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Nephrological care in the conditions of martial law in Ukraine

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Abstract. During armed conflicts (AC) and other disasters, the elderly, women, children, the infirm and the chronically ill patients are the most vulnerable population, with a high risk to health and life. Chronically ill people with kidney diseases, including those with kidney failure, deserve special attention due to their complete dependence on available functional infrastructure, and access to vital drugs and well-trained personnel. Currently, there is little information on the effects of AC on patients with kidney damage compared to the available data about the effects of other disasters. Mechanisms of injuries in AC and natural or man-made disasters have similar and distinctive features. Distinctive features: during AC — mainly gunshot and mine blast injuries, bleedings, poisonings by toxic substances, during disasters — hypothermia or burns, mechanical injuries, etc. Similar features include damage to infrastructure, particularly health care facilities, shortage of medicines, medical personnel, humanitarian and other crises, and a large number of injured and traumatized people in the hospitals. In this article, we systematized the material obtained during the military conflict, as well as reviewed domestic and foreign articles on this topic in order to optimize the work of nephrologists in the conditions of martial law and limited resources.

Keywords: martial law; chronic kidney disease; refugees; nuclear conflict; renal replacement therapy; dialysis; kidney transplantation; humanitarian crisis

Background

Emmanuel Macron, at the beginning of the full-scale invasion by Russia, said: “That nothing will be like before”. Most people will probably agree with this quote. But there is another famous quote: “War is barbarism when attacking a peaceful neighbour, but it is a sacred duty when defending the Motherland” (Guy De Maupassant). All too often, in recent times, armed conflicts (AC) with violence and mass damage and killing of civilians, and non-combatants have occurred [1]. More than 70 wars are currently going on in the world, which means that there are more than 400 million children in conflict zones [2].

International or inter-ethnic conflicts (wars) are force options, with the use of armed forces, to resolve disputed issues between two or more parties. The number of active conflicts in 2020 reached a record level since the Second World War. The United Nations (UN) constantly calls on

all conflicting parties to cease fire, but, despite this, more than one billion people (in 2022) are at health and life risk of active conflicts (Africa, Syria, Ukraine and others) [3, 4].

The war is a catastrophe that has seriously affected and continues to negatively affect the lives of all patients. About 2.7 million people with disabilities are registered in Ukraine. Broken infrastructure creates significant barriers for patients to receive by them vital treatments. Patients are at high risk regardless of whether they remain in affected areas or move elsewhere, putting themselves at risk in the absence of appropriate care, resulting in increased morbidity and mortality [5–8].

The war artificially creates a defect in chronic care for our patients [9]. Military actions induce long-term consequences for the health of all Ukrainians. Children, the sick, the elderly and senile, women, the poor and refugees suffer the most [10].

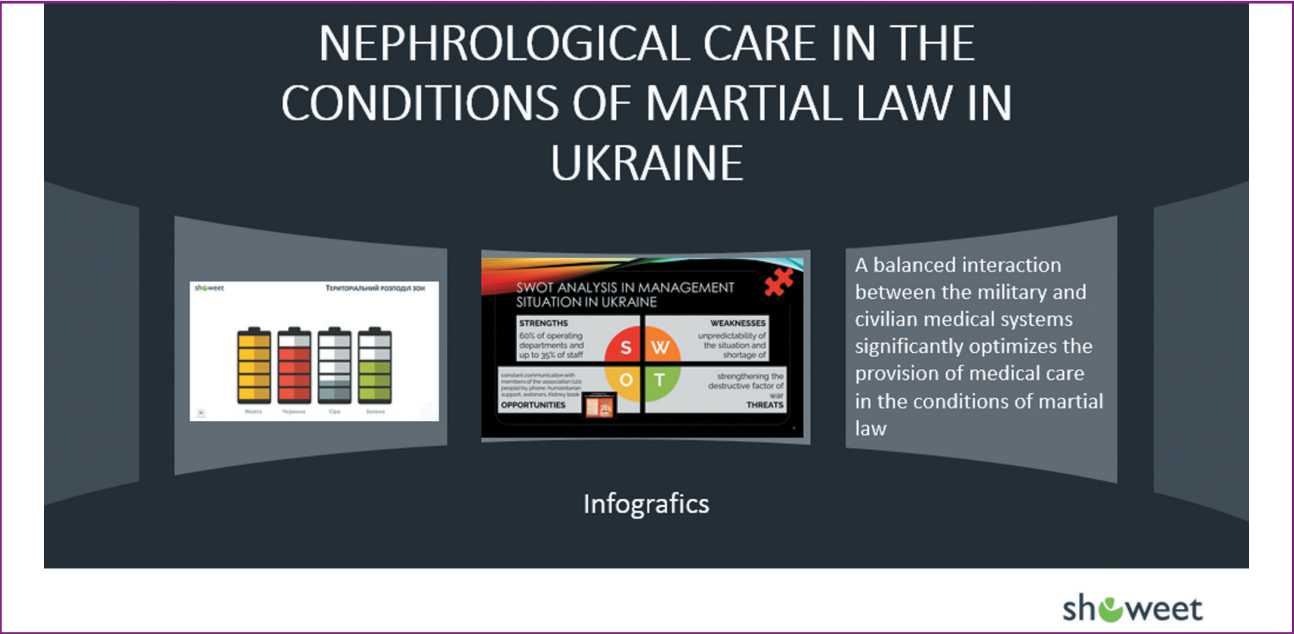


Figure 1

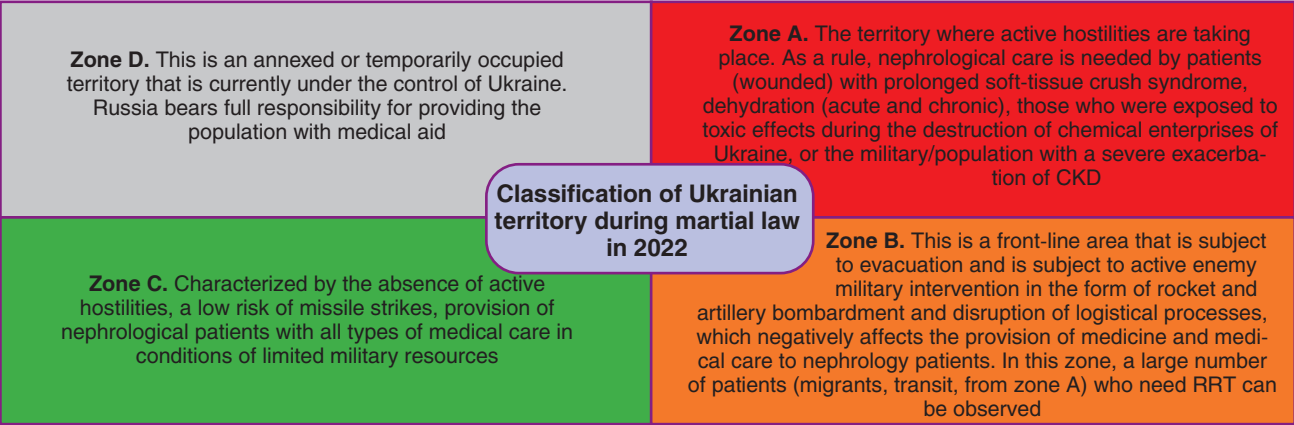


Figure 2. Classification of Ukraine territory zones during ML in 2022

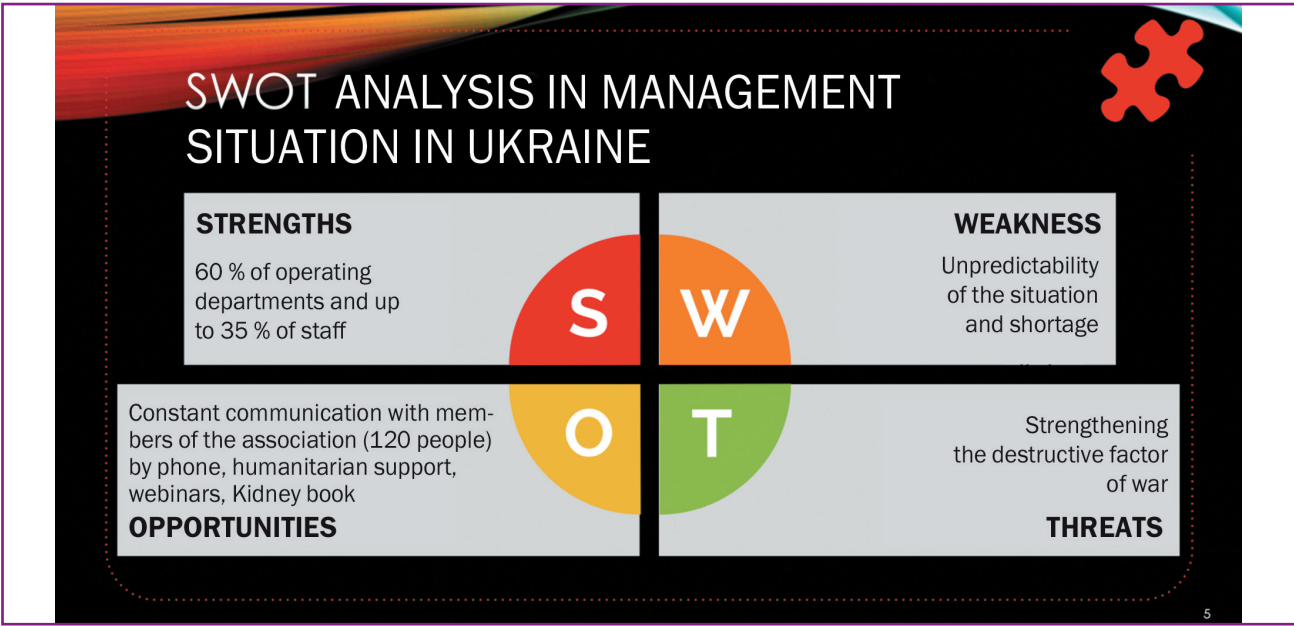


Figure 3

Personal problems

The increase in the burden on medical personnel, the shortage of medical personnel and the lack of algorithms and protocols of action during ML in various situations worsen the quality of nephrological care for patients [3].

From the professional point of view of a nephrologist, we have conditionally divided the territory of Ukraine into four zones (Figure 2):

— Zone A (red). The territory in which active hostilities take place. As a rule, nephrological care is needed for patients (wounded) with prolonged soft-tissue crush syndrome, dehydration (acute and chronic), those who were exposed to toxic effects during the destruction of chemical enterprises of Ukraine, or the military/population with a severe exacerbation of CKD. Patients with acute kidney injury who need RRT can receive it at the nearest dialysis units [3, 11];

— Zone B (orange). This is a frontline area that is subject to evacuation and is subject to active enemy military intervention in the form of missile and artillery bombardment and disruption of logistical processes, which negatively affects the provision of drugs and medical care to nephrology patients. In this zone, a large number of patients (refugees, transit, from zone A) who need RRT may be observed [3, 11];

— Zone C (green) — characterized by the absence of active hostilities, low risk of missile strikes, and provision of nephrological patients with all types of medical care in conditions of limited resources of the ML [3, 11];

— Zone D (grey) is an annexed or temporarily occupied territory that is not currently under the control of Ukraine.

Russia is fully responsible for providing the population with medical care [3, 11].

Patients of the most vulnerable category are the first to suffer: dialysis patients, who will have logistical problems with visiting their centers and receiving a dialysis procedure (air alarms, lack of drugs or consumables, etc.), kidney transplant patients, who may be left without vitally necessary drugs [9].

Mortality is expected to be higher in CKD patients compared to healthy people, due to logistical problems, unsatisfactory medical care, etc. Of course, the highest risks are seen in patients receiving dialysis or after a kidney transplant. 4 million CKD patients (10–15 % of the population) in Ukraine are at risk of the consequences of ML [3].

During the period from February 24 to August 1, almost 600 patients with CKD stage 5D left Ukraine. The authors gained their own experience by remotely consulting such patients, helping them to solve organizational issues with conducting RRT abroad and continuing to provide dialysis care on the territory of Ukraine, with extremely limited opportunities (lack of supply of consumables, difficulties in transportation to dialysis, etc.).

In order to improve the provision of medical care in Ukraine, we analyzed the experience of acute kidney injury (AKI) according to the data on the Korean military conflict [9]. During the Korean War, the mortality rate was 53 % among AKI patients (dialyzed and non-dialyzed). In recent wars, despite some improvement, the mortality rate is still 22 % [3]. Chronic, long-term disasters (the 11th year of the Syrian war) [12] have a greater negative impact on the course of CKD than short-term conflicts.

Table 1. Military-Induced Factors Affecting KD [5]

		Medical factors	Logistic factors
Specific KD Patients with acute kidney injury	Patients with acute kidney injury	The cause of the disease can be bleeding (when wounded), crushing and other injuries, exposure to harmful gases/agents	Shortage of nephrological personnel, medical appliance and materials, technical capabilities of dialysis
	Patients with CKD, pre-dialysis stage	High risk of complications through to interruption of treatment due to suboptimal conditions	There is limited or no access to immunosuppressive, hypoglycemic, antihypertensive and other drugs necessary for routine treatment of CKD
	Patients with CKD stage 5D	Complications due to inadequate dialysis	The shortage of dialysis personnel and consumables for its implementation leads to inadequate dialysis
	Kidney transplant patients	Complications due to interruption of treatment, high risk of developing infections (due to living in unhygienic conditions and immunological imbalance) ¹	There is limited or no access to immunosuppressant drugs and transplant doctors
Non-specific		High risk of medical problems due to prolonged stay in an “unhealthy” environment (hypothermia, etc.) ¹ , inadequate and/or inappropriate nutrition and treatment	Damage to general infrastructure and health care infrastructure, shortage of nephrologists and other medical personnel, necessary materials and medicines, limited or no access to vital resources/means

Note: ¹ — Subway tunnels, basements, open-air tents, etc.

The mortality rate of dialysis patients who remained in the conflict zone during the Iraq-Kuwait war was 42 %, which is significantly higher than for patients who left the country (12.7 %). Sick and elderly patients may not have had the opportunity to leave. Insufficient weekly dialysis doses due to damaged health infrastructure likely also contributed to these negative outcomes in regions affected by AK [3].

During the period of limited conditions for the provision of medical care (February 24 — May 31, 2022), the number of patients receiving RRT in Kyiv decreased by 34 %, some patients were transferred to dialysis 2 times a week, and the number of erythropoietin, immunosuppressant, antihypertensive drugs was reduced. An increase in average daily BP levels was recorded: SBP by 12.2 ± 2 , DBP by 6 ± 2 mm Hg.

Traffic in the city was limited, and in some areas — absent, due to the bombing. In Kyiv, almost the entire non-governmental dialysis service has stopped working due to a shortage of medical personnel and disruption of logistical processes (see slide). Prof. D. Ivanov's nephrology clinic (clinical base of the Department of Nephrology and RRT of the Shupyk National Healthcare University of Ukraine) worked all this time. During the period from February 24 to August 1, there was an increase in consultations, diagnostic examinations (invasive and non-invasive) and hemodialysis (HD) sessions for patients who could not receive care at the place of their previous observation. The entire team of the clinic, including employees of the department, who are attached to the clinical base, remained at their workplace almost in full. Thanks to the courage and dedication of the employees of the clinic and the Department of Nephrology and RRT, all patients of the clinic received proper nephrological care [3, 11].

Picture 3 presents a SWOT analysis of the management situation in Ukraine [3, 11, 13].

In Kyiv, the city's largest clinical children's hospital was closed, and the staff was reduced by 70 %. The supply of medicines was stopped, and there was a defect in nephrological care due to a decrease in the number of paediatric nephrologists in the field and disruption of the logistical chains of providing medical care to the children population [3, 11]. We were forced to reduce the doses of immunosuppressive drugs due to their shortage, to transfer children with nephrotic syndrome to rituximab due to a shortage of hormones and mycophenolate mofetil, to reduce the dialysis dose for children on dialysis due to a shortage of consumables, to reduce the prescription of erythropoietin, drugs affecting bone metabolism, to increase doses of antihypertensive drugs, as hypertension, that possibly caused by stress, increased by 34 %. In approximately 70 % of cases, such temporary changes did not lead to a fatal outcome, in 20 % they significantly worsened the condition, and in 10 % they ended tragically.

Paediatric population

Until February 24, 2022, two Ukrainian centers — Lviv and Kyiv — provided RRT for children. Until February 24, 17 children were receiving RRT at the OHMATDYT Na-

tional specialized children's hospital Ministry of Health of Ukraine (OHMATDYT NSCH) base, 8 children were on HD and 13 were on peritoneal dialysis (PD) at the West Ukrainian Specialized Medical Center. In March, the situation in Kyiv was very tense, in this regard, on March 8, 2022, children receiving RRT at the OHMATDYT NSCH were evacuated to the Western Ukrainian specialized children's medical center (WUSCMC). After evacuation from other regions of Ukraine, the number of patients increased to 22 on HD and 30 on PD, some children went abroad for treatment.

Almost all children with CKD stage 5D from the city of Kyiv were evacuated to Western Ukraine and abroad, only 3 children remained in OHMATDYT NSCH. Today, more than 2/3 of them have returned to Ukraine. Approximately 30 % moved to safer regions. This process of displacement within the borders of Ukraine continues even now, this is determined by the map of the activity of military actions [3, 11]. The evacuation from Kyiv of almost all children who received RRT allowed them to continue their specialized nephrological treatment. Although we would feel safer if we had mobile dialyzers, which are needed during the transportation of children to their temporary evacuation site.

During the first 3 months of ML, 29 children on RRT together with 40 family members crossed the border: 13 were on PD, 10 on HD and 4 after kidney transplantation and 3 patients with syndromes: congenital nephrotic syndrome, atypical hemolytic-uremic syndrome and nail-patella syndrome. 26 children were referred to Polish nephrology centers (Warsaw, Krakow, Lublin, Gdansk, Wroclaw, Białystok, Poznań, Szczecin), and 3 children were referred for further treatment to Germany (Marburg, Cologne and Hamburg).

Since the beginning of ML in Lviv, 5 kidney transplants have been performed for children, in particular, 3 transplants have been performed at the WUSCMC. Fruitful cooperation has been established with children's nephrology centers in Warsaw, Krakow, Gdansk, and the Charite Clinic. We express our sincere thanks for the constant support and provision of humanitarian aid for Ukrainian children in the form of medicines and consumables for HD.

During the period of ML, 133 patients, internally displaced persons (IDPs) from the affected regions were treated at the Kyiv city center of nephrology and dialysis and 8 kidney transplants were performed, of which 4 were family, and 4 were donors.

The Institute of Nephrology of the Academy of Medical Sciences of Ukraine has developed recommendations for the organization of treatment of HD patients in wartime (cooperation with military administrations, disinfection of HD devices in conditions of water and time shortages, an algorithm for emergency disconnection of patients if necessary and optimization of isolation of patients with COVID-19) [14].

Disruptions in the health care system create a serious long-term risk for patients, especially those with CKD, chronic cardiovascular disease (CVDs), and oncology. Military actions cause a shortage of personnel and an increase in the burden on personnel and patients. Many medical work-

ers were injured, killed or forced to flee their homes, leading to shortages of medical personnel and disruption of logistics processes [10].

Care by general practitioners

It is difficult to underestimate the nephrology care provided by primary health care. Basically, the majority of patients over 60 years of age with early-stage CKD seek primary care (prevalence of almost 30 %). In only a small number of patients, CKD progresses to end-stage renal disease (ESRD) requiring RRT. It is known that referral to a nephrologist one to six months before the start of dialysis reduces mortality and hospitalization, and also has a positive effect on the quality of preparation for dialysis [15]. War-time family medicine is more than just primary care. In addition to the fact that family doctors take care of the health of their patients, they have a load, including volunteer work. In addition, our family doctors provide medical care to the wounded.

Internationally, there are differences in health care systems regarding referral to specialized nephrology services, which are reflected in many clinical practice guidelines and recommendations for the treatment of CKD with different criteria. In most guidelines (British guidelines of The National Institute for Health and Care Excellence (NICE, 2014), The KD: Improving Global Outcomes (KDIGO, 2012), and The German College of General Practice and Family Medicine (DEGAM, 2019)), the patient is referred to a nephrologist from stage 4 (estimated glomerular filtration rate (eGFR) < 30 ml/min). Also, referral with GFR 30–59 ml/min is recommended, if additional criteria are present. The German Society of Nephrology (Deutsche Gesellschaft für Nephrologie (DGfN)) and The German Society of Internal Medicine (Deutschen Gesellschaft für Innere Medizin (DGIM)) recommend referral with GFR < 45 ml/min (Guideline with recommendations, 2015). In 2021, a KF risk equation was proposed for clinical practice to estimate the 5-year risk of RRT need (NICE, 2021). A risk of 5 % is suggested as a threshold for referral to a nephrologist [15].

Many Ukrainians are used to waiting until the last thing to do when it comes to taking care of their health, and during hostilities, their own health always takes the last place on their agenda. Therefore, the role of family doctors should also be to draw the attention of all their patients who have signed declarations that ML is not a reason not to worry about their health. On the contrary, we have a great burden on the psychological health of each person, we may not diagnose the development or exacerbation of chronic diseases in advance, or miss the optimal time to start treatment.

All this can be done by contacting a family doctor. This is important now because after ML we will have many people who will need a large amount of time to bring their health back to the level it was before ML. Military time is exactly the time when you need to go to the family doctor to check your health again and prevent health problems.

Avoiding the unnecessary referral of patients to a nephrologist at low risk of KF is not usually a primary goal, but given the high incidence of CKD, the shortage of nephrolo-

gists, and the additional financial burden on health care in an ML environment, it is essential [15].

In the first months, mostly forcibly displaced Ukrainians, who were often in a state of stress and in need of external support, turned to medical institutions. Therefore, the specifics of the work of family doctors have changed, because, despite various diseases, patients also needed the consultation of a psychologist. In the conditions of ML, family doctors also provide psychological help.

Family physicians continue to issue electronic prescriptions to their patients. During ML, about three million Ukrainians were issued electronic prescriptions, which means that family doctors are in constant contact with their patients. They consult remotely, in particular, by phone. And this makes it possible to keep the entire medical system in good shape.

For patients with a nephrological profile who are shown specialized treatment and patients with a high risk of progression of CKD to the ESRD, ensuring timely and full access to a nephrological service, in the conditions of ML and limited resources, is a priority, and unified criteria for referral to a nephrologist, significantly facilitate the work of the primary link [15].

Damage to HCF in Ukraine has a negative impact on the health of citizens. The World Health Organization (WHO) recorded more than 200 attacks on HCF by the end of April 2022, including 54 injuries and 75 deaths among medical personnel and patients [10]. On April 28, the UN High Commissioner for Human Rights reported 6,009 civilian casualties (including 2,829 dead and 3,180 wounded) as a result of the AC in Ukraine, the real number is expected to be much higher [16]. During the 3 weeks of the AC, according to the Ministry of Health (MoH), 117 hospitals were damaged (including maternity centers) [7, 10, 16–18].

It is expected that the number of non-working HCF will increase. According to the assessment of the former Deputy Minister of Health of Ukraine, the damage caused to the medical facilities of Ukraine is enormous: the medical infrastructure of entire cities was destroyed, and roads were damaged and mined, which further limited access to medical facilities [10].

A particular problem is dialysis refugee patients, who are often on the move for several days, with limited or no access to their usual therapeutic resources and are deprived of nephrologist follow-up, who always need support in an unfamiliar area, because of communication problems (foreign culture or/and language) [5, 7, 19].

Refugee CKD patients

Refugee-hosting countries have implemented a large number of short-term emergency measures to support refugees. Long-term measures to integrate refugees into the life of the local population remain problematic. These countries, acting as a transit for the transportation of goods and essential items to and from Ukraine, feel the need for coordinated cooperation between all interested parties [20].

During an AC, patients with KD, like the general population, may stay in the war zone or move to other safer re-

gions of Ukraine, IDPs, or leave for other countries (refugees) [3, 21].

In 2021, the number of displaced persons reached 89.3 million. The Syria crisis has led to 6.9 million IDPs and another 5.6 million refugees after 11 years of war [12].

On March 19, 2022, 2.0107 million refugees from Ukraine arrived in Poland, 518.3 thousand — in Romania, 359.1 thousand — in Moldova, 299.3 thousand — in Hungary, 240.0 thousand — in Slovakia, 184.6 thousand — in Russia, and 2.5 thousand arrived in Belarus [22].

On March 29, more than 4 million refugees left Ukraine (over 1.5 million children), and about 7 million IDPs. The majority of refugees (76 %) arrived in Poland [22–26].

At the beginning of May 2022, more than 5.8 million refugees left Ukraine. Found asylum in neighboring countries: 3.2 million — in Poland, 0.86 million — in Romania and 0.56 million — in Hungary, but a much larger number is IDPs [10, 24–26].

6.8 million Ukrainians became refugees as of May 31, 2022. IDPs during this period — another 8.0 million Ukrainians who remained in Ukraine. A total of 14.8 million Ukrainians (33.5 % of the country's 44.1 million citizens) were forced to leave their homes within three months. Due to the AC in Ukraine, the world's number of displaced persons increased from 84 million to 99 million (a total increase of 17 %). Children and women make up almost 90 % of refugees from Ukraine. As of May 31, 2022, only one-third of the 7.5 million Ukrainian children under the age of 18 remained at home. The remaining two-thirds of children (over 2.2 million) migrated to European countries, and 3 million became IDPs [4].

As of June 9, 2022, the Office of the United Nations High Commissioner for Refugees (UN HCR) reported on its website the number of refugees from Ukraine registered for temporary protection in Europe — was 3.207 million [<https://interfax.com.ua/news/general/838562.html>].

As of June 14, 2022, during the Ukrainian disaster, the number of IDPs (7.1 million) and refugees (4.9 million). During displacement and in destination countries, refugees may face more dangerous conditions than those who remain at home. Difficulties in using a foreign health care system and problems in communication due to language or cultural barriers negatively affect the provision of medical care, the number of medical errors, etc. [3, 7, 19, 27, 28].

Most of the Ukrainian refugees went to Poland and several other border countries. The support provided by European countries and their people is extraordinary. However, the local therapeutic infrastructure, near the Polish border, maybe overwhelmed [5, 24–26].

In Poland, a law was adopted that guarantees legal stay and employment for 18 months, and also provides access to health care and social security systems (funds for children's education) [20]. Providing one million refugees with access to health care is estimated at 200 million zlotys per month (US\$47 million) [7].

According to UN HCR data, the largest number of refugees with the status of temporary protection is in Poland — 1 million 152.36 thousand, despite the fact that, according to the data of the Polish border service, 3.865 million people

arrived in the country from Ukraine from the beginning of the war until June 9, and in the reverse direction, 1.738 million people travelled to Ukraine [<https://interfax.com.ua/news/general/838562.html>].

For Ukrainians, Canada issued 112,035 temporary visas (241,620 people applied), and 32,201 refugees were registered as of May 18, 2022. There are 2 ways to enter Canada for Ukrainians: for those who wish to become permanent residents (family reunification) or as temporary residents with a 3-year visa (Canadian-Ukrainian Emergency Travel Authorization (CUAET)). Citizens of Ukraine, under the CUAET program, can obtain visas within 14 days, without any processing fees, with a term of up to 3 years, for temporary residence. Residents have the right to apply for a free open work permit, attend primary and secondary schools, and receive provincial health insurance [29].

In general, according to the UN, about 10 million people have left Ukraine since the beginning of ML, while 2.388 million have returned (without data from Hungary, the Russian Federation, and Belarus). According to this information, the total number of refugees since the beginning of ML is estimated by the UN to be approximately 4.8 million people [<https://interfax.com.ua/news/general/838562.html>].

In addition to the deep concern about the increase in the cost of energy and gas, and the recession of the economy, which will significantly affect the cost of providing care to our patients, the world media, from the first days, talked about humanitarian corridors and helping refugees [9, 30].

The “Directive on Temporary Protection”, which came into force on March 4, 2022, provides for social security in any EU member state, granting Ukrainians residence permits, access to work, access to education for minors, and the possibility of family relocation [20].

On March 8, 2022, the legislative act “Program for Cohesion for Refugees in Europe (CARE)” was adopted, which allows the financing of humanitarian measures [20].

WHO, UN agencies and the International Federation of Red Cross and Red Crescent Societies (IFRC) also actively support Ukraine and neighbouring countries, provide first aid, transport people, and organize humanitarian aid and basic training [20, 31].

The International Movement of the Red Cross in Poland, Hungary, Romania, Moldova, and Slovakia has centres at border posts with rescue teams that provided assistance to arriving refugees [20].

Organizations such as the International Red Cross or Doctors Without Borders provide medical assistance to people who find themselves in disputed parts of Ukraine, as well as to IDPs and refugees. Also, they provide fresh water, food, shelter, emergency medicine and treatment [10].

To monitor the impact on public health in Ukraine, the Association of Schools of Public Health in the European Region (ASPHER) created a working group to prevent, prepare for and respond to the AC in Ukraine [32].

For Ukrainian refugees in the countries, humanitarian benefits have been introduced:

1. Free treatment of military personnel injured as a result of hostilities.

2. Free psychologist consultations, medical examinations, and dental and medical services.

3. Registration of children in preschool and school institutions.

4. Organization of information centers, specialized sites, and hotlines in Ukrainian and Russian.

5. Free prescription drugs that were issued in Ukraine or in the host country.

6. One-time cash payment to arrive refugees and host families.

7. Establishing guardianship over unaccompanied minors, etc.

8. Free public transport.

9. Creation of medical teams at border checkpoints to examine people and domestic animals [20].

In EU countries, there are doctors and nurses among the refugees from Ukraine. In many countries, in their own health care systems, programs have been created to optimize the work of refugee doctors and nurses [7].

According to the provided results of the estimates of the International Organization for Migration, from March 9 to 16, 2022, about 6.5 million Ukrainians were IDPs, and 53 % of displaced persons were women. Ukraine ranked ninth among IDPs in the world, even before the Russian invasion. It has been recorded how IDPs faced deliberate beatings, rapes, kidnappings, murders, bombings and attacks by the Russian military [20, 33]. Another vulnerable population group is stateless persons, almost 40,000 such people live in Ukraine according to UNHCR estimates. Also, there are more than 5,000 refugees and persons who have received additional state protection in Ukraine, their fate is not yet determined. These vulnerable population groups need more attention and help [20].

Adult patients

In 2019, 10,250 patients received RRT (European Renal Association (ERA) 2019) in Ukraine; of them on HD or hemodiafiltration — 7869, 922 — on PD and 1459 with a transplanted kidney (mainly from living donors) [5]. In Ukraine, at the beginning of 2021, 11,181 patients (268 per million) received RRT, of which 6,017 were treated with HD, 2,700 with hemodiafiltration, and 931 with PD, and 1,533 underwent kidney transplantation [14].

The number of patients with HD and after kidney transplantation has increased significantly in recent years (2021–2022) due to the implementation of medical reform. A register of kidney transplant recipients was created (more than 300 kidney transplants from cadaveric donors) [14].

Before the start of hostilities, all patients after kidney transplantation received immunosuppressants, iron preparations, erythropoietin, and phosphate binders in full. Patients with CKD stage 5 could freely choose the method of RRT and the dialysis center, if there were restrictions on choice, they were of a purely medical nature [14].

Now, especially in some regions, the state of nephrology and dialysis services has changed. The problem of delivery of consumables for HD comes to the fore, as well as limited or no access to the dialysis center for patients and medical personnel due to bombing and rocket attacks. Dozens of patients have problems getting to their dialysis centers and

there are even those who have not received dialysis for more than a week [14].

Currently, some dialysis centers and departments have been evacuated, some are not working, and some are at risk of becoming inoperable. Some part (no one knows the exact numbers) of 10,250 patients moved to another place in Ukraine, or, in general, abroad. Nephrologists of Ukraine and neighbouring countries have probably already felt the burden [5].

Patients receiving RRT in conditions of ML, limited resources, constant rocket bombardment and curfews are the most vulnerable category [14]. Every day, risking their lives, our nephrologists and nurses and other staff do everything possible and impossible to provide patients with adequate HD. The entire Ukrainian nephrology community is united now, more than ever [14]. In Ukraine, from an ordinary medical workers to the president, the workplace courage index (which defines 11 forms of behaviour) (Detert, 2021) is impressive [34].

As of April 22, 2022, the population of Ukraine is 44.1 million people, of which 4.99 million people (11.31 %) are already infected with COVID-19 and more than 0.1 million deaths from COVID-19 have been recorded. In Ukraine, 15 million people (33 %) are vaccinated against COVID-19 (WHO), despite the fact that vaccination campaigns against COVID-19 and routine immunization have practically stopped throughout the country [35–39].

So far, many offers have been received from several countries to treat our dialysis patients and fortunately many of our patients are now continuing their treatment in Poland, Germany and other countries [14].

As the present shows, the nephrology sector suffered the most from military operations. The reasons are different: the need for intact general and medical infrastructure and special equipment risks to the life and health of nephrologists and their families, and a large number of patients with complications of AKI and CKD [5].

The proper work of a nephrologist depends on teamwork (dialysis nurses, engineers, technicians and laboratory technicians, nutritionists, psychologists), where everyone faces the same problems and overloads as nephrologists themselves. Also, for effective work, nephrologists often need the consultation of related specialists, such as intensive care specialists, surgeons, traumatologists, and emergency physicians, which significantly increases their workload. Burnout during the period of military operations among nephrologists is a common phenomenon, which has a very negative effect on the nephrology and dialysis services of Ukraine [5].

Patients with CKD are very vulnerable and there is a high risk that they may be injured during military operations. Because access to dialysis, immunosuppressive and other drugs for them may be limited or absent, which may lead to their death. The CKD patient community requires uninterrupted access to dialysis, transplantation, and medical care. There is solidarity between the various kidney disease communities and they are all willing to support each other [5].

The international nephrology community must be ready to organize support for affected nephrology patients and nephrologists. Unfortunately, there are no patient algorithms

and routes and other information (instructions, protocols, recommendations) in the conditions of military operations and a shortage of medical resources and other material and technical problems in nephrology [5].

The following are examples of possible solutions during wartime:

1. Everyone must be prepared, at all levels, from the nephrologist to the MoH, to respond effectively to disasters and military operations to ensure adequate nephrology care for all who need it [5].

2. Reduced demand for dialysis during hostilities may result in fewer dialysis sessions per week, reducing the burden on the dialysis service. In this case, patients should be recommended a special low-protein diet and other dietary restrictions to reduce intoxication, electrolyte disorders and hyperhydration [5].

3. Telemedicine and drones for the delivery of medicines, etc., are a very good option for optimizing the work of a nephrologist, but there may be obstacles such as cyber-attacks, lack of Internet, computers, phones, or an insufficient level of computer skills [5].

4. The principles of treatment of victims during military operations may differ from standard nephrological practice in peacetime; it is necessary to use as simple and pragmatic recommendations as possible in the treatment of both AKI and CKD during military actions [5].

5. Nephrology of catastrophes should be included in the curricula of teaching nephrology, as well as in the scientific programs of international and national annual congresses [5].

The first humanitarian aid to the central and eastern regions of Ukraine, to Kyiv, began to arrive approximately 3 weeks after the start of the conflict. For the Ukrainian Association of Paediatric Nephrologists/Ukrainian Association of Nephrologists, the first to provide humanitarian aid were ESPN, the nephrology associations of Germany, Belgium, and France. It should be noted that their help with medicines and consumables for dialysis was the most significant [3, 11].

Many EU universities have supported their Ukrainian students with scholarships, exemption from accommodation fees, providing psychological counselling and providing temporary housing for the family [20].

Many private European companies helped and continue to help Ukrainian refugees and Ukraine, along with airlines that provided Ukrainians with discounted (including free) fares [20].

But, unfortunately, despite the efforts and measures taken, many legal, material, technical and organizational problems remain [20].

Among our foreign colleagues, we should note, first of all, Prof. Lars (Pape), President-Elect, International Paediatric Transplant Association, Prof. Dr. Jun Oh, Prof. Dr. Elena Levchenko, MD, PhD, FESPN, Prof. Dr. Lutz T. Weber, Prof. Dr. Hermann Pavenstädt President of the German Society of Nephrology, Prof. Arnaud Devresse MD, PhD, Prof. Dr. Lionel Rostaing, MD, PhD, Prof. Rukshana Shroff, Prof. Dr. Andrzej Więcek, MD, Prof. Dr. Justine Bacchetta, MD, PhD. Prof. D. Ivanov was awarded the IPNA Humanitarian Award 2022 [3, 11].

The Ukrainian Association of Paediatric Nephrologists jointly with the Institute of Nephrology of the Medical Academy of Ukraine held a kidney day on March 10 (152 participants). The Ukrainian Association of Nephrologists together with the Department of Nephrology and RRT spent WKD on April 2. The number of participants — 201, the number of speakers — 16 (from 3 countries of the world) and the number of issued certificates for participation in scientific medical forums — 217. Ukrainian Association of Nephrologists/Ukrainian Association of Paediatric Nephrologists and the staff of the Department of Nephrology and RRT of Shupyk National Healthcare University of Ukraine, with the help of these measures, doctors were allowed to feel mutual support and agree on their actions [3, 11].

It should be noted that all employees of the Department of Nephrology and RRT did not leave the territory of Ukraine during the entire period of ML, remained and remain at their workplaces within the city of Kyiv and the Kyiv region. During the period from February 24 to August 1, they consulted 348 patients face-to-face and conducted 61 sessions of chronic HD, 25 kidney biopsies (according to a unique technique that increases the verification of the diagnosis and reduces the risk of trans- and post-puncture complications in patients) at the clinical base of the Department of Nephrology and RRT — “Clinic of Prof. D. Ivanov” [3, 11].

Also, employees of the department held telephone consultations with nephrologists in other cities of Ukraine (mostly in Zaporizhzhia) regarding the examination and treatment of nephrological patients. One employee of the department even went to Zaporizhzhia, where, in addition to consulting work, he organized humanitarian aid for refugees from Mariupol and other regions [3, 11].

Despite the technical difficulties, the publication of the specialized KIDNEYS magazine, video conferences and consultations were continued with our own funds, which also became a certain test for our specialists.

International assistance

It should be noted that international support was provided by ERA, which organized Task Force Ukraine (Prof. Serhan Tuglular, members Mehmet Sukru Sever, Raymond Vanholder, Valerie Luyckx, Kai-Uwe Eckardt, Mykola Kolesnyk, Andrzej Wiecek, Ewa Pawlowicz-Szlarzka, Daniel Gallego, Rukshana Shroff, Andrej Škoberne, Ionut Nistor, Mohamed Sekkarie, Dmytro Ivanov, Edita Norušienė, the Renal Disaster Relief Task Force of the ERA) [3, 11].

This group is responsible for the consistent analysis of the nephrological situation in Ukraine and the organization of humanitarian aid. Members of the group developed a questionnaire for refugee patients with CKD and staff of RRT departments, which are filled out by our doctors and patients. Consultation webinars were introduced every Monday (moderated by Prof. D. Ivanov) for clinical analysis of cases and discussion of modern treatment recommendations. Experts were colleagues from Germany (Sharite) and members of Task Force Ukraine. Two documents have also

been prepared, which define the modern understanding and algorithm of actions during the AC in Ukraine [3, 11].

The situation in wartime is constantly changing, there are new issues in providing nephrological care that requires immediate resolution. Nephrologists of Ukraine work selflessly to preserve the health and lives of patients [3, 11].

The support of foreign colleagues is important to us, but, unfortunately, most European medical workers have little experience of working in the conditions of military operations and related threats [5].

Treatment of patients with AKI or CKD with KF requires increased attention, as the quality of life and survival of patients depends on advanced technologies and professional personnel. Patients with CKD, in addition to drug therapy, must follow a special diet; PD requires an uninterrupted supply of materials and is impossible without auxiliary medical means; HD requires special conditions: a significant amount of energy, water and general infrastructure; patients with a transplanted kidney vitally need immunosuppressants to prevent transplant rejection. Military actions create problems for providing nephrological care to patients in full, there is a high risk of not only medical but also material and technical problems [5]. Treatment of CKD 1–4 stages in Ukraine is carried out exclusively at the expense of the patient or through insurance [40].

Today presents difficult challenges to Ukraine and to every Ukrainian. Not least among them are crises: health crises, economic crises and humanitarian crises, and other crises. It is frightening how quickly we get used to them and the inability of many of us to cope with them. Our medical duty is to support our patients, provide them with timely help, and prevent their health from deteriorating [9, 30, 41].

Another high risk of a terrible catastrophe is nuclear terrorism. Examples, the seizure of the Chornobyl and Zaporizhia nuclear power plants (NPP), the termination of electricity supply to the Chornobyl NPP, the dangerous fire-fights near Zaporizhzhia (the largest NPP in Europe), and the fire at the Zaporizhia NPP, the location of dangerous explosive materials on the territory of the Zaporizhia NPP, all this creates the danger of a terrible ecological disaster during ML in Ukraine. Intentional or unintentional damage to a NPP due to gunfire, or due to interruptions in the supply of electricity or cooling of spent radioactive fuel rods, can lead to a disaster [27, 42]. And, of course, there remains the danger of Russia using tactical or strategic nuclear weapons on the territory of Ukraine [2, 42, 43].

It should not be forgotten that in the East of Ukraine there is the storage of radioactive water, which was used during the Cold War for the development of nuclear weapons. Damage to these underground structures will lead to contamination of groundwater with radioactive water, and, as a result, contamination of agricultural fields and an increase in the background radiation exposure of the region for decades [42].

Before the start of military actions, the MoH of Ukraine provided information on the availability of individual first-aid kits and medicines for 120 % and 72 % of the available personnel, respectively, in the areas of the Joint Forces Op-

eration (JFO) in Ukraine (Donbas). The shortage of drugs (antiviral drugs, antibiotics, dressing material, cardiovascular drugs, etc.) can adversely affect the current ML scenario and, in the future, increase the percentage of servicemen with KD [20].

The health care system of Ukraine (the Semashko health care system) was inherited from the USSR (it provides free general access to medical care for everyone). The existing health care system based on the Semashko model has a controversial assessment. In 2017, the Verkhovna Rada of Ukraine launched a series of reforms to create a new patient-oriented healthcare system [17, 44].

Between 2016 and 2020, the government published nine documents on medical support. These documents reflect the provisions and implementation of NATO (North Atlantic Treaty Organization) standards. From 2019 to 2020, more than 180 armoured medical vehicles and sanitary vehicles were purchased. The Ukrainian Military Medical Academy created a special course in medical psychology and introduced a program of psychological rehabilitation of servicemen (over 42,000 servicemen used it) [20].

In 1994, Ukraine established an office at WHO. To coordinate cooperation between Ukraine and WHO, two-year agreements are regularly mutually signed. Another document was signed on January 31 [38].

In order to optimize primary and secondary healthcare services (including in the nephrology sector) [13] during ML, it is possible to involve medical students in more active actions. Unfortunately, the current curriculum does not meet modern needs. It is necessary to provide medical students with the opportunity of voluntary service in “hot” zones, in order to gain the necessary experience [20, 45]. A special course on conflict and disaster management in medicine, with an appropriation, identification and management, of vulnerable populations and resources, should be included in routine training programs. Before sending the students, a mandatory briefing should be conducted to better understand the tasks and goals. Similar strategies can be applied, also, for nurses, psychologists and other professionals. But when implementing such a strategy, many ethical and legal problems will arise [20].

In the context of military actions, the classical ethical principles “do no harm”, “do good”, fair distribution and respect for autonomy should be applied, but some principles of medical ethics may require different approaches. For example, the balance between individual benefit/autonomy and fair distribution of resources among the population [3, 46].

Do not forget about primary and secondary prevention of CKD. During military operations, prevention becomes more relevant than ever. The main non-communicable diseases (NCDs) that can cause CKD are diabetes mellitus, hypertension and other CVDs, gout, systemic autoimmune diseases, urolithiasis and others. These NCDs are the target of preventive measures.

Until February 24, 2022, NCDs were the cause of 91 % of deaths in Ukraine (CVDs — 67 %). This is due to the high prevalence of NCDs risk factors, which has the highest level, according to WHO data, in the European region. Alcohol and tobacco use is one of the risk factors [10, 47].

Before the full-scale invasion, of Ukraine, CVDs mortality was nearly 800/100,000 for men and 1,000/100,000 for women, compared with 328/100,000 and 311/100,000 in high-income European countries and 449/100,000 and 458/100,000 in middle-income European countries (According to data from the European Society of Cardiology (ESC)) [10].

In 2019, almost a quarter of Ukrainians suffered from obesity, the prevalence of overweight was 59 %. From 2010 to 2013, a survey of adolescents and children in Ukraine revealed an obesity rate of 17.2 %. An increase in the level of total cholesterol in the blood (norm ≥ 5.0 mmol/l) was found in more than 40 % of the population. Only 11 % achieved the lipid target, and among high-risk secondary prevention patients, only 9 % achieved the target. Among the adult population, the prevalence of diabetes is 7.1 % [10, 47].

Almost 35 % of the population of Ukraine suffers from systemic hypertension. In 85 % of cases, antihypertensive therapy with incomplete blood pressure control. In order to improve the cardiovascular health of the population, the nationwide program for the prevention and treatment of hypertension (1999–2005) (Decree of the President of Ukraine dated February 4, 1996, № 117/99) and the state program for the prevention and treatment of CVDs and cerebrovascular diseases were implemented for decades (2006–2010) (Resolution of the Cabinet of Ministers of May 31, 2006 No. 761) [10].

The prevalence of hypertension has changed little, in the male population, the overall risk factor has increased. The number of men with one risk factor decreased by 2.6 times, but the number of men with three or more risk factors increased by five times [10].

For comparison, in Western Europe, approximately 30 % have hypertension and 5 % of the population suffer from diabetes, 10 % of the adult population is diagnosed with kidney damage, and about 1 in 1,000 is shown RRT [9].

Data on the health status of newly arrived refugees (75 % of all emigrants, 92 different nationalities) are registered in the medical information system (The electronic Personal Health Record (ePHR)), which was introduced in eight European countries (Italy, Croatia, Cyprus, Bulgaria, Romania, Greece, Slovenia and Serbia). A cross-sectional study (2016–2019) of the health status and health problems of all refugees was introduced at the reception points. In the period from January 2016 to October 2019, 19,564 clinical episodes in 14,436 patients were registered in ePHR: 2,531/19,564 (12.9 %) episodes of infectious diseases (283/2,531 (50.7 %) — pharyngotonsillitis, 529 (20.9 %) — scabies, 158 (6.2 %) — viral hepatitis and 156 (6.1 %) lower respiratory tract infections) and NCDs — 2462 persons (17.1 %) (821 (5.7 %) CVD, 1,183 (8.2 %) neurological diseases, 644 (4.5 %) diabetes mellitus and 212 (1.5 %) KD) [48].

Also, according to PRISMA recommendations (PROSPERO CRD420201970430), a literature review was conducted (Al-Oraibi A., 2022). The search was conducted from January 1, 2011, to November 1, 2021, in the PubMed, CINAHL, MEDLINE, and EMBASE databases. The selected reviewed studies included data on the prevalence of five NCDs among Syrian refugees (adults) living in Turkey, Jordan or Lebanon.

466 references were found (237,723 Syrian refugees): prevalence of hypertension — 24 %, type 2 diabetes — 12 % (8–15), CVDs — 5 % (3–7), chronic respiratory diseases — 4 % (3–5) and arthritis was 11 % (7–14). In primary care institutions, the prevalence of hypertension — 35 % (33–36) and type 2 diabetes — 48 % (24–72) was significantly higher [49].

Primary health care, screening and immunization programs are failing. Patients with chronic diseases, such as CKD, coronary heart disease, heart failure, diabetes, etc., with international medical support, risk not receiving adequate treatment, or not receiving any treatment at all [10].

The search for new “early” biomarkers of the onset and progression of CKD is very relevant and promising [50, 51].

Patients with CKD often have comorbidities, including clinical frailty, cognitive dysfunction, mobility limitations, and CVDs, which significantly increase the risk of complications and/or decompensation of the underlying disease and impair quality of life [3].

The clinical syndrome of weakness is determined by a decrease in the functional reserve and susceptibility to negative consequences, which is complicated by the existing CKD. Clinical decision-making and pre-treatment planning by a nephrologist should follow a clinical frailty assessment. Weakness is a common clinical syndrome among patients with CKD (7 % in patients with mild CKD, 19 % with mixed CKD, 42.6 % with severe CKD and 53.8 % in the pre-dialysis population), the largest share is in dialysis patients (from 30 to 73–82 %), especially the elderly (over 65 — 14–24 %), especially when hospitalized — up to 90 % [52].

Frailty is an independent risk factor for conversion to dialysis/death. Rockwood proposed a 9-point clinical frailty scale (CFS) (“frailty indices” (FI) gives a quantitative characteristic), in which each increase of 1 point is associated with a mortality risk ratio of 1.22, regardless of comorbidity, modality dialysis and old age. Risk factors include diabetic nephropathy, peripheral arterial disease, and obesity, which independently increase the risk of frailty in patients receiving HD. There is evidence of a direct pathogenic role of uraemia. In almost 60 % of patients with CKD, there is a lack of physical activity (increasing the risk of mortality by 56 %) — one of the criteria of Fried’s weakness. A decrease of 0.1 m/s in gait speed is associated with a 26 % increase in the risk of mortality, and an increase of 1 s in the Timed Up-and-Go test is associated with an 8 % increase in the risk of death [52].

Gait disturbances in patients with CKD are caused not only by metabolic factors but also by brain changes that affect motor control. Treatment of CKD should include correction of cognitive impairment [53].

Strict dietary restrictions (medical recommendations or related to dysgeusia), as well as chronic molecular stress, in patients with CKD, affect the pathogenesis of clinical weakness [52, 54].

Clinical supervision of patients outside the HCF is not possible. Patients suffering from chronic diseases, due to limited or no access to medical care, such as insulin therapy, antiplatelet, lipid-lowering and antihypertensive therapy, may require immediate medical care when crossing a border with another country. As statistics show, for every direct victim of military operations, there can be many more indirect

victims. The victims need urgent global action to receive immediate medical and humanitarian assistance [10, 30].

Unexpectedly, high rates of KF and other NCDs requiring continuous treatment were found among refugees. A significant number of patients with severe conditions requiring long-term special treatment (RRT) were successfully evacuated to neighbouring countries for continued treatment. Unfortunately, among refugees or hospitalized Ukrainians, there are cases of sudden death (arrhythmia, myocardial infarction, heart failure) and worsening of major diseases, including CKD, which are often not provided with assistance due to a lack of personnel and/or resources [10].

During hostilities, for various reasons (economic, security, or logistical), many planned medical issues were ignored; therefore, whenever possible, delayed medical problems should be addressed as soon as possible (screening, diagnosis and treatment), not forgetting about mental health [3].

In order to avoid repeating mistakes in the event of new natural or man-made disasters, it is necessary to analyse the experience gained to identify defects in the response to disasters [3].

Conclusions

The ML in Ukraine has shown how vulnerable the current concept of dialysis is, with its high consumption of water and energy. As never before, the question of early detection and prevention of progression of CKD with leakage into the ESRD is becoming acute. The search for new “early” biomarkers of the onset and progression of CKD is very relevant and promising.

The concept of dialysis probably needs to be changed. Perhaps it makes sense to pay more attention to the widespread introduction into the practice of “home” dialysis, which is the best option for patients. A flexible health care system is more productive and viable in the event of disasters such as hurricanes, COVID-19, and other disasters (earthquakes, etc.).

During military actions and disasters, unlike healthy people, people with KD have a higher risk of adverse consequences. This category of patients is extremely vulnerable due to forced displacement (internally or abroad), total dependence on life-saving therapies, functioning infrastructure, advanced technologies and well-trained personnel.

The doctor's duty is to ensure the right of every patient to health care. World Kidney Day (2022) with the slogan “Kidney Health for All” has undoubtedly given much attention to this issue.

Our country should be ready for anything, but with the threat of Russia using weapons of mass destruction during military actions, support and assistance at the international level are no less important.

A balanced interaction between the military and civilian medical systems significantly optimizes the provision of medical care in the conditions of the Armed Forces.

Possible appropriate measures, in our opinion, include:

1. The need for a bomb shelter in which children with their mothers and medical personnel could be/live.
2. The need for mobile devices for HD and PD.
3. The need for at least a 3-month supply of consumables and accompanying medicines.

4. Rapid interchangeability of personnel to replace absent doctors and nurses and their training directly at the patient's bedside.

5. Communicating with foreign nephrologists and nephrology societies that could quickly help with humanitarian aid.

6. Communication with foreign specialists, to whom our patients have been referred, to ensure continuity of patient treatment.

7. It would be rational to have the possibility of additional funding for the payment of medical personnel, outside of local sources of funding, to maintain personnel in hot regions.

8. Humanitarian aid with food would be very useful, both for patients and for staff.

There is a need to plan in advance how to deal with such situations and constantly search for new successful solutions to improve and preserve health, and optimize the work of the health care service at all levels and stages.

Our collective of authors condemns all criminal military actions of Russia, the mass murder of people, children, and other vulnerable categories of the population. And we know and feel the support of the whole world, including our foreign colleagues.

References

1. War in Ukraine. *Thromb Res*. 2022 May;213:137. doi: 10.1016/j.thromres.2022.03.020.
2. Piccoli GB, Brunori G, Gesualdo L, Kalantar-Zadeh K. The impact of the Russian-Ukrainian war for people with chronic diseases. *Nat Rev Nephrol*. 2022 Jul;18(7):411-412. doi: 10.1038/s41581-022-00574-z.
3. Sever MS, Vanholder R, Luyckx V, et al; Renal Disaster Relief Task Force of the ERA. Armed conflicts and kidney patients: A consensus statement from the renal disaster relief task force of the ERA. *Nephrol Dial Transplant*. 2022 Aug 23;gfac247. doi: 10.1093/ndt/gfac247.
4. Maggioni A, Gonzales-Zamora JA, Maggioni A, et al. Cascading Risks for Preventable Infectious Diseases in Children and Adolescents during the 2022 Invasion of Ukraine. *Int J Environ Res Public Health*. 2022 Jun 8;19(12):7005. doi: 10.3390/ijerph19127005.
5. Vanholder R, Gallego D, Sever MS. Wars and kidney patients: a statement by the European Kidney Health Alliance related to the Russian-Ukrainian conflict. *J Nephrol*. 2022 Mar;35(2):377-380. doi: 10.1007/s40620-022-01301-4.
6. Mungmunpuntipantip R, Kebayoon A, Wiwanitkit V. Correspondence on 'Inside the war: life in Ukraine' by Shushkevich. *Int J Gynecol Cancer*. 2022 Jun 6;32(6):821. doi: 10.1136/ijgc-2022-003572.
7. The Lancet Regional Health-Europe. The regional and global impact of the Russian invasion of Ukraine. *Lancet Reg Health Eur*. 2022 Apr 1;15:100379. doi: 10.1016/j.lanepe.2022.100379.
8. Zaliska O, Oleshchuk O, Forman R, Mossialos E. Health impacts of the Russian invasion in Ukraine: need for global health action. *Lancet*. 2022 Apr 16;399(10334):1450-1452. doi: 10.1016/S0140-6736(22)00615-8.

9. Barbara PG, Gaetano M. The disasters of war. On kidney patients in the Ukrainian-Russian war. *J Nephrol*. 2022 Mar;35(2):375-376. doi: 10.1007/s40620-022-01300-5.
10. Navarese EP, Grzelakowska K, Mangini F, et al. The spoils of war and the long-term spoiling of health conditions of entire nations. *Atherosclerosis*. 2022 Jul;352:76-79. doi: 10.1016/j.atherosclerosis.2022.05.012.
11. Navarese EP, Grzelakowska K, Mangini F, et al. The spoils of war and the long-term spoiling of health conditions of entire nations. *Atherosclerosis*. 2022 Jul;352:76-79. doi: 10.1016/j.atherosclerosis.2022.05.012.
12. Nott E. Ukraine invasion: Why I fear for Ukraine's healthcare workers. *BMJ*. 2022 Mar 7;376:o605. doi: 10.1136/bmj.o605.
13. Kolesnyk P, Frese T, Vinker S, et al. Steps towards implementing evidence-based screening in family medicine in Ukraine: SWOT-analysis of an approach of multidimensional empowerment. *BMC Fam Pract*. 2021 Jan 14;22(1):20. doi: 10.1186/s12875-021-01367-2.
14. Stepanova N. War in Ukraine: the price of dialysis patients' survival. *J Nephrol*. 2022 Apr;35(3):717-718. doi: 10.1007/s40620-022-01308-x.
15. Kiel S, Weckmann G, Chenot JF, Stracke S, Spallek J, Angelow A. Referral criteria for chronic kidney disease: implications for disease management and healthcare expenditure-analysis of a population-based sample. *BMC Nephrol*. 2022 Jun 24;23(1):225. doi: 10.1186/s12882-022-02845-0.
16. PLOS Medicine Editors. Ukraine conflict: Prioritizing lives and health. *PLoS Med*. 2022 May 25;19(5):e1004007. doi: 10.1371/journal.pmed.1004007.
17. Shushkevich A. Inside the war: life in Ukraine. *Int J Gynecol Cancer*. 2022 May 3;32(5):686-687. doi: 10.1136/ijgc-2022-003556.
18. Curchoe CL, Chang TA, Trolice MP, et al. Protecting life in a time of war. *J Assist Reprod Genet*. 2022 Mar;39(3):555-557. doi: 10.1007/s10815-022-02463-7.
19. Nijman RG, Bressan S, Brandenberger J, et al. Update on the Coordinated Efforts of Looking After the Health Care Needs of Children and Young People Fleeing the Conflict Zone of Ukraine Presenting to European Emergency Departments-A Joint Statement of the European Society for Emergency Paediatrics and the European Academy of Paediatrics. *Front Pediatr*. 2022 Apr 26;10:897803. doi: 10.3389/fped.2022.897803.
20. Jain N, Prasad S, Bordeniuc A, et al. European Countries Step-up Humanitarian and Medical Assistance to Ukraine as the Conflict Continues. *J Prim Care Community Health*. 2022 Jan-Dec;13:21501319221095358. doi: 10.1177/21501319221095358.
21. Armitage R. War in Ukraine and the inverse care law. *Lancet Reg Health Eur*. 2022 May 2;17:100401. doi: 10.1016/j.lanepe.2022.100401.
22. Ociepa-Kicińska E, Gorzałczyńska-Koczkodaj M. Forms of Aid Provided to Refugees of the 2022 Russia-Ukraine War: The Case of Poland. *Int J Environ Res Public Health*. 2022 Jun 9;19(12):7085. doi: 10.3390/ijerph19127085.
23. Jankowski M, Gujski M. Editorial: The Public Health Implications for the Refugee Population, Particularly in Poland, Due to the War in Ukraine. *Med Sci Monit*. 2022 Apr 1;28:e936808-1-4. doi: 10.12659/MSM.936808.
24. Lewtak K, Kanecki K, Tyszko P, Goryński P, Bogdan M, Nitsch-Osuch A. Ukraine war refugees - threats and new challenges for healthcare in Poland. *J Hosp Infect*. 2022 Jul;125:37-43. doi: 10.1016/j.jhin.2022.04.006.
25. Kardas P, Babicki M, Krawczyk J, Mastalerz-Migas A. War in Ukraine and the challenges it brings to the Polish healthcare system. *Lancet Reg Health Eur*. 2022 Mar 15;15:100365. doi: 10.1016/j.lanepe.2022.100365.
26. Fatyga E, Dziegielewska-Gęsiak S, Muc-Wiergoń M. Organization of Medical Assistance in Poland for Ukrainian Citizens During the Russia-Ukraine War. *Front Public Health*. 2022 Jul 7;10:904588. doi: 10.3389/fpubh.2022.904588.
27. Miller AC. What's new in critical illness and injury science? The effect of concomitant natural and manmade disasters on chronic disease exacerbations: COVID-19, armed conflicts, refugee crises and research needs. *Int J Crit Illn Inj Sci*. 2022 Jan-Mar;12(1):1-3. doi: 10.4103/ijciis.ijciis_19_22.
28. Fontanarosa PB, Flanagan A, Golub RM. Catastrophic Health Consequences of the War in Ukraine. *JAMA*. 2022 Apr 26;327(16):1549-1550. doi: 10.1001/jama.2022.6046.
29. Greenaway C, Fabreau G, Pottier K. The war in Ukraine and refugee health care: considerations for health care providers in Canada. *CMAJ*. 2022 Jul 11;194(26):E911-E915. doi: 10.1503/cmaj.220675.
30. Southall DP, MacDonald R, Kostiuk O, Shcherbakov V, Deierl A. The UN must provide secure medical and humanitarian assistance in Ukraine. *Lancet*. 2022 Apr 2;399(10332):1301-1302. doi: 10.1016/S0140-6736(22)00526-8.
31. Bielka K, Kotfis K, Poropatich R, Pinsky MR. Act now! Critical care roles and obligations during an urban war. *Crit Care*. 2022 Mar 21;26(1):65. doi: 10.1186/s13054-022-03951-z.
32. Wandschneider L, Namer Y, Davidovitch N, et al. The Role of Europe's Schools of Public Health in Times of War: ASPHER Statement on the War Against Ukraine. *Public Health Rev*. 2022 Mar 16;43:1604880. doi: 10.3389/phrs.2022.1604880.
33. Capasso A, Skipalska H, Nadal J, et al. Lessons from the field: Recommendations for gender-based violence prevention and treatment for displaced women in conflict-affected Ukraine. *Lancet Reg Health Eur*. 2022 May 7;17:100408. doi: 10.1016/j.lanepe.2022.100408.
34. Jones-Schenk J. Courageous Leadership. *J Contin Educ Nurs*. 2022 May;53(5):198-199. doi: 10.3928/00220124-20220407-02.
35. Zimba O, Gasparyan AY, Ahmed S. Sustainable Development Goals in the Time of Crisis. *J Korean Med Sci*. 2022 May 16;37(19):e152. doi: 10.3346/jkms.2022.37.e152.
36. Dhawan M, Choudhary OP, Priyanka, Saied AA. Russo-Ukrainian war amid the COVID-19 pandemic: Global impact and containment strategy. *Int J Surg*. 2022 Jun;102:106675. doi: 10.1016/j.ijsu.2022.106675.
37. Choudhary OP, Saied AA, Priyanka, Ali RK, Maulud SQ. Russo-Ukrainian war: An unexpected event during the COVID-19 pandemic. *Travel Med Infect Dis*. 2022 Jul-Aug;48:102346. doi: 10.1016/j.tmaid.2022.102346.
38. The Lancet. Health and health care in Ukraine: in transition and at risk. *Lancet*. 2022 Feb 12;399(10325):605. doi: 10.1016/S0140-6736(22)00271-9.
39. Butenop J, Brake T, Mauder S, Razum O. Health Situation in Ukraine Before Onset of War and Its Relevance for Health

Care for Ukrainian Refugees in Germany: Literature Review, Risk Analysis, and Priority Setting. *Gesundheitswesen*. 2022 Aug;84(8-09):679-688. doi: 10.1055/a-1876-2423. (in German).

40. Nkunu V, Wiebe N, Bello A, et al. Update on Existing Care Models for Chronic Kidney Disease in Low- and Middle-Income Countries: A Systematic Review. *Can J Kidney Health Dis*. 2022 Mar 2;9:20543581221077505. doi: 10.1177/20543581221077505.

41. Patel SS, Erickson TB. The new humanitarian crisis in Ukraine: Coping with the public health impact of hybrid warfare, mass migration, and mental health trauma. *Disaster Med Public Health Prep*. 2022 Mar 23;1-5. doi: 10.1017/dmp.2022.70.

42. Chai PR, Berlyand Y, Goralnick E, et al. War-time toxicology: the spectre of chemical and radiological warfare in Ukraine. *Toxicol Commun*. 2022;6(1):52-58. doi: 10.1080/24734306.2022.2056374.

43. Ramirez C, Durón RM. The Russia-Ukraine war could bring catastrophic public-health challenges beyond COVID-19. *Int J Infect Dis*. 2022 Jul;120:44-45. doi: 10.1016/j.ijid.2022.04.016.

44. Gruzjeva TS, Hrechyskyna NV, Inshakova HV, Dubovyk VY, Kalashnykova NM. Development of the Public Health System in the conditions of current challenges and threats. *Wiad Lek*. 2022;75(5 pt 1):1130-1135. doi: 10.36740/WLek202205114.

45. Srichawla BS, Khazeei Tabari MA, Gman MA, Munoz-Valencia A, Bonilla-Escobar FJ. War on Ukraine: Impact on Ukrainian Medical Students. *Int J Med Stud*. 2022 Jan-Mar;10(1):15-17. doi: 10.5195/ijms.2022.1468.

46. Denova LD. Principles of bioethics in treatment and rehabilitation of patients with chronic kidney disease. 30 May 2022. doi: 10.5281/zenodo.6815211.

47. Srichawla BS, Khazeei Tabari MA, Găman MA, Munoz-Valencia A, Bonilla-Escobar FJ. War on Ukraine: Impact on Ukrainian Medical Students. *Int J Med Stud*. 2022 Jan-Mar;10(1):15-17. doi: 10.5195/ijms.2022.1468.

48. Zenner D, Requena Méndez A, Schillinger S, Val E, Wickramage K. Health and illness in migrants and refugees arriving in Europe: analysis of the electronic personal health record system. *J Travel Med*. 2022 Mar 2;taac035. doi: 10.1093/jtm/taac035.

49. Al-Oraibi A, Hassan O, Chattopadhyay K, Nellums LB. The prevalence of non-communicable diseases among Syrian refugees in Syria's neighbouring host countries: a systematic review and meta-analysis. *Public Health*. 2022 Apr;205:139-149. doi: 10.1016/j.puhe.2022.01.034.

50. Denova LD. Uromodulin as a potential candidate marker for predicting the course of chronic kidney dis-

ease. *Počki*. 2021;10(4):237-243. doi: 10.22141/2307-1257.10.4.2021.247898. (in Ukrainian).

51. Denova LD. The value of proteomic studies of the latest markers of kidney damage in the urine to assess the course, progression and complications in patients with CKD. *Počki*. 2022;11(2):68-80. doi: 10.22141/2307-1257.11.2.2022.363. (in Ukrainian).

52. Kennard A, Glasgow N, Rainsford S, Talaulikar G. Frailty in chronic kidney disease: challenges in nephrology practice. A review of current literature. *Intern Med J*. 2022 Mar 30. doi: 10.1111/imj.15759.

53. Zemp DD, Giannini O, Quadri P, Rabuffetti M, Tetamanti M, de Bruin ED. Gait disorders in CKD patients: muscle wasting or cognitive impairment? A cross-sectional pilot study to investigate gait signatures in Stage 1-5 CKD patients. *BMC Nephrol*. 2022 Feb 21;23(1):72. doi: 10.1186/s12882-022-02697-8.

54. Denova LD, Ivanov DD. Influence of oxidative, carbonyl, and nitrosative stresses on the course of chronic kidney disease (analytical review). *Počki*. 2022;11(1):53-61. doi: 10.22141/2307-1257.11.1.2022.360.

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Нефрологічна допомога в умовах воєнного стану в Україні

Резюме. Під час збройних конфліктів (ЗК) і інших катастроф люди похилого віку, жінки, діти, немічні й хронічно хворі є найбільш вразливою категорією населення з високим ризиком для здоров'я і життя. Хронічно хворі люди із захворюваннями нирок (у тому числі з нирковою недостатністю) заслуговують на особливу увагу через повну залежність від доступного функціоналу інфраструктури й доступу до життєво важливих ліків і добре навченого персоналу. На даний час є мало інформації про наслідки ЗК для хворих з ураженням нирок порівняно з наявними даними про вплив інших катастроф. Механізми уражень при ЗК і природних або техногенних катастрофах мають схожі й відмінні риси. Відмінні риси: при ЗК переважають вогнепальні й мінно-вибухові по-

ранення, кровотеча, отруєння токсичними речовинами, при катастрофах — переохолодження або опіки, механічні травми тощо. Спільне — пошкодження інфраструктури, у тому числі закладів охорони здоров'я, дефіцит ліків, медичного персоналу, гуманітарні та інші кризи, велике навантаження пораненими й травмованими закладів охорони здоров'я. У цій статті ми систематизували отриманий під час воєнного конфлікту матеріал, а також зробили огляд вітчизняних і іноземних статей з даної тематики, щоб оптимізувати роботу нефрологів в умовах воєнного стану й обмежених ресурсів.

Ключові слова: воєнний стан; хронічна хвороба нирок; біженці; ядерний конфлікт; нирково-замісна терапія; діаліз; трансплантація нирки; гуманітарна криза