Journal of the American Pharmacists Association xxx (2023) 1–6

Contents lists available at ScienceDirect

Journal of the American Pharmacists Association

journal homepage: www.japha.org

RESEARCH

Patterns of pharmaceutical supplies and medicines donations received during a natural disaster

Jorge A. Schlottke, José María Bermúdez, Lucía Armaleo, Jorge Alberto Robledo*, Santiago Daniel Palma, José Julio Daniel Alvarado

ARTICLE INFO

Article history:
Received 8 October 2022
Accepted 24 May 2023

ABSTRACT

Background: In response to emergencies, such as wildfires, donations of pharmaceuticals often occur. These donations can be given directly by governments, to non-governmental organizations as corporate donations, or by private entities that donate to individual health institutions.
Objective: This paper aimed to collect, review and analyze pharmaceutical product donations received during the natural disaster caused by wildfires in the San Luis province, Argentina, in September and October 2020.
Methods: A descriptive, cross-sectional, and retrospective study was performed. An introductory approach to good donation practices was also carried out. Medicines were classified and in the case of products that were not suitable for administration, these were discarded.
Results: A total of 15,593 units were segregated, of which 52.8% were over-the-counter products and 47.2% were prescription drugs. 86.3% (13,467 units) were accepted, while 13.7% (2126 units) had to be destroyed. The value of donations totaled USD 16,544. The analysis of the results showed that an important part of the donations was irrelevant in the emergency context. Donations were also received in incorrect amounts, which generated a large stock of medicines that couldn't be used. In emergencies, inappropriate donations create additional work during sorting, storage, and distribution, increasing the time professionals need to complete tasks. This extra work can easily overwhelm limited human and logistical resources.
Conclusions: It is important to previously evaluate the real need for donations. In addition, the distribution of donations must be done through pre-established systems and policies. Otherwise, unsolicited and unnecessary drug donations become wasteful and should therefore be avoided.

Introduction

Wildfires are a highly frequent event globally. Some high-profile events in Chile, Australia, and California[1-3] have become a grim reminder of the potentially devastating effect that wildfires can have. Wildfires in tropical and subtropical regions account for 90% of global emissions of $PM_{2.5}$ (PM with a mean aerodynamic diameter of up to 2.5 μm) from blazes[4,5] so it is not surprising that they are a major source of particulate matter (PM) pollution in the tropics.[6,7] In Argentina, by the end of September and during October 2020, San Luis province was struck by wildfires that burnt almost 90,000 hectares (about 222,000 acres) among all the fire sources that were battled.[8]

Blazes can negatively affect human health: they are an important source of PM and trace gases to the atmosphere which causes a degradation of air quality focused in the event region. An environmental $PM_{2.5}$ is considered a risk factor that increases mortality and morbidity rates and decreases life expectancy.[9,10] Besides, it is estimated that exposure to $PM_{2.5}$ as a consequence of wildfires causes between 179,000 and 339,000 premature deaths each year—equivalent to 5% of the Global Burden of Disease—due to environmental exposure to $PM_{2.5}$.[6,7]

Declarations: The authors declare no relevant conflicts of interest or financial relationships.
Funding support: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
* **Correspondence:** Jorge A. Robledo, PhD, Pharmacist–Biochemist, Programa Interinstitucional de Prevención y Educación en Salud (PIPES), Gral. Paz 75 (6127) Jovita, Córdoba, Argentina.
E-mail address: pipes.jovita@gmail.com (J.A. Robledo).

ORCIDs
Jorge A. Robledo: https://orcid.org/0000-0003-4133-6291
José María Bermúdez: https://orcid.org/0000-0003-4927-4830
Lucía Armaleo: https://orcid.org/0000-0002-3100-8385
Jorge Alberto Robledo: https://orcid.org/0000-0003-4133-6291
Santiago Daniel Palma: https://orcid.org/0000-0003-2767-9087
José Daniel Alvarado: https://orcid.org/0000-0001-8984-7184

https://doi.org/10.1016/j.japh.2023.05.020
1544-3191/

Key Points

Background:

- Improper pharmaceutical donations create logistical problems as donated products must be sorted, stored and distributed; occupying valuable human resources and transportation capacity.
- Uncontrolled pharmaceutical product donations can become an environmental threat if they have to be destroyed.
- Many times, the total cost of transportation is higher than the value of the pharmaceutical products themselves.

Findings:

- Understanding what motivates spontaneous and mass donations from the general population would help define national guidelines to optimize drug donations.
- All donations must come from a stated need and unsolicited medications should be discouraged.
- The distribution of donations must be done through pre-established systems and policies.

The effects of PM presented as smoke from wildfires can range from eye and airways irritation to severe conditions, such as decreased lung function, bronchitis, asthma flare-ups, heart failure, and premature death. Kids, pregnant women, and the older make up a particularly vulnerable population to smoke exposure.

In response to acute emergencies, such as natural disasters, for example, wildfires, there generally occur pharmaceutical product donations. These donations may be granted directly by governments, to the non-governmental organizations as corporate donations, or by private parties donating to individual health institutions.

National and local efforts to provide humanitarian aid during emergency situations can hugely benefit when pharmaceutical products are donated appropriately. Unfortunately, there is a myriad of cases in which medicine or medical product donations cause problems instead of helping solve them. The most prominent reason for this is likely the commonly-held —but wrong—belief that any kind of pharmaceutical product is better than nothing or, in the same vein, that an expired product is good enough when people need it. Secondly, pharmaceutical product donations are often made even when the recipient has not stated a particular need or even authorized them.

Inappropriate pharmaceutical donations create logistic issues since the donated products have to be classified, stored, and distributed, sometimes occupying valuable human resources and transportation capacity in disaster or war areas. They can also become an environmental threat if they have to be destroyed. Often, the total cost of transportation is higher than the value of the pharmaceutical products themselves. Storing unused pharmaceutical products can encourage their theft and resell in the black market.

For example: Armenia 1988 earthquake: 5000 tons of medication and medical supplies donated, it took 50 people 6 months to process all of it. Only 42% was relevant for the emergency.[11]

Eritrea: the country received 7 trucks loaded with expired aspirin that took 6 months to be burnt, an unrequested drum with cardiovascular medication that was 2 months away from its expiry date, and 30,000 bottles of expired amino acid infusion that couldn't be discarded anywhere near a settlement due to the stench they caused.[11]

Lithuania 1992: 11 women temporarily lost sight after taking a donated closantel, it was a veterinary anthelmintic but was mistakenly administered to treat endometriosis.[12]

Among all the medications received by the World Health Organization field office in Zagreb in 1994, 15% were completely unusable, and 30% were unnecessary.[11] In late 1995, there were 340 tons of expired medications stored in Mostar. Most of these were donated by European nations. The European Union had to destroy them.

Even the donations that are considered appropriate can cause problems when they exceed the required quantities. An analysis by the World Bank about pharmaceutical product donations during emergencies found out that in Gujarat, India, after an earthquake in 2001, 95% of the received donations were appropriate, but there were 1,178 tons over what was necessary.[13]

This paper aimed to collect, review and analyze pharmaceutical product donations received during the natural disaster caused by wildfires in the San Luis province, Argentina, in September and October 2020. Understanding spontaneous and massive donations from the general population would help define national guidelines to optimize medication donations. This approach is in line with the idea put forward by the WHO: all donations should stem from a declared necessity, and unsolicited medications should be discouraged.

Methods

This is a descriptive, cross-sectional, and retrospective study. Due to the popular and massive recollection of medications to assemble first aid kits that occurred in the city of San Luis, the local contact from *Farmacéuticos sin Fronteras Argentina* (FSFA) offered professional services to the local firefighters to classify the donations. He contacted the Colegio Farmacéutico de San Luis, and this institution immediately offered its cooperation through its Institutional-Social Articulation Committee.

Pharmacists that agreed to collaborate were previously trained by the FSFA coordinator on the work strategy regarding the institution's objectives, mission, and vision. This training also included an introduction to donation good practices and a thorough explanation of the operation process. After receiving authorization from the fire department, a specific schedule was set up to work on. The work was carried out in the fire department, where the pharmaceuticals were stored. Two groups of 4 to 6 pharmacists were formed that worked 2 hours a day for 6 consecutive days. Safety measures were observed at all times to avoid potential coronavirus disease-2019 infections.

Figure 1. Classification procedure.

Drugs were classified and disposed of, as shown in Figure 1. Finally, instructional material was given to the fire department staff aimed to encourage the rational administration of the received donations.

Since medications and supplies were scattered around the fire station, it was necessary to group everything in a spacious and well-ventilated place. The staff gently assigned a spot to appropriately carry out the task.

Drug donations were classified into 5 groups:

1. Topical route: creams, gels, ointments, emulsions.
2. Ophthalmic route: eye drops, tears, ointments.
3. Oral route: tablets, capsules, syrups, and suspensions.
4. Supplies and disposables: gauze, bandages, adhesive, disinfectants.
5. Other: any product that does not fall into any other category.

A second classification was done into 3 categories according to the following criteria:

1. Medications to be destroyed as hazardous pathogen waste.
2. Prescription medications.
3. Medication and supplies to be used in first aid kits.

After the classification process, all the medications and supplies in every group were inventoried manually-recording trademark, active pharmaceutical ingredient, strength, dosage form, expiration date, and sale condition (over-the-counter or prescription only). At this stage, the expiration date was highlighted on the packages. Then, the medications were divided into 23 different batches in numbered boxes, each with an inventory list on them.

Medications that had expired did not have a readable expiration date, were in bad conditions or dubious stability conditions, and used or open topical or liquid medications were discarded in a red bag and given to a private company dedicated to managing hazardous pathogen waste.

In the following stage, inventory lists were digitalized in spreadsheets and classified according to their Anatomical Therapeutic Chemical code for their correct assessment. Afterward, the final inventory list was generated, and it was used to create the final instructive datasheets for the rational use of the received donations. These data sheets had the following information: drug, therapeutic action, when it should be used, how it should be used, and warnings.

To write this article, the price of the drug products and supplies was also registered in the database. The price was calculated according to the Consumer Sell Price indicated by the Alfa Beta database; this way, the total value of the donations could be calculated.

To digitalize the information in a decentralized way, a Google form was used, wherein the pharmacists transcribed the information in the hand-written inventory list. The input of information demanded a week, and it was done by 11 pharmacists. About 16 hours were necessary to input all the information, both the classified products as well as the discarded ones.

Since this work was done during the coronavirus disease-2019 pandemic, some general safety guidelines were put in place. Superficial disinfection was done by spraying 70% alcohol on every donation. It was also established that people had to be 1.5 meters (5 feet) apart, use face masks, goggles or face shields, and latex gloves to handle the donated items. Volunteers were asked to avoid touching the face or eyes with their hands and to cough into their elbows. They also had to stay at home if they showed any symptoms related to coronavirus disease-2019 as they are health care workers, any symptom is considered suspicious.

Lastly, a model first aid kit was assembled (Appendix 1) according to the actual needs at the fire station to face wildfires for up to a year and to cover the needs of 14 fire stations in strategic places in the province.

Results

Classified Units and Their Segregation

A total of 15,593 units were segregated, of which 71.3% (11,212 units) were accepted for the fire station, and 15.0% (2255 units) were delivered to the hospital because they

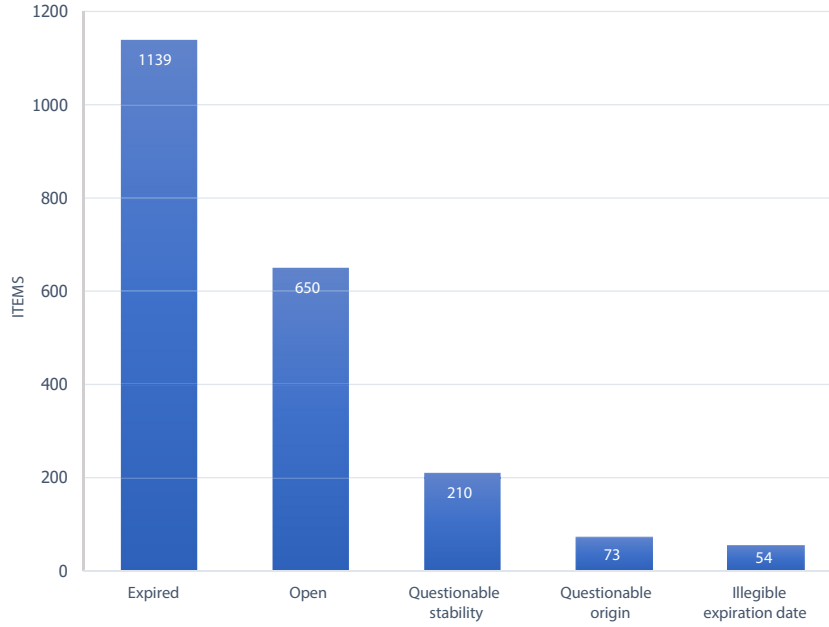

Figure 2. Reason for disposal.

were prescription drugs. 13.7% (2126 units) had to be destroyed (Figure 2). The value of the donations added up to USD 16,544.

Donations had to be discarded or destroyed (2126 units) for the following reasons: 53.6% (1139 units) were discarded for having expired, some products were up to 4 years past their expiration date at the moment of their classifying; 30.6% (650 units) were open; 9.9%(210 units) for having their stability compromised; 3.4% (73 units), had an uncertain origin; and 2.5% had an unreadable expiration date (Figure 2).

Accepted donations were classified as follows: oral route 78.2% (10,531 units), ophthalmic route 4.7% (633 units), topical route 4.9% (660 units), supplies and disposables 6.3% (848), and other 5.9% (795 units). Prescription drugs (2255 units) were separated and delivered to a hospital pharmacy so they would be used rationally after the corresponding prescription was issued.

Then, the donations were reclassified by their Anatomical Therapeutic Chemical Classification System codes for assessment, which showed the following results: Musculoskeletal system 44.9% (6047 units); nervous system 26.6% (3582 units), dermatological 9.3% (1252 units), medical product 5.6% (754), cardiovascular system 5.1% (687 units), sensory organs 4.6% (619 units), respiratory system 1.8% (242 units), alimentary tract and metabolism 1.2% (162 units), and others 0.9% (121 units).

Professional Resources and Time Allotted

To organize and carry out the task at the fire station, it was required an average of 4 pharmacists worked 4 hours a day for 6 consecutive days, which resulted in a total of 96 hours of work at this stage. Eleven pharmacists worked for 16 hours to digitalize the inventory lists. Additional activities such as organization, logistics and transportation required a workload of 18 hours.

This made a total of 26 pharmacists work on the tasks for a final workload of 130 hours.

The total cost in pharmacists-hours, considering an average cost of USD 6.88—the average hourly wage for a pharmacist in Argentina—was USD 894.4.

Received Donations vs. Real Needs

Despite the huge number of received donations, it wasn't enough to assemble 14 first aid kits, the amount needed to cover the real needs at the moment. The value of each first aid kit was USD 217, which makes a total value of USD 3038, an amount quite below a fifth of the value of the total donations received.

Each first aid kit comprising 27 items. 10 items in each kit could be covered with received donations, 8 could be partially covered with donations, and 9 items in each kit had to be bought. In this context, donations for a value of USD 1248 could be used to assemble 14 first aid kits, and about USD 1790 had to be raised to cover the actual needs (Additional information has been included as supplementary material).

One of the supplies — Silver sulfadiazine + Vitamin A + Lidocaine — was received in large numbers. Table 1 shows the excessive amount received.

Each of the 14 first aid kits contained 4 units of 30 grams, and thus, from the 333 donated units, only 56 would be used, and there would be 277 left. The remaining amount was equivalent to 41,905 grams (almost 42 kg) and with an approximate value of USD 5249.

Discussion

Medications are an essential need to prevent, treat, and cure diseases. Therefore, national and provincial aid efforts could be maximized if donations were appropriate. Medical

Table 1
Donations received of medicines containing the drug association (Silver Sulfadiazine + Vitamin A + Lidocaine)

Package size (g)	Amount	Total grams
5	19	95
30	333	9990
50	141	7050
200	61	12,200
350	27	9450
400	2	800
800	5	4000
Overall weight (g)		43,585

product donations can occur in different shapes: from long-term donations of a single drug for a specific disease to emergency donations of several drugs for health care in general.

According to the results of our data, it is clear that an emergency or natural disaster may interfere with an objective assessment of what health care products are necessary. Consequently, biased requests for medical and pharmaceutical aid can be issued without clear guidelines that consider real priorities. Besides, as was shown above, there are plenty of examples of inappropriate drug product donations.

The analysis of the results showed that an important part of the donated medicines was irrelevant to the emergency they were trying to attend to. Donations were also received in incorrect amounts, which generated a large stock of medicines that could not be used; e.g., ointments for burns that would not be used during their shelf life.

There is no certainty about the reason for this phenomenon, but there are some possible explanations. The most likely factor for this is the common-held —but wrong— belief that any medication could be useful, even health care products that are not useful in other health care settings. Another important cause that might add to this problem is the lack of appropriate information between donor and recipient. In emergencies, inappropriate donations create additional work during classification, storage, and distribution, which increases the time professionals need to complete the tasks. This additional work can easily overwhelm limited human and logistic resources.

It is evident that when medical product donations are being considered, careful planning is of utmost importance. Coordination and communication between donor and recipient are essential. Mutual respect is necessary to accomplish effective donations, and the recipient should have the ability to refuse a donation when it is considered that it is not the best fit for the emergency that is taking place at the moment.

Accordingly, in emergencies such as the one described in this article, there must be close collaboration among the relevant provincial and national non-governmental organizations and the local health care groups. Using communications networks and mechanisms already in place is key, as it is the exchange of information about needs and responses. To enhance collaboration, we think it is advisable to set up a coordination mechanism for received donations. This mechanism must assess the needs, priorities, and required amounts. Also, it may act as a central contact point and guarantee the dissemination of information so that the donations will adhere to local requisites for an actual emergency.

Conclusion

Medical products need during emergency management vary according to the specific situation unfolding. We consider it is essential that the medications to be donated be based on a robust assessment of the actual needs. This work shows how important it is to assess what is needed by working closely between donors and recipients. In addition, the distribution of donations must be done through established systems and policies. Otherwise, unsolicited and unnecessary drug donations become wasteful, and therefore should be avoided.

Hence, to be prepared for an emergency and have donations that are useful and necessary, national guidelines must be elaborated for drug product donations. It is also advisable that these national guidelines be in line with international ones. In this context, recipients should also clarify what kind of aid, and medications, in this case, are necessary and clearly state what minimum requirements these donations must satisfy and what makes a donation unacceptable.

To conclude, when national guidelines are established, they should be clearly and officially communicated to potential donors and also readily available to the general public. In addition, they must be included in an emergency preparedness plan for any contingency that occurs, as was the case with the forest fires in San Luis, Argentina.

Acknowledgments

To the Fire Department of San Luis for allowing our collaboration in the professional treatment of the donations.

To the Institutional-Social Articulation Committee of the San Luis Pharmacist Association for their organizational, logistical and field work support.

To the pharmacists who collaborated in the sorting of donations: Romina Belén Gaggioli, Valeria Yamilé Enrique, Aime Lucero, Valeria Diambri, Fátima Elizabeth Schlottke, Jorge Aníbal Schlottke, Juan Ignacio Flores Roig, Juan Marcos Kremnitzer, Vidaurre María Alejandra, Manuel Solari, Claudia Ortega, Analía Testarmata, Carolina De La Rocha, Guido Andiñach, Marta Mendoza.

References

1. The Guardian. Chile battles devastating wildfires: “We have never seen anything on this scale” | Wildfires. Available at: https://www.theguardian.com/world/2017/jan/25/chile-fire-firefighting-international-help. Accessed November 5, 2021. Published 2012.
2. BBC News. Australia fires leave trail of devastation near Perth. Available at: https://www.bbc.com/news/world-asia-pacific-12378717. Accessed November 5, 2021. Published 2011.
3. A.Gov. California department of forestry and fire protection agency details. Available at: https://www.ca.gov/agency/?item=california-department-of-forestry-and-fire-protection. Accessed November 5, 2021.
4. Wiedinmyer C, Akagi SK, Yokelson RJ, et al. The Fire INventory from NCAR (FINN): A high resolution global model to estimate the emissions from open burning. *Geosci Model Dev*. 2011;4(3):625–641.
5. Van Der Werf GR, Randerson JT, Giglio L, et al. Global fire emissions estimates during 1997–2016. *Earth Syst Sci Data*. 2017;9(2):697–720.
6. Johnston FH, Henderson SB, Chen Y, et al. Estimated global mortality attributable to smoke from landscape fires. *Environ Health Perspect*. 2012;120(5):695–701.

7. Lelieveld J, Evans JS, Fnais M, Giannadaki D, Pozzer A. The contribution of outdoor air pollution sources to premature mortality on a global scale. *Nature*. 2015;525(7569):367–371.
8. En lo Que Va del Año. los Incendios Forestales Afectaron Más de 84 Mil Hectáreas en Toda la Provincia – Secretaría de Medio Ambiente. Available at: https://medioambiente.sanluis.gov.ar/en-lo-que-va-del-ano-los-incendios-forestales-afectaron-mas-de-84-mil-hectareas-en-toda-la-provincia/?doing_wp_cron=1636370173.0798220634460449218750. Accessed November 8, 2021. Published 2021.
9. Cohen AJ, Brauer M, Burnett R, et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. *Lancet*. 2017;389(10082):1907–1918.
10. Apte JS, Brauer M, Cohen AJ, Ezzati M, Pope CA, Ambient I. PM2.5 reduces global and regional life expectancy. *Environ Sci Technol Lett*. 2018;5(9):546–551.
11. (Scotland) NE. National Health Service Executive. The primary care development fund: 1995/96. The Scottish Office. Available at: https://www.sehd.scot.nhs.uk/mels/1994_95.pdf. Accessed XXX.
12. Bradley CP, Taylor RJ, Blenkinsopp A. Primary care—opportunities and threats: developing prescribing in primary care. *BMJ*. 1997;314(7082):744–747.
13. Autier P, Govindaraj R, Gray R, Lakshminarayanan R, Nassery HG, Schmets G. Drug donations in post-emergency situations. Health Nutrition and Population Discussion Papers Ser World Bank, Washington, DC. World Bank. Published online. Available at: https://openknowledge.worldbank.org/handle/10986/13673. Accessed November 5, 2021. Published 2002.

Jorge A. Schlottke, MSc, Pharmacist, Asociación Civil Farmacéuticos Sin Fronteras de Argentina. Alsina Argentina

José María Bermúdez, PhD, Pharmacist, Asociación Civil Farmacéuticos Sin Fronteras de Argentina. Alsina, C.A.B.A, Argentina; Instituto de Investigaciones para la Industria Química, Consejo Nacional de Investigaciones Científicas y Técnicas-Universidad Nacional de Salta, Avenida Bolivia, CP, Salta, Argentina

Lucía Armaleo, PharmD, Pharmacist, Asociación Civil Farmacéuticos Sin Fronteras de Argentina. Alsina, CP 1088, C.A.B.A, Argentina

Jorge Alberto Robledo, PhD, Pharmacist, Biochemist, Asociación Civil Farmacéuticos Sin Fronteras de Argentina, Alsina, CP, C.A.B.A, Argentina; Programa Interinstitucional de Prevención y Educación en Salud, (PIPES), Gral. Paz Jovita, Córdoba, Argentina

Santiago Daniel Palma, PhD, Pharmacist, Asociación Civil Farmacéuticos Sin Fronteras de Argentina, Alsina, CP, C.A.B.A, Argentina; Unidad de Investigación y Desarrollo en Tecnología Farmacéutica (UNITEFA), CONICET, Haya de la Torre y Medina Allende, X5000XHUA Córdoba, Argentina; Departamento de Ciencias Farmacéuticas, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Haya de la Torre y Medina Allende, X5000XHUA Córdoba, Argentina

José Julio Daniel Alvarado, PharmD, Pharmacist, Asociación Civil Farmacéuticos Sin Fronteras de Argentina. Alsina, CP, C.A.B.A, Argentina

ANNEX 1. Model First Aid Kit

Contents of the model first aid kit assembled to cover the basic needs of firefighters fighting wildfires. This kit was designed to last one year. //

ITEM	QTY
Peroxide 10 vol (500 ml)	2
Ethyl alcohol (gel - 500 ml)	1
Ethyl alcohol 96% (500 ml)	1
Cotton (75 g)	1
Sterile dressings (15 × 20 cm)	5
Adhesive bandages (10 count)	8
Sterile gauze (10 × 10 cm)	10
After sun lotion (250 g)	1
Latex gloves (100 count)	1
Ibuprofen (tablets - 400 mg)	24
Povidone-iodine (60 ml)	2
Bar soap (120 g)	1
Liquid soap (250 ml)	1
Nitrofurazone dressing (100 g)	1
Paracetamol (tablets - 500 mg)	60
Polyethylene glycol 400 and related (10 ml)	1
Saline solution (100 ml)	3
Saline solution (500 ml)	3
Silver sulfadiazine + Vitamin A + Lidocaine (30 g)	4
Adhesive tape (several sizes)	4
Tetrahydrozoline (eye drops - 10 ml)	4
Cambric bandage (7 cm)	3
Cambric bandage (10 cm)	3
Elastic bandage (7 cm)	2
Elastic bandage (10 cm)	2
Stainless steel scissors	1
Sling	1