability, legal, administrative, and other barriers. There may be issues such as collaboration with neighbouring states, sustainability and development transitions, conflict related policy and its Implementation [4-6].

Priorities for health system restoration in Ukraine discovered new ways to improve war victim medical care. This study showed that infrastructure damage, staff loss, security concerns, mass population displacement, greater health care input costs, and lower population capacity to pay for health care disrupted health services. Emergency medical services, trauma, and burns (with a 12-fold increase in the number of patients treated for similar conditions in normal circumstances), rehabilitation (with a 1.6-fold increase), and mental health conditions have all seen increased health needs because of the war, though the extent of these increases varies depending on the context. Service delivery ranks top among the four key areas, followed by capital investment, finance for health care, and institutional development [7].

At the national and international levels, legislative and regulatory frameworks are required to properly update medical care for war casualties. One such institution is international humanitarian law, sometimes known as the law of war or the law of armed conflict. A set of laws known as international humanitarian law (IHL) tries to mitigate the effects of armed conflict for humanitarian reasons. While safeguarding individuals who choose not to participate in the fights, it restricts the weapons and tactics of warfare [8]. According to the WHO, peace is necessary for a healthy, productive global population. The solution to the issue of attacks on health systems and personnel during times of conflict is necessary for the achievement of SDGs 3 and 16 [9].

A guidance document for medical teams narrated the purpose of a patient-centred mission statement for medical teams responding to health emergencies in armed conflicts and other unstable environments is to save lives, relieve suffering, safeguard vulnerable populations, and lessen the effects of war and violence in highly unstable, austere, resource-constrained environments, frequently spanning a continuum of care. Teams must take extra effort to ensure that their activities uphold fundamental humanitarian ideals, fundamental clinical standards of care, and ethical behaviour while adhering to IHL [10].

The ethical repercussions of using cutting-edge methods and technology in the context of giving medical care to battle victims are a major concern. Ethical standards lay a heavy focus on providing healthcare to everyone without distinction and making sure that international humanitarian law is effectively followed in times of armed conflict and disasters. Giving everyone equitable access to current methods and technology is crucial to preventing aggravated inequality and maintaining moral standards. This calls for providing accurate information, obtaining informed consent, preserving data security, doing in-depth research, and accounting for local cultural contexts [11].

Within the first month of the war, an armed conflict prompted many people to escape their homes, sparking a significant refugee crisis that had ramifications far beyond the Ukrainian border. People from the nearby nations have generously sent food, clothing, medicines, money, and other necessities, demonstrating their immense solidarity. Governments and other regional players have also helped by lowering rules and making accommodations for the entering migrants. These further highlight possible difficulties that might arise in Ukraine and the host nations, as well as appropriate remedies to these difficulties [12-13].

Over the last several years, an increasing number of fatal assaults have targeted hospitals and medical professionals worldwide. Practical steps military may take to better prevent unintentional assaults on medical institutions include a full, life-cycle strategy to safeguarding people in armed conflict, stronger deconfliction techniques, and more alternatives for identifying medical facilities. The essential requirement right now is to keep working on the bigger problem of raising knowledge of where medical services in conflict are located [14].

Health professionals must never be targeted since they risk their lives to help others who need medical attention. Additionally, individuals lose hope when they are unable to seek out and get medical treatment; either because the facilities have been destroyed or out of concern that they could become a target. It is impossible to understate the impact of the conflict on mental health, which affects both the general public and the medical community [15].

To increase access, quality, and efficacy of healthcare delivery, there has been a growing understanding of the need to modernise the system of medical treatment for victims of armed conflict. The goal of modernisation initiatives is to remove obstacles that prevent people from receiving medical treatment in war zones and to take advantage of chances for novel techniques to enhance healthcare for armed conflict victims. The scope of this study's research will be established by the research questions. The research will look at the difficulties that victims have while trying to receive high-quality medical care.

Research Problem

1. Limited access to quality medical care.
2. Inadequate integration of innovative technologies.
3. Inadequate policy and regulatory frameworks.
4. Ethical implications of using innovative approaches and technologies.
5. Lack of coordination and collaboration among stakeholders.

Research Focus

The research focus could be multi-dimensional, encompassing different aspects such as assessing the current state of the system, exploring innovative approaches and technologies, analysing policy and regulatory frameworks, addressing ethical considerations, enhancing coordination and collaboration among stakeholders, and learning from other settings to propose strategies for modernising the system of medical care for victims of armed conflict.

Research Aim and Research Questions

The objectives of the research article on the modernisation of medical care system for victims of armed conflict are:

1. Assess the current state, challenges, and barriers to effective medical care system for victims of armed conflict in Ukraine.
2. Explore innovative approaches and technologies for modernising medical care.
3. Analyse policy and regulatory frameworks and proposing strategies for improving medical care.
4. Highlight the ethical implications of modernising medical care for victims of armed conflict

Research Questions

1. What is the status, challenges and barriers to provide timely and effective medical care for victims of armed conflict, and how can these be addressed through modernisation efforts?
2. What policy and regulatory frameworks are currently in place for medical care for victims of armed conflict, and how effective are they in meeting the needs of the affected population?

Research Methodology

General Background

To minimise morbidity, death, and suffering among soldiers, civilians, and non-combatants via better medical treatment in war zones; to solve such problems as burns, starvation, infectious diseases, mental health issues, and lack of access to medical care in battle zones as well as gunshots and bomb injuries; to modernise medical systems for war victims by researching emergency treatment, trauma care, surgery, rehabilitation, psychological support, and public health initiatives [16]. It requires new techniques, technologies, and research-backed plans, regulations, and policies. This research includes stakeholders including governments, international organisations, academic

institutions, and healthcare providers. Modernising medical therapy for war victims must include psychological help and mental health treatments. This study seeks to understand the psychological repercussions of armed conflict, such as, depression, and anxiety, and develop effective therapies, such as trauma-focused cognitive-behavioural therapy [17].

In conclusion, modernising the healthcare system for war victims is a complex and evolving field that considers clinical, technological, public health, and ethical challenges. This project aims to improve medical delivery, accessibility, and effectiveness in conflict zones to reduce war victims' morbidity, mortality, and suffering.

Sample / Participants / Group

The following sample/participants/groups will be involved in the research "Regarding the modernisation of the system of medical care for victims of armed conflicts (Ukrainian experience)":

1. Healthcare workers and Healthcare institutions.
2. War victims.
3. Key stakeholders.

Instrument and Procedures

A questionnaire was utilised to collect the necessary data. Secondary data was acquired for the questionnaire from public and government sources using both online and offline methods. Both quantitative and qualitative procedures may be used in data analysis techniques. The study's findings may be shown as a table or graph.

Data Analysis

To summarise and define the information gleaned through surveys, quantitative data analysis may make use of descriptive statistics including frequency tables, mean, median, mode, standard deviation, and range. In the discussion section, there was just a data comparison and no data analysis.

Research Results

Health care facilities and workers Status

Results (Table 1) showed that 4,094 assaults and threats were made against the medical system. In the battle, 1,524 healthcare professionals suffered injuries. 681 health professionals died. 401 health professionals were abducted. Despite the United States Security Council's historic decision promising states to avoid assaults on healthcare institutions and hold criminals responsible, there were 978 occurrences involving health facilities that were destroyed or damaged [18].

Table 1. Health care facilities and workers Attacks worldwide status

Variable	Frequency
Attacks and threats against health care in conflict	4,094
Health workers injured	1,524
Health workers killed	681
Health workers kidnapped	401
Incidents where health facilities were destroyed or damaged	978

Source: Authors' development based on ReliefWeb n.d.

The global mortality statistics (figure 1) showed 5913 in Ukraine, 141948 in Syria, and 47519 in Afghanistan because of armed conflicts [19].

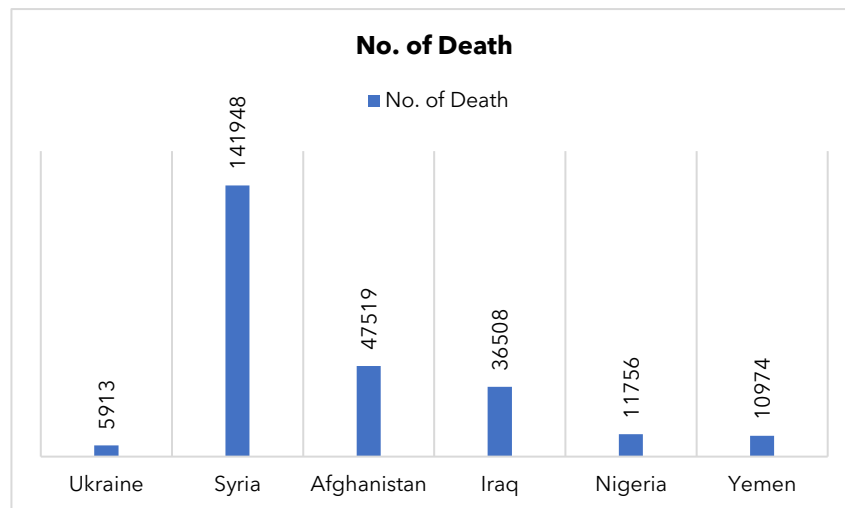


Figure 1. A Number of deaths during arm conflict from 2014 - 2016

Source: Authors' development based on Uppsala Conflict Data Program n.d.

Physicians for Human Rights recorded assaults on 315 institutions in Syria over a seven-year period, while the Monitoring Violence against Health Care tool, Turkey Health Cluster, documented attacks on 135 facilities (9.64 per month) during a fourteen-month period. Yemen saw 93 assaults (4.65 per month), Iraq experienced 12, Chechnya experienced 24, Kosovo experienced 100, and Bosnia experienced 21 attacks (0.41 per month) [20-21].

The World Health Organisation has been monitoring the increasing situation in Sudan with considerable worry. Since November 2021, there have been 15 reported assaults on healthcare personnel and institutions in Khartoum and other locations, 11 of which have been substantiated [22]. One of the most prominent instances of healthcare facilities being specifically attacked as part of a military plan is the current Syrian Civil War. Local field surveillance teams and NGOs have thoroughly recorded data on assaults on healthcare facilities in Syria thanks to technical improvements including satellite technology and social media [23-25].

The study's results highlight the grave humanitarian concern by highlighting the urgent issue of assaults on medical personnel, infrastructure, and transportation in war zones. It is important to address the problem and take precautions to avoid such assaults, which emphasises the necessity for action to safeguard healthcare in war zones. The research, however, lacks particular information on the type and context of the assaults, which may impede a thorough knowledge of the problem and make it more difficult to find workable remedies. To fully comprehend the issue and create effective measures for countering assaults on healthcare in war zones, further investigation and analysis are required.

Current state, challenges and limitations

Results (Table 2) show the current status, challenges and limitations of the system of medical care in the conflict. The first group concentrated on the limitations and needs of the health system, including infrastructure breakdown, shortages of medicines and medical supplies. The second group focused on obstacles to providing and obtaining health care, including Insecurity and Instability, legal, administrative, and other barriers. The third group focused on issues such as collaboration with neighbouring states, sustainability and development transitions conflict related policy and its implementation [26].

Table 2. Current state, challenges and limitations of the system of medical care in the conflict

Category	Focused on	Description
First group	Concentrated on the limitations and needs of the health system	• Infrastructure breakdown • Shortages of medicines and medical supplies • Shortages of health (and other) • Gaps in health data, • Lack of financial resources, • Unchecked private sector involvement, • Increase in the burden of disease, • Insecurity and instability, and • Lack of human resources

Second group	Focused on obstacles to providing and obtaining health care, including	• Insecurity and Instability • Legal, Administrative, and Other Barriers. • Healthcare becoming militarized and politicized, • Bad governance • Population movements • Increased vulnerabilities. • Gaining public access to health services and gaining access for health personnel to communities in need continue to be major obstacles.
Third group	The focused-on issues such as collaboration with neighbouring states, sustainability and development transitions, context-specificity and localization, accountability involvement, and providing Inadequate	• Short-Term International Funding, • Aid Allocation, • Healthcare Securitization, and • Clauses in Donor Contracts Related to Counterterrorism • Gaps in International Health: Conflict-Related Policy and its Implementation

Source: Authors' development based on *Providing Healthcare in Armed Conflict* n.d.

Results of other study showed that among the challenges attack on healthcare and health care workers are all over the globe. HCWs have been forced to leave conflict zones because of these attacks because of direct assaults and security issues. For instance, since 2011, 50% of the country's medical personnel and 95% of Aleppo's physicians have departed Syria. Since 2014, over half of the medical staff in Iraq has escaped. Since 2012, almost all the medical staff in Nigeria has left the Boko Haram-controlled areas, leading to the shutdown of 450 medical facilities. Poor health outcomes are often caused by the lack of HCWs and the instability of health systems in post-conflict settings. Another challenge is to satisfy health requirements and create a resilient [27-28]. According to research done in Syria, there was little access to healthcare throughout the conflict in the country's afflicted regions. The research offers proof that the use of common medical services, such prenatal care and outpatient visits, was adversely affected by war situations [29-30].

The above results of the study conclude to three significant issues and limitations with the medical care system in areas impacted by armed conflict. Inadequacies in the healthcare system, such as deteriorating physical settings, a shortage of treatments and supplies, and a lack of financial resources, fall under the first group. The second group of obstacles to providing and obtaining healthcare includes industry policy control, administrative and legal limitations, and insecurity. Concerns with accountability, teamwork, sustainability, context-specificity, and a lack of adequate international finance and donor contracts are the main topics of the third group. These problems need a holistic approach, taking into account the social-political determinants of health in war zones as well as the design of the health system.

Health problems and armed conflicts

Statistics show that no communicable illnesses have replaced communicable diseases as the main causes of sickness and death in Ukraine, despite the fact that the number of fatalities and injuries resulting from military operations is rising. Cardiovascular disease, diabetes, cancer, chronic respiratory illnesses, and mental disorders account for up to 84% of all morbidity. Ukraine has the highest incidence of chronic infectious diseases including HIV and TB in Europe. Due to disturbances in infrastructure and sanitation, respiratory and diarrheal illness outbreaks are very frequent in regions experiencing war. The danger of COVID-19 and illnesses that may be prevented by vaccination, such measles and polio, has increased due to low vaccination uptake, particularly in vulnerable people, and disruptions in testing and treatment. The conflict has also led to a rise in antimicrobial resistance. Malnutrition is a problem especially in new-borns and young children. Although there is a lack of evidence, it is anticipated that battle trauma will have a significant psychological effect on Ukrainians [31].

During Russia's invasion of Ukraine in 2014, internally displaced Ukrainians were more likely to report having experienced considerable combat trauma and to show signs of post-traumatic stress disorder than Ukrainians who had not been forced to flee. With underlying factors like trauma, family dissolution, loss of employment and education, forced relocation, and witnessing atrocities contributing to the psychological impacts of war, it is expected that the need for mental health and psychosocial support will be great and keep growing [32-33].

The results show that no communicable illnesses have supplanted communicable diseases as the main causes of illness and death in Ukraine, and that the negative health impacts of military operations are also becoming worse.

The conflict has resulted in a number of health problems, such as heart disease, diabetes, cancer, mental health problems, and infectious diseases including HIV and TB. The dangers for respiratory and diarrheal epidemics, antibiotic resistance, and malnutrition have been made much worse by the interruptions in the healthcare infrastructure, sanitation, and immunisation programs. It is also expected that the psychological effects of the conflict, like as trauma, relocation, and witnessing crimes, would have a substantial influence on Ukrainians' mental health. To address these complicated health issues and provide the afflicted population the necessary mental health and psychological assistance, comprehensive efforts are required.

Measures and strategies undertaken by the Ukrainian government and humanitarian organizations

Officials from the Ukrainian government and humanitarian groups (Table 3) take action to reform the system of medical treatment for armed war casualties. They created mobile medical facilities, advanced telemedicine, and offered counselling and rehabilitation services.

Solutions that may be used to safeguard and preserve health systems increasing national and international adherence to international humanitarian law improving data collection to detect threats and prepare a worldwide reaction alongside governmental and humanitarian actors, academics have a role to play in enhancing data quality and analysis. Giving of humanitarian aid: In conflict-hit regions, the Ukrainian government and humanitarian groups have offered impacted communities immediate relief assistance, including food, water, shelter, and medical services. To help vulnerable groups, such internally displaced people and impacted communities, who have urgent needs; this has been done via government agencies, foreign organisations, and local NGOs.

Table 3. Measures and strategies undertaken by the Ukrainian government and humanitarian organizations in Ukraine
Armed conflicts

Variable
Provision of humanitarian assistance (Strengthening international humanitarian law compliance)
Protection of civilians (Detecting and responding to attacks)
Health care provision (Mobile medical units, and development of telemedicine capabilities)
Displacement management and shelter support:
Humanitarian coordination and advocacy (Training, education, research and development.)
Mine action and risk education:
Psychosocial support and protection:
Peacebuilding and conflict resolution

Source: Authors' development based on american sociological association n.d..

Among the measures are Protection of people, sustain and restore health care services for impacted communities, management of displacement and assistance with sheltering, humanitarian coordination and advocacy, mine action and risk education, providing impacted communities with psychological assistance and safety, particularly for those who have suffered trauma and loss as a result of the fighting and efforts have also been made to advance peacebuilding and conflict resolution in Ukraine. This includes diplomatic initiatives, talks, and mediation to settle the dispute amicably and deal with its underlying issues [34].

Analyses of collaboration and coordination among various stakeholders

The critical role of governmental organisations, humanitarian organisations, healthcare providers, and local communities in treating violent conflict casualties is revealed by the analysis of collaboration and coordination among various stakeholders in providing medical care to victims of armed conflicts in Ukraine. Due to divergent goals, procedures, and resources, it may be difficult for humanitarian organisations to coordinate, which might hinder the delivery of medical treatment. Hospitals, clinics, and medical professionals are busy treating Ukrainian combat victims, providing trauma care, urgent surgery, and life-saving techniques. The provision of mental health treatment also requires the collaboration of therapists. However, security risks, a lack of medical supplies and equipment, and restricted access to afflicted patients may make it difficult for healthcare workers who have been

affected by a war to give adequate treatment. To satisfy the medical needs of Ukraine's war victims, good coordination between the government, humanitarian organisations, healthcare providers, and local communities is essential. However, this coordination may be challenging due to the many factors that must be taken into account for successful and meaningful healthcare delivery [35].

Discussion

Health care facilities and workers Status

According to the findings (Table 1), there were 4,094 assaults and threats made against health care. During the war, 1,524 medical personnel sustained injuries. 681 people who worked in health care were slain. 401 health care professionals were taken hostage. 978 cases concerned health institutions that were destroyed or damaged, despite the historic resolution passed by the United States Security Council that committed states to preventing assaults on healthcare and holding criminals responsible for their actions [18]. Because of armed conflicts, the worldwide mortality data (figure 1) indicated that there were 5913 deaths in Ukraine, 141948 deaths in Syria, and 47519 deaths in Afghanistan [19]. All this shows that during war no one tried to save healthcare settings and healthcare staff. All healthcare staff has to work at the cost of their lives.

Similar results were reported by another research. In 49 conflict-affected nations in 2021, medical facilities and staff were exposed to severe and pervasive violence and obstruction of treatment. Based on information gathered by coalition member Insecurity Insight, the Safeguarding Health in Conflict Coalition's report this year lists 1,335 instances of violence or obstruction against health treatment that occurred in 2021. According to the research, assaults on healthcare facilities resulted in 161 deaths and 320 injuries among health personnel in 2021. While 713 people were apprehended, 170 healthcare personnel were abducted. In 188 occurrences, medical facilities were damaged or destroyed, and 82 of those events included military occupation. 64 health transports were taken or kidnapped, compared to 111 health transports that were destroyed or damaged [36]. The recommendations highlight the detrimental consequences of armed conflict on healthcare and the urgent need to ensure the security of medical workers and institutions in such settings.

Syria's civil conflict has killed over 250,000 people and displaced 4.8 million, according to the WHO. Syria's conflict has caused our largest humanitarian and refugee crises. Medical institutions and staff were intentionally attacked during the crisis. Physicians for Human Rights estimated that 782 medical workers were murdered and an indeterminate number were intimidated and arrested from the start of the war until September 2016. In 2012, Syria criminalised providing health treatment to opposition soldiers or sympathisers. This violated international humanitarian law, which states that no one may be penalised for ethical medical practices, regardless of who benefits [37].

Health practitioners in war zones try to treat both sides and civilians equally. Despite the Geneva Conventions and other international rules, they are increasingly attacked for their activity. Sniper fire, kidnapping, and infrastructure damage may be purposeful or accidental attacks against health professionals and institutions. The APHA suggests enhancing the tracking, investigation, and reporting of targeted violence against health professionals, enhancing compliance with international law through education and legal reform, and holding offenders accountable while removing financial and political support for their actions. The APHA requests that the WHO keep track of assaults on medical professionals and that the UN and its member states look into politically motivated attacks [38].

In conclusion, the data from several studies provide a gloomy picture of the continuous violence against health personnel, institutions, and transportation in war zones. Despite the historic decision by the United Nations Security Council to prohibit attacks on healthcare and bring perpetrators responsible. The continuous and extensive nature of these assaults highlights the critical need for action to defend health care in conflict-affected communities. It is vital for countries, international organisations, and humanitarian agencies to take proactive efforts to guarantee the safety and security of health workers, fulfil the pledges made by the United Nations, and limit the destructive effect of armed conflict on healthcare. Efforts must be strengthened to prevent assaults, hold criminals responsible, and guarantee that healthcare remains available and secure for everyone, even in the midst of crisis.

Current state, challenges and limitations

Results (Table 2) demonstrated the conflict's medical care system's status, problems, and limits, which were grouped into three categories. The first group focused on health system limitations and needs, including infrastructure breakdown, shortages of medicines and medical supplies, shortages of health and other health-related services, gaps in health data, a lack of financial resources, unchecked private sector involvement, an increase in disease burden, insecurity and instability, and a lack of human and financial resources. The second group addressed Insecurity and Instability, Legal, Administrative, and Other Barriers to health treatment: healthcare

militarisation, inadequate governance, population migrations, and increasing vulnerability. Public and health worker access to populations in need is a key challenge in most violent conflicts. The third group discussed collaboration with neighbouring states, sustainability and development transitions, context-specificity and localization, accountability involvement, and providing Inadequate, Short-Term International Funding, Aid Allocation, Healthcare Securitization, and Clauses in Donor Contracts Related to Counterterrorism Gaps in International Health: Conflict-Related Policy and its Implementation.

While Four goals for the health sector are identified by another study: restoring critical health services as soon as possible while accelerating the Government of Ukraine's plan to restructure the health care system; Identifying critical choices and trade-offs that the government and its partners should take into account when undertaking sizeable recovery and reconstruction investments that will have long-term repercussions on the health system is the second capital investment. Thirdly, health financing—establishing financing priorities to maintain essential services despite severe budgetary constraints and accomplish more with the funds at hand; fourth, institutional strengthening—supporting central and local government institutions that are in charge of policy, planning, stewardship, and governance in the health sector. It also underlines that other vital investment sectors are not fully covered but will continue to be important and need to be adequately managed in national plans, most notably public health and disaster preparedness [7].

According to research on obstacles in Afghanistan, IDP health was strongly influenced by environmental variables, inadequate housing infrastructure, lack of economic opportunities, and access to water. The closure of clinics within the camps severely restricted access to healthcare services. Cost, distance, prejudice, and restricted availability to medicines and immunisations, especially for children, were barriers to using the current health care system. The distribution of vaccinations and healthcare financing were highlighted as the two top issues in key informant interviews. A strong and trustworthy patient-provider connection seemed to exist across all focus groups and key informant interviews [39].

The results conclude three kinds of existing problems and restrictions with the medical care system in conflict-affected regions. The first group focuses on the shortcomings and requirements of the healthcare system, such as the deterioration of the physical environment, a lack of medications and supplies, and a lack of financial resources while the second category focuses on impediments to delivering and accessing healthcare, including as insecurity, administrative and legal restrictions, militarisation and politicisation of the healthcare industry, the third category focuses on problems with responsibility, cooperation, sustainability, context-specificity, and insufficient international finance and donor contracts. A comprehensive strategy is needed to address these issues, one that takes into account the architecture of the health system as well as the social and political determinants of health.

Health problems and Arm conflicts

In Ukraine, no communicable illnesses are the main cause of sickness and death. Since 84% of morbidity is caused by chronic conditions, such as cardiovascular disease, diabetes, cancer, chronic respiratory diseases, and mental illnesses, chronic care is required. Wartime healthcare shortages are dangerous. The lack of medical supplies and pauses in preventive, diagnostic, and treatment services are increasing unfavourable disease outcomes, placing vulnerable people at risk of severe illness and death. Cancer-stricken According to accounts, Ukrainian children have been forced to leave their homes and hospitals and travel dangerously to other countries for safety and treatment. War zones often see frequent respiratory and diarrheal outbreaks, compromising public health. Ukraine faces a deadly COVID-19 outbreak. Ukraine suffers from measles and polio outbreaks that may be averted through vaccine and antimicrobial resistance. Malnutrition, particularly in babies and toddlers, is another key worry. Nutritional deficits slow physical and cognitive development and increase the risk of subsequent health problems. Despite a paucity of data, battle trauma is expected to have significant psychological and physical impacts on Ukrainians. Trauma, family breakdown, loved ones' deaths, career and educational losses, forced migration, and witnessing atrocities. Demographic shifts due to male loss, female relocation, and one-person households may aggravate vulnerable communities' wartime situations. After ten years of the Syrian crisis, a literature assessment on the public health effects looked at mental health, maternity and child health, dental health, non-communicable illnesses, infectious diseases, occupational health, and the COVID-19 pandemic's impact on the Syrian healthcare system. The evaluation concluded with recommendations for restructuring the healthcare system in light of the present and foreseeable issues it faces [40-41].

Another research found that individuals who congregate in bunkers, live in destroyed homes and temporary shelters, or get stranded on clogged roadways, are unable to maintain excellent hygiene. Critical infrastructure damage worsens the sanitary situation by robbing populations of clean water and electricity. Infectious illnesses like typhus and cholera may become more prevalent as a result of this. Inadequate treatment for resistant infections creates a vicious cycle that increases mortality. Poor sanitary conditions combined with insufficient access to medical services in war-torn Ukraine may have the same effect. A further worry is the possibility for the spread of

new zoonotic diseases, or illnesses that may be acquired from animals and spread to people. Therefore, a series of viral outbreaks after the war might complicate epidemiological monitoring efforts in Europe and endanger the region's financial and social stability [42].

Measures and strategies undertaken by the Ukrainian government and humanitarian organizations

The establishment of mobile medical units, and development of telemedicine capabilities, are established as innovative strategies that may be used in armed conflicts. Literature showed that the number of US telemedicine physicians increased from 20% in 2020 to 40% in 2021. After COVID-19 telehealth is spreading worldwide [43], and more than 50% of doctors used computers, mobile phones, and social media to engage with patients and stay updated on medical procedures literary assessments [44]. A Saudi Arabian study indicated that younger physicians utilise telemedicine more than those with 5–10 years of experience. As younger doctors are more tech-savvy, they may practise more and use the internet to benefit patients [34].

Similarly other studies have found that up to 25% of patient-physician exchanges of information occur over the phone in settings like US internal medicine and UK primary care healthcare. This study agreed with the findings that phone consultations are the most common alternative to in-person consultations and may broaden access, convenience, and choice. The research comparing the two methods of consultation show those patients are satisfied with both equally [45–47].

In certain brutal armed situations, armed organisations may take children away from their homes and communities. These "child soldiers" may witness murders or take part in them, in addition to going through other terrible experiences. After the conflict, many former child soldiers experience rejection from their families and communities in addition to the psychological anguish and physical wounds [48].

Increasing adherence to international humanitarian law The ICRC ran two significant consultation procedures between 2012 and 2015 about enhancing the legal protection for victims of armed conflict. In accordance with Resolutions 1 and 2 of the 32nd International Conference of the Red Cross and Red Crescent, these two procedures have subsequently entered a new phase. The first's main goal is to improve legal protection for those who are deprived of their liberty due to armed conflict. The second is to enhance IHL by making IHL compliance methods more effective [49].

Better data is needed for a worldwide response to assaults that will improve the protection of people in armed conflict and other violent circumstances [50–51]. Through instruction, teaching, research, and development, academics may help state and humanitarian actors by improving the quality of data and analysis.

Investing in neighbourhood networks to bring peace Long-term implications result from failing to safeguard citizens. Doctors, teachers, and other people leave out of fear of the violence, which has an impact on refugees' inclination to return. IHL violations undermine public confidence in a functional society, which jeopardizes the restoration effort. According to Dr. Kaade, maintaining and rebuilding health systems also has a longer-term benefit of encouraging recovery and reviving hope for the survivors. Early action in war zones is increasingly required of development players for peace and development [52].

Analyses of collaboration and coordination

Among various stakeholders in delivering medical care to victims of armed conflicts in Ukraine (Table 3), including Ukraine's governmental, humanitarian, healthcare and local communities must collaborate to treat violent conflict casualties. Government agencies – national and local – coordinate and manage medical treatment in disaster zones. They organise healthcare providers and humanitarian groups, develop rules, norms, and laws, and offer resources. These organisations may provide emergency medical supplies, equipment, and labour to impacted areas. They safeguard medical staff and assure impartial, unbiased care. Humanitarian group coordination is difficult due to competing missions, processes, and resources. These may impair medical care. Hospitals, clinics, and physicians are treating Ukrainian battle wounded. They treat trauma, do emergency surgery, and save lives. Therapists must collaborate to offer treatment. However, security hazards, a shortage of medical supplies and equipment, and restricted access to afflicted persons may prevent conflict-affected healthcare personnel from delivering adequate treatment. Government, humanitarian, healthcare, and local communities must collaborate to cure Ukraine's war casualties. To offer effective and efficient medical treatment to Ukraine's war casualties, prioritising these stakeholders' engagement is tough [35, 53, 54].

Conflict zones typically have infrastructural breakdown, medication and medical supply shortages, gaps in health services, lack of health data, financial resources, and human resources. Unchecked private sector engagement may raise disease burden. Insecurity and instability hinder the health system. Healthcare militarisation, poor governance, population movements, and increased vulnerability hinder public and health worker access to health services. Conflict zones may face legal and administrative obstacles to healthcare. Conflict zones may complicate

international cooperation. Health services, alleviation to development, context-specific and regional methods, and stakeholder accountability may be restricted. Short-term and insufficient foreign finance, assistance distribution, and counterterrorism terms in donor contracts may hinder healthcare supply. In conclusion, the medical care system in war zones suffers infrastructural collapse, resource shortages, insecurity and instability, legal and administrative hurdles, limited financing, and lack of coordination. These issues must be addressed to provide health care to people in need and assure stakeholder responsibility and sustainability. Countries, international organisations, and humanitarian agencies must work together to reduce the harm armed conflict causes healthcare and safeguard health professionals.

Conclusions and Implications

The results of a number of studies bring to light the precarious state of health care facilities and the personnel who work in them in regions that are experiencing violence. According to these results, health care workers and institutions are purposefully targeted and assaulted during armed conflicts, which leads to injuries, fatalities, kidnappings, and the destruction of health facilities and transportation. The violation of international humanitarian law that occurs when violence is used against health care facilities in war zones presents substantial problems and constraints to the system of medical treatment in circumstances of armed conflict. In conflict-affected regions, health care professionals and facilities are subject to serious risks, such as hostage-taking, assaults, threats, injuries, and deaths.

1. Attacks on healthcare facilities persist despite international agreements and resolutions to safeguard medical treatment in war areas, having catastrophic effects on medical personnel, medical facilities, and the people they serve.
2. Health care providers in war zones often put their lives in danger while attempting to treat both combatants and civilians, while also dealing with deliberate or unintentional assaults, sniper fire, abduction, and infrastructure damage.
3. Infrastructure breakdown, lack of medicines and medical supplies, gaps in health data, a lack of financial resources, insecurity and instability, militarisation of healthcare, insufficient governance, population migrations, and rising vulnerability are just a few of the medical care system's drawbacks and difficulties in conflict-affected areas.
4. Priorities for the health sector in conflict-affected regions include the restoration of essential healthcare services, making wise capital investments, establishing funding priorities, and bolstering organizations that are in charge of policy, planning, stewardship, and governance.

Implications:

1. Action must be taken immediately to safeguard the safety and security of healthcare professionals, uphold international agreements, and lessen the negative effects of armed conflict on the delivery of healthcare.
2. It is important to step up efforts to stop attacks on medical institutions and staff, prosecute offenders, and guarantee that everyone has access to safe medical treatment even during times of emergency.
3. Improved training and legislative changes should be made to increase conformity with international law, as well as better monitoring, tracking, investigation, and reporting of targeted violence against health professionals.
4. In order to solve the shortcomings and difficulties of the medical care system in conflict-affected regions, cooperation among surrounding governments, sustainability and development transitions, context-specificity, localization, and accountable engagement should be taken into consideration.
5. Prioritizing the requirements of the health sector in conflict-affected regions calls for adequate financing, assistance distribution, healthcare securitization, and donor contracts connected to counterterrorism to be examined and modified.
6. National plans should give top priority to disaster preparedness and public health in order to overcome the shortcomings and difficulties of the healthcare system in conflict-affected regions.

In conclusion, coordinated efforts by nations, international organizations, humanitarian agencies, and other stakeholders are needed to safeguard the medical care system in conflict-affected regions and solve its shortcomings and problems. To make sure that health services remain available and secure for everyone, even in the middle of armed conflicts, proactive measures, adherence to international law, and ongoing investments in healthcare are required.

Author contributions

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding

No funding source is reported for this study.

Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

Acknowledgements

We would like to offer our heartfelt appreciation to everyone who helped make this article a reality. We would like to thank our colleagues and friends who gave us with comments and recommendations that helped us enhance the quality of this article. Thank you for your essential contributions regarding the modernization of the system of medical care for victims of armed conflicts (Ukrainian experience).

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Citation article: Tatarina, O. Innovations in Ukrainian medicine: priorities, directions, and forecasts. *Futur Med [Internet]*. 2022;1(3):50-59. Available from: <https://doi.org/10.57125/FEM.2022.09.30.05>

Innovations in Ukrainian medicine: priorities, directions, and forecasts

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Abstract

Aims: There is a tangible informative lack in terms of medical innovation in Ukraine. Little accessible information regarding the steps being taken to foster medical innovation in Ukraine is due to the country's ongoing conflict and the significant pressure on its healthcare sector. Such an informative gap emphasises the necessity for additional research into Ukraine's unique medical landscape.

Study design: Literature review

Methodology: MEDLINE, Cochrane Reviews, and Pedro were among the databases used to conduct the literature search. The conjunctions "AND" and "OR" were used with certain keywords. The articles' time range was restricted between 2018 and 2022 in order to evaluate only present recent facts. Papers discussing innovative medicine, their development, distribution or procurement were included in the inclusion criteria.

Results: Most studies examined how could be achieved the access to revolutionary medicine ignoring the medicine development. The creation of innovative medications was the subject of just one study. Most of the research discussed HTA and MEA and how important they were to ensuring patients had easy access to cutting-edge medications. Legislative or economic restrictions were the only one's present.

Conclusion: It is unclear how innovative pharmaceutical development is currently progressing in Ukraine. Health Technology Assessment (HTA) and Managed Entry Agreements (MEA) are being used to improve the access to innovative medicine in Ukraine. Buying medications for chronic illnesses is simple and convenient. In order to develop and distribute new medicine in Ukraine, regulatory and economic restrictions must be removed.

Scientific Novelty: This study is the first to analyse the availability or development of innovative medication, therefore it can serve as the foundation for future studies by other groups. However, it would necessitate further on-the-ground research concerning the actual situation surrounding the creation, dissemination, and acquisition of innovative medicines. The ongoing war effort may hinder this.

Keywords: advanced medicine; Ukraine; development; pharmaceuticals; HTA; MEA

Received: June 26, 2022

Revised: July 17, 2022

Accepted: September 21, 2022

Published: September 30, 2022

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DOI: <https://doi.org/10.57125/FEM.2022.09.30.05>

Introduction

Background

Innovative medicine refers to new or improved solutions with the transformative ability to accelerate a positive health impact. Examples of innovative medicine include digital health, big data, artificial intelligence, and other technologies that are fuelling a wave of health innovations around the world [1, 2]. Due to the rising need for a better healthcare and the quickening speed of technological development, there is an increasing need for the development of innovative medicine today, primarily to enhance healthcare for the patients as it is their right [3]. By offering original or better solutions, innovative medicine could hasten the health improvement. The creation of new technologies like digital health, big data, artificial intelligence, and other technologies that are catalysing a wave of health advances globally are some steps taken to achieve this. By utilising this technology, healthcare delivery may be done more effectively while also being more individualised and precise. However, there are also constraints encountered in the search for novel medical treatments. These include difficulties like data fragmentation, exorbitant prices, and uncertainty regarding data ownership.

Thus, it is pertinent to understand Ukraine's status as far as innovative medicine is concerned. This means finding out what new advancements are made in not only developing and distributing drugs, but also the amount of fundamental research that is being carried. While the war has hampered efforts in this regard, at the same time it has brought a stimulus for healthcare providers and scientists to find new ways in order to reach and treat patients, especially those who are victims of war crimes.

Unfortunately, information concerning the level of medical innovation in Ukraine now is lacking. There is little information accessible regarding the steps being taken to foster medical innovation in Ukraine, despite the country's protracted conflict and the significant burden on its healthcare sector. This knowledge gap emphasises the necessity for more research on Ukraine's unique medical landscape and the steps being taken to solve the system's problems. Thus, the goal of this evaluation of the literature is to locate and evaluate the material that is currently accessible on innovative medicine that is either already available or actively being produced in Ukraine.

Literature Review

Ukraine is still in infancy when it comes to implementing innovative medicine, but it has made recent progresses in pushing innovation despite the obstacles it faces which include a struggling economy already compounded by the ongoing war [4]. That said, a lot of the ground realities are not being fully uncovered and there is a dearth of information on the number and quality of innovation being conducted in the field of medicine.

Regarding the subtypes of innovative medicine, Ukraine has at least earnestly attempted to delve into each one. The Ukrainian healthcare system is re-organised to digital health, which refers to the use of digital technologies to improve health and healthcare. In order to improve the effectiveness of healthcare delivery and make medicine more individualised and accurate, it incorporates digital care programs and technology with health, healthcare, life, and society [5]. Technologies used in digital health include hardware and software products and services, as well as telemedicine, wearable technology, augmented reality, and virtual reality.

Another one is big data which refers to a big collection of structured and unstructured data that is analysed to discover patterns, trends, and insights. Personal health records (PHRs), electronic medical records (EMRs), electronic health records (EHRs), and data created by widely used digital health tools like wearable medical devices and mobile health apps are some of the sources of big data in the healthcare industry [6]. Ukraine has had a small success with establishing the aforementioned [7-9]. The use of big data is crucial as it allows analysis that can be used to inform decisions, enhance patient outcomes, and lower healthcare expenses.

The use of machine-learning algorithms and software to simulate human cognition in the analysis, presentation, and understanding of intricate medical and healthcare data is known as artificial intelligence (AI) in the healthcare industry [10]. Artificial intelligence programs are used in areas including medication research, personalised medicine, patient monitoring, and diagnostics. Even though other countries have made strides in the development of AI, Ukraine is still trailing behind, mostly due to legal obstacles [11], but has been open minded to include its application into medicine and other non-medical fields [12,13]. As far as untapped areas of innovative medicine are concerned, AI remains the most unexploited.

It is important to note that Ukraine's healthcare system has been under severe pressure due to the ongoing conflict in the country [14]. Due to the war's effects on the country's infrastructure and availability to care, the healthcare system has especially encountered difficulties [15]. While the healthcare system in Ukraine is still strong overall, a recent health needs assessment has found that access to essential services is becoming more difficult for a growing number of civilians as a result of rising costs, logistical difficulties, and damaged infrastructure. To assist

in addressing the nation's growing healthcare demands, the World Health Organisation (WHO) has expanded its presence in Ukraine. Innovation is desperately needed given the state of healthcare in Ukraine [16]. The WHO has launched a fundraising campaign to support the country's escalating humanitarian needs, providing emergency medical care, and aid in the long-term resilience of the health system.

In order to elaborate the further situation it should be noted that the prime reason for the hampering of innovation in medicine is due to a shortage of experienced medical professionals, numerous healthcare institutions have been destroyed, and the availability of services is constrained [17]. The elderly is especially affected by the recent conflict, as they form the brunt of the burden of care [18]. Numerous services have been severely disrupted [19], and millions of Ukrainians who are undergoing long-term therapies for chronic conditions are suffering because of war-related issues. Medicines availability is especially scarce in areas that are inhabited. The spread of disease is another issue, such as reports of new incidences of tuberculosis [20]. The healthcare of other countries is also indirectly affected, such as in Poland where cancers care has been experiencing new problems [21]. Expecting mothers are also in dire need of attention to their health [22]. This is where the healthcare sector has applied ingenuity, as even though the conflict itself is a limitation to innovation, the Ukrainian healthcare sector has used the war to stimulate effort into devising and applying innovative activities that range from drug distribution, medical education, and rescue services [23-25]. The Ukrainian government itself has passed new legislation to lessen the effects of these war-related difficulties and has executed these in tandem with innovative measures. This legislation simplifies the licensing, quality control, and import of medicinal products into Ukraine, gives displaced people the option of using local healthcare facilities, expands the use of the ePrescription system, allows primary care physicians to write prescriptions for refugees, and increases the number of drugs availability.

Research Problem

There is a lack of information concerning Ukraine's current state of innovation with regards to medicine. Despite the ongoing conflict in the country and the severe pressure on its healthcare system, there is little information available about the measures being taken to promote innovation in medicine in Ukraine. This lack of information highlights the need for further investigation into the state of innovative medicine in Ukraine and the measures being taken to address the challenges faced by its healthcare system.

Research Focus

The focus of this literature review is to find and assess the currently available literature on available innovative or currently being developed medicines in Ukraine. This review will include any type of study written in any language to ensure the inclusion of comprehensive information on the subject matter.

Research Questions

1. What are the currently available innovative medicines and medical technologies in Ukraine?
2. What efforts, investments, policies, or legislation are being implemented for the development of further innovative medicine in Ukraine?
3. What limitations is Ukraine currently experiencing in availing or developing innovative medicine.

Research Methodology

General Background

A literature search was conducted on several databases, including MEDLINE, Cochrane Reviews, and Pedro. Specific keywords with the conjunctions 'AND' and 'OR' were utilised, and these are displayed in Table 1. The time frame of the articles was kept beyond 2018-2022 to include only the latest data. The inclusion criteria included papers discussing any form of innovative medicine, therapy, or management of a disease. These could be experimental but had to be exclusively developed or designed in Ukraine. The exclusion criteria were any innovative form of treatment that was adopted from abroad. Also, papers published in a language other than English were excluded, but those published in Ukraine that had a translated portion were included. While this was not a systematic review, the authors felt an ordered approach to the search strategy was warranted to ensure a maximum number of articles found.

Data analysis

Information sources:

-  PubMed/MEDLINE (2018-2022)
-  Cochrane/EMBASE (2018-2022)

 Pedro (2018-2022)

Data items:

 Author, Study type, Innovative medicine or approach to access, Findings

Search strategy:

The search strategy is displayed in Table 1

Table 1. Search strategy on Pubmed

#	Query	Search Details	Results	Time
1	innovative therapies [MeSH Terms]	"Therapies, investigational"[MeSH Terms]	2778	14:36:54
2	Ukraine [MeSH Terms]	"Ukraine"[MeSH Terms]	17072	14:37:19
4	(Ukraine [MeSH Terms]) AND (innovative therapies [MeSH Terms])	"Ukraine"[MeSH Terms] AND "therapies, investigational"[MeSH Terms]	0	14:37:37
7	innovative medicine AND Ukraine	((("creativity"[MeSH Terms] OR "creativity"[All Fields] OR "innovativeness"[All Fields] OR "innovate"[All Fields] OR "innovated"[All Fields] OR "innovates"[All Fields] OR "innovating"[All Fields] OR "innovation"[All Fields] OR "innovation s"[All Fields] OR "innovational"[All Fields] OR "innovations"[All Fields] OR "innovative"[All Fields] OR "innovatively"[All Fields] OR "innovator"[All Fields] OR "innovator s"[All Fields] OR "innovators"[All Fields]) AND ("medicine"[All Fields] OR "medicinal"[All Fields] OR "medicinally"[All Fields] OR "medicinal"[All Fields] OR "medicine"[MeSH Terms] OR "medicine"[All Fields] OR "medicine s"[All Fields] OR "medicines"[All Fields]) AND ("Ukraine"[MeSH Terms] OR "Ukraine"[All Fields] OR "Ukraine s"[All Fields])) AND (2018:2022[pdat])	170	14:38:50
8	(Medications [MeSH Terms]) AND (Ukraine [MeSH Terms])	"Pharmaceutical preparations"[MeSH Terms] AND "Ukraine"[MeSH Terms]	258	14:40:03
11	(Medications [MeSH Terms]) AND (Ukraine [MeSH Terms])	("pharmaceutical preparations"[MeSH Terms] AND "Ukraine"[MeSH Terms]) AND (2018:2022[pdat])	31	14:40:13

Source: created by the authors based on analysis of relevant terms that outputted the most hits in the search engine

Research results

Salient findings

The first study to analyse the literature review of the development, distribution, and procurement methods of innovative medicine within the health sector of Ukraine:

1. The majority of studies concerned the access to innovative medicine and its accomplishment instead of medicine development analysis.
2. Only one study focused on new medicines development.
3. Most studies made mention of HTA and MEA, and how this was essential to ensure convenient and open access of innovative medicines to patients.
4. Limitations were confined to economical or legislative, but efforts are being made to mitigate these.

Synthesis of studies

The table below displays notable findings from studies that fell under our inclusion criteria.

Table 2. Synthesis of studies

Author	Study type	Innovative medicine or approach to access medicine	Findings
[26]	Observational	Managed entry agreements	MEA can be used synergistically with HTA to allow access to innovative medicine

[27]	Experimental	FTIR and NMR	Clustering of water molecules as a basic ingredient for making novel medicines
[28]	Systematic review	Managed entry agreements	MEA can be used to allow ease of access to assisted reproductive technology
[29]	Survey	Health technology assessment	Several limitations and outcomes uncovered regarding the HTA
[30]	Literature review	Novel techniques in procurement of medicines	Utilising generics and biosimilars, and controlled entry agreements for novel medications are all tools that can be exploited to ensure access to medicine.
[31]	Literature review	Reimbursement of medications for chronic illness to patients in a convenient manner.	The HTA can be used for more efficient reimbursement of medication for chronic illness such as asthma.
[32]	Commentary	Cooperation between public and private clinics	Increased availability of medications for opioid use disorder
[33]	RCT	Dietary supplement	Supplements are efficacious in improving health parameters of diabetic patients

Source: created by based on analysis 26-33 of relevant studies that fit under the inclusion criteria

Elucidation of results

Zaliska et al. sought to describe the market access for novel medicines, the phases of Health Technology Assessment (HTA) development, and the reimbursement of medications for the treatment of asthma in Ukraine. A literature review was used to perform the study, which concentrated at Ukrainian laws and academic articles on the study's topics. The findings revealed that a legal framework for the creation of the National List of Essential Medicines (NLEM) and protocols for reference pricing and reimbursement schemes were developed in 2016. Based on quality, efficacy, effectiveness, safety evidence, and economic analyses, HTA is used to decide which medications to list. The legislation, HTA training for experts on the Expert committee of the Ministry of Health (MoH), and the creation of NLEM comprised the implementation of HTA in 2016. As a result of newly enacted laws, reimbursement programs for cardiovascular disorders, 2nd type diabetes (T2D), and asthma began in April 2017 [31]. According to the study's findings, the application of HTA in decision-making in Ukraine will give patients access to cutting-edge medications and ensure an open, uniform procedure for deciding which health technologies to include on regulatory lists and reimbursement schemes.

As far as the HTA implementation is concerned, a study that sought to investigate the context of Ukraine's healthcare decision-making from the perspectives of specific stakeholder groups to promote the country's adoption of HTA. Results from two workshops using PEST methodology with two groups of HTA stakeholders in May 2019 were included in the study. The investigation uncovered both favourable and unfavourable macroeconomic aspects affecting how HTA was implemented in Ukraine. HTA-related political, economic, sociocultural, and technological factors were noted [29]. The HTA-informed system should be improved because of the analysis' findings.

The market share of medicines in Ukraine that were paid for by the state budget in 2017 was studied, and the authors suggested future initiatives to increase access to new medications by increasing the effectiveness of procurement processes. A survey of the literature using secondary sources of information was used to perform the study. The findings revealed that, in accordance with Law of Ukraine No. 269, international organisations spent EUR 0.19 billion on medications for 38 state initiatives in 2017. As a result of this engagement, the Accounting Chamber of Ukraine saw cost reductions of up to 39% in 2017 [30]. The study concludes that effective procurement in Ukraine needs to be implemented in a synergistic way based on best practices abroad and encompasses more than just finding the best deal. Utilising generics and biosimilars, establishing a competitive market through therapeutic tenders, and implementing controlled entry agreements for novel medications are all tools that can be utilised to increase efficiency. In the absence of more efficient methods of procurement, the real stakeholders to suffer are the patients. Medical companies, such as pharmaceuticals take a back seat given the current circumstances, as profit needs to be put on a low priority for the sake of patient welfare. This is easier said than done, and tackling the players involved in commerce would only breed more problems than solve. This is why the nation becomes reliant on external aid, as local companies focus almost entirely on capitalistic endeavours. A compromise should be made to at least focus on the 'essential' medications, such as those for chronic illness e.g., anti-hypertensives, anti-diabetic, anti-asthma, etc.

As far as the actual medications are concerned, Babak and Zaliska examined the primary drug markers purchased with budget dollars and in accordance with medical aid criteria, in addition to the list of new medicines

registered on the Ukrainian market over the previous five years. The study's objectives were to evaluate the market access for novel drugs and find areas for advancement. The study made use of statistical observation techniques and official drug registration data from the Ministry of Health (MoH). The findings demonstrated that Ukraine's access to novel medications is severely constrained. For the period 2014–2018, only 8 novel medications were authorised on the Ukrainian market and included in national treatment guidelines. The Expert Committee only recommended one of them for the National Essential Medicines List (NEML) [26]. The study's findings support the need for Managed Entry Agreements (MEA) approaches to ensure the efficient use of budget monies for national state programs based on HTA data for pricing and procurement.

Other medications include treatment for opioid abuse such as methadone. Care for those who suffer from opioid use disorder (OUD) has been hampered by the escalation of the war in Ukraine [32]. In occupied Ukrainian territory, the Russian Federation prioritises methadone cessation and outlaws its use. Due to opioid injection using contaminated injecting equipment, Ukraine is experiencing one of the worst HIV epidemics in the world. A top national priority is expanding the use of pharmaceuticals for opioid use disorder (MOUD). Prior to the war, government-run and for-profit clinics in Ukraine offered MOUD. The conservative healthcare system in Ukraine has many restrictions on MOUD. Private clinics now offer a differentiated care model that gets through most obstacles seen in public clinics, increasing the number of MOUD alternatives, and streamlining the delivery of care. The cooperation of public and private institutions in distribution of MOUDs serves as an innovative example in the Ukrainian healthcare sector.

All studies included above present credible results, but because most were reviews, bias analysis from the authors did not reveal anything worth noting. The only randomised control trial in our review had a very low risk of bias but does have the limitation of being a small study. The other experimental research on FTIR and NMR has been cited by multiple studies and shows sound scientific analysis of the experiment's result.

Discussion

Even while there aren't many publications describing the use of innovative medicine in Ukraine, this in no way suggests that there isn't any effort being made in this direction. It simply means that there isn't much coverage, which the most recent war can be blamed for. The question is that if indeed there is a sizeable amount of ongoing activities in designing, developing, distributing or even researching innovative medicine, then why haven't these been given been brought to the forefront. Its possible language barriers are one of the reasons, but given that the current global focus is on Ukraine, it was expected that more material would be available. And in the scenario if there aren't really a good number of articles covering innovative medicine, then the question arises that why hasn't the due investment of funds and effort been made to accomplish this. Even if we consider the economic barriers, there still should be enough for emulating the creating and distribution of innovative medicine like in other countries. Moreover, policy makers have a key role in ensuring the success of this.

From the above results, it appears that so far the only success has been made into devising strategies to actually make innovative medicine affordable. This is understandable as the need of the hour is the ease of availability of medicines to the public. Health policy makers probably deem those affected by the war, or those living in poor circumstances are priorities and thus the main focus is on 'supply' instead of 'development'. This is reinforced by a study that talks about how Ukraine's legislative system controls the supply and standard of medical supplies and services [34]. It draws attention to discrepancies in sexual orientation, age, and geographic location in the frequency of referrals for medical professionals, as well as economic, physical, and informational accessibility. The challenging financial condition and lack of treatment funding are the key contributors to uncertainty. Because there are fewer medical supplies and services available in rural areas than in urban ones, the health of the rural population is worse. The staffing and financial support of healthcare in Ukraine and EU nations are compared, and strategies to increase accessibility and quality are presented.

While effort put into making innovative medicine easily available is a commendable endeavour in itself, it still does not bring Ukraine up to the mark in being the forefront of innovation in medicine. Health assessment technology is one innovation to that Ukraine can benefit from investing further into this option. To illustrate the strategy being employed, a research, with the help of national stakeholders, aimed to offer a customized HTA application path for Ukraine [35]. Policymakers, executives from pharmaceutical firms, and representatives from patient organizations participated in a poll. The findings indicated that although financing for HTA study was now scarce, it will grow going forward, mostly from public sources. Organizationally, a public HTA organization with academic backing was most favoured. The importance of healthcare and cost effectiveness was the main determining factors in judgments. Ukraine is only beginning to adopt HTA, and this study gives national stakeholders a clear picture of the future orientations. Both MEA and HTA [36] can still be emulated by other developing countries that can look towards Ukraine as a model; however, whether or not healthcare systems in third-world countries do indeed look towards Ukraine as a model to emulate still remains unclear as there is no

clear indication in current literature.

By far the most impressive of the innovative medicines that deserves more spotlight is the FTIR and NMR used to devise novel medicines [37, 38]. While still experimental, it shows promising results, and this can serve as not only an initiative but a template for other parts of the healthcare sector to utilize. At the moment, the technology is only used to aid in clustering of water molecules, but potential applications of this can expand beyond healthcare, such as food and agriculture, though discussions of those applications take a back seat to healthcare due to the scope of this literature review.

It is interesting noting that there was a lack of articles discussing innovative measures in devising medication for chronic illnesses. While palliative care has been given due importance [39], the same cannot be said for management of chronic diseases. This is significant as chronic illnesses comprise the majority of the illness-stricken population, the lot of which belong to the geriatric category [40–42]. This is reinforced by a study which set out to identify the incidence of non-communicable illnesses (NCDs) in order to analyse the perceived impact of conflict on the severity of NCDs as well as accessibility to treatment among individuals impacted by conflict in Ukraine [43]. Two cross-sectional household surveys that were stratified, population-representative, were performed among adult internally displaced persons across all of Ukraine and adult residents of Donbas in eastern Ukraine. The study discovered a significant incidence of NCDs in both populations and pointed out barriers to receiving medical attention and prescription treatment. In Donbas, more displaced people than safer adults reported experiencing psychological anguish, care disruptions, and medication interruptions. The study recommended that to address the particular requirements of these communities, there is a demand for tailored policies and initiatives. Given the increase in longevity and the rapid pace of aging in recent decades, an older population may be disproportionately impacted by humanitarian crises than in decades past. Although they have been identified as a vulnerable population in humanitarian crises, older people have not historically been given priority in humanitarian aid. Though there are specific recommendations on including this population during humanitarian crises and international guidelines that take elderly individuals into account, their practical applicability in the real world is still limited. The older population faces specific difficulties and barriers in humanitarian settings, such as barriers to obtaining food, clean water, and medical care; comorbidities and a greater susceptibility to illness, starvation, impairment, and trauma; a greater likelihood of prejudice and assault, especially for those with handicaps; insufficient treatment for chronic illnesses; a lower socioeconomic status with monetary reliance and social and economic disadvantages. Thus a greater emphasis is imperative to be placed on the development and procurement of chronic medications.

Until the war recedes, investment and effort into innovative medicine will remain sluggish. Healthcare policymakers can resolve this somewhat by taking a tactful approach. It is possible to increase the accessibility of medical supplies and services in Ukraine in a number of ways, such as sending unused medical supplies to Ukraine, offering on-site medical assistance or other remote services like telemedicine, enlisting the help of respectable organizations that can send aid. Other countries like Israel have provided training through its national field hospitals to Ukrainian healthcare personnel [44]. Certain specialized services, such as for patients with chronic kidney diseases, have also shown their effectiveness [45]. As WHO has already committed a sizeable amount in its own support the health sector of Ukraine must also increase its efficiency. This requires concentrating on patient needs, and replacing the outdated healthcare system. Implementing the new healthcare finance system is the first stage, where patient comes before profit. Instead of paying for hospitals, doctors, and inpatient beds, the state should now allot funds for a patient's particular requirements.

Conclusion and Implications

1. The current state of innovative medicine development in Ukraine is unknown.
2. Efforts are being made towards improving access to innovative medicine in Ukraine using Health Technology Assessment (HTA) and Managed Entry Agreements (MEA).
3. There is ease of access to the procurement of medicines for chronic illnesses.
4. Economic and legislative limitations need to be overcome in order to ensure further development and distribution of innovative medicine in Ukraine.
5. Future directions should involve higher investment in innovative medicine by ensuring that stakeholders have sufficient resources.

Prospects for further research

Since this is the foremost study that attempts to assess the availability or development of innovative medicine, it can be used as base for prospective research by other groups. But it would require more field work into investigating the actual situation in the development, distribution, and procurement of innovative medications. This can be hampered by the ongoing war efforts, but remains critical to accomplish, nonetheless.

Limitations

The study was unable to synthesize comprehensive information regarding the subject matter due to the lack of availability of literature. One reason may be that much of the information has either not been published in journals yet or is not indexed in the top search engines. Moreover, since we did not include articles that were in a completely different language than English, it's possible that some of that information may have been missed.

Declaration

Author contribution

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding

No funding source is reported for this study.

Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

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