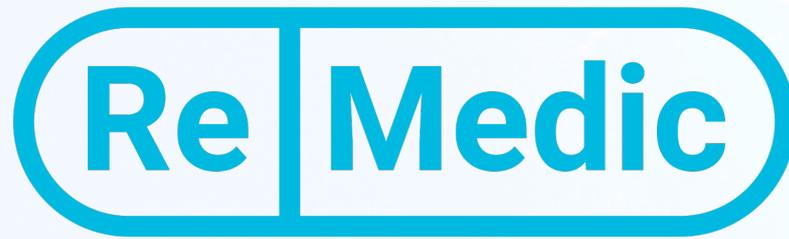


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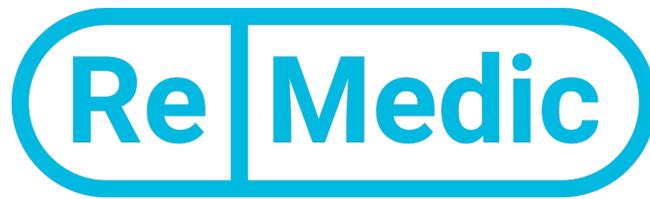


An integrative solution turning medicines excess into access



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Abstract

Over the last two decades, the use of medications and pharmaceutical products became highly abundant and widespread. Although it has a tremendous contribution to our health and quality of life, it acts as a double edge sword. When disposed improperly, which is the common situation in the modern world, they pose a serious threat to the environment and to human health as a result. Moreover, many of the disposed products are still valid and reusable, while there are parts in the world in which most people do not have access even to the most basic medications.

ReMedic aims to solve these two problems together, using an integrative approach. ReMedic solution suggest policy establishment that will encourage people to return their unused medications and be rewarded for that. Out of the returned products, valid ones will be used to aid areas and populations in need. This creates a “triple win” solution- responsible disposal to protect the environment and population health, Increasing access for those in need and health-related benefits. This is the ReMedic goal: turning excess into access.

The Team

A Jewish-Arab cooperation integrating different views and experience



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1 INTRODUCTION- PROJECT SCOPE AND STRATEGY

ReMedic is a solution for two global health challenges: the environmental and health consequences caused by pollution of improper disposal of medications (section 2.1), and the shortage in safe essential medicines in low income countries (section 2.2).

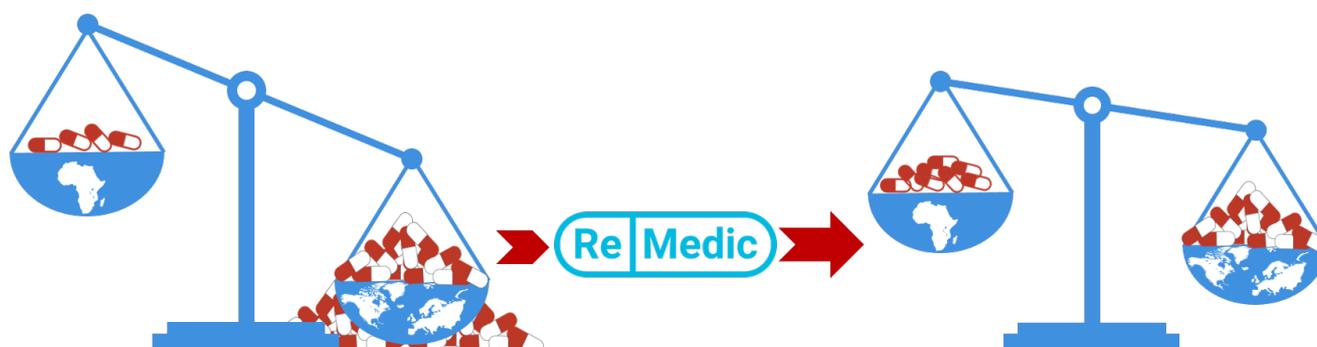
The **ReMedic** solution was born from the following insights:

1. There is imbalance between the first and third world when it comes to medications: the first world suffers from environmental pollution caused by excess medications that are improperly disposed (section 2.1), while about 1/3 of the world population do not have access to life saving, essential medicines (section 2.2).
2. The main reason for improper medication disposal is lack of motivation from the customer side.
3. The main factor preventing access to essential medications is lack of resources (reasonably priced, safe medications, low income).
4. Goodwill alone is not enough - we understand that in order to benefit the third world we need strong enough motivations for the first world, and these motivations can be either financial or government regulations (support for this statement can be found in section 3.1- regulation).

ReMedic tackles these two global health issues using an **integrative approach**- solving two problems at once.

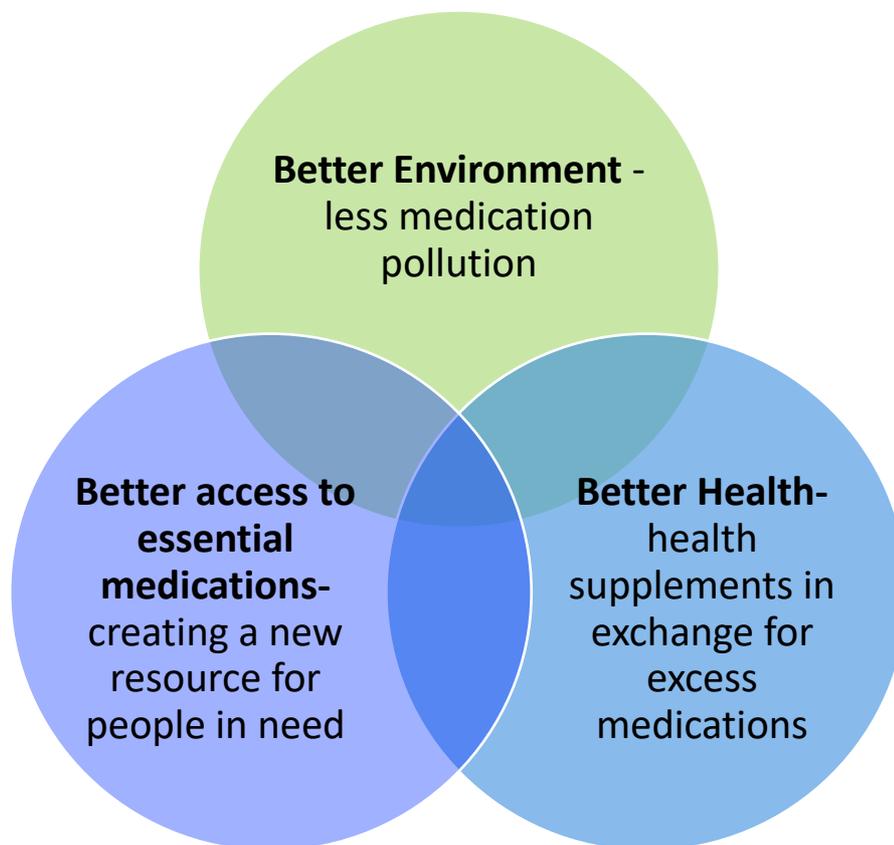
Briefly, the proposed solution (described in detail in section 3.2) prevents the surplus medications of the first world from contaminating the environment, and instead repurposes them as safe, essential medical products that can be used by those who otherwise cannot access them.

We suggest integrating **policy, reward and education** approaches, to **turn excess into access**.



1.1 WIN-WIN-WIN SOLUTION

ReMedic benefits everyone:



2 INTRODUCTION- TWO GLOBAL HEALTH CHALLENGES

ReMedic is a solution for two global health challenges: the environmental and health consequences caused by pollution of improper disposal of medications (section 2.1), and the shortage in safe essential medicines in low income countries (section 2.2).

2.1 PHARMACEUTICAL POLLUTION IN THE ENVIRONMENT – A WORLDWIDE PROBLEM

Pharmaceutical pollution of the environment is a global problem in the modern world. In 2014, a global review demonstrated that pharmaceutical residues are found in the environment all over the world¹. This is due to improper disposal of pharmaceuticals. Proper pharmaceutical disposal includes various measures to prevent any residues or compounds from ending up in the environment- such as encapsulation, inertization, incineration, decomposition and more². Unfortunately, most medical products in the world today do not go that way when disposed.

Based on a review of more than 1,000 international publications, pharmaceutical residues have been detected in 71 countries worldwide in all five UN regional groups (Figure 1). The Pharmaceuticals residues have mostly been detected in surface water and sewage effluent, but they have been also found in soil, manure, groundwater, and other environmental matrices. More than 600 active pharmaceutical compounds, including their metabolites and transformation products have been detected. These compounds include antibiotics, analgesics, synthetic estrogens and more

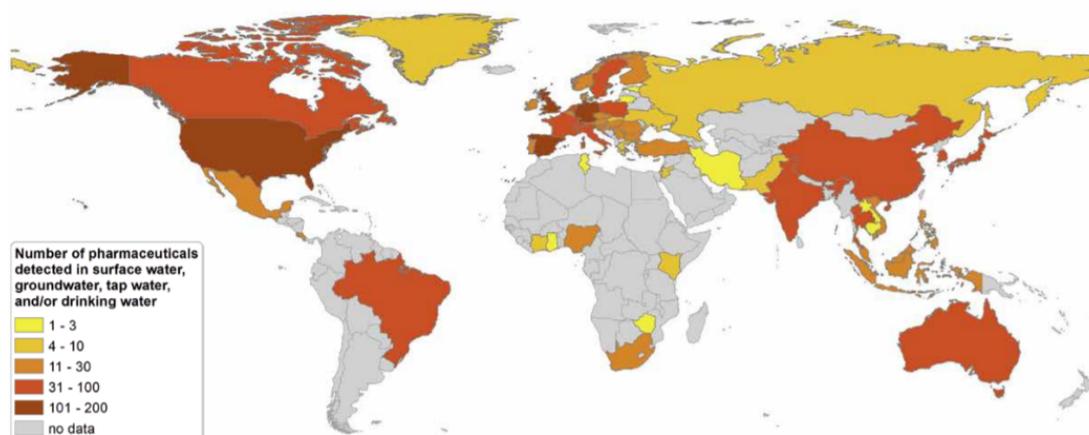


Figure 1- Global occurrence of pharmaceuticals: Pharmaceuticals have been found in the environment in all UN regional groups. Source: IWW 2014.

These pharmaceutical residues in the environment have **severe environmental and health implications**. In the following sections, we will discuss the environmental and health consequences of this problem and will explore how these residues end up in the environment, in what volumes and additional economic implications.

2.1.1 ENVIRONMENTAL AND HEALTH IMPLICATIONS OF PHARMACEUTICALS POLLUTION

Improper disposal of pharmaceutical waste leads to serious environmental and personal health issues. This includes antimicrobial resistance, abnormal hormonal effects, interference with reproduction and growth and more. Not only humans are affected, but also the surrounding ecosystem, mainly aquatic life. Among several potential risks and health hazards of pharmaceuticals pollution are the following main alarming threats that have been addressed firmly by the WHO.

2.1.1.1 ANTIBIOTIC RESISTANCE

A recent alarming public health threat is the spread of antibiotic-resistant pathogens. Antibiotic resistance is considered one of the biggest threats to global health, food security and general development. One of the main causes for the development of resistance genes is the presence of antibiotic residues in the environment, posing a selective pressure on resistant organisms. Improper disposal of antibiotics by individuals has a significant contribution to this process. Thus, strategies to reduce the introduction of antibiotics into the environment will help to contain antimicrobial resistance³.

2.1.1.2 ENDOCRINE-DISRUPTING PHARMACEUTICALS

Some of the improperly disposed pharmaceuticals have an endocrine function, meaning that they affect the hormonal system. Examples of these include contraceptives, cancer treatments and medicines for thyroid and nervous system diseases. Besides having health implications on humans, and mainly during teenage years, some have been found to have adverse effects on wildlife at very low concentrations, such as feminizing male fish, preventing reproduction and leading to population collapse³. Besides the ecological tragedy, this also affects global food security. These pharmaceuticals are a subgroup of endocrine-disrupting chemicals, which has been addressed as an emerging policy issue since 2012⁵.

2.1.1.3 PHARMACEUTICALS IN DRINKING WATER

Another concern of the environmental pollution by pharmaceuticals is the contamination of drinking water. Data collected demonstrated that millions of Americans drink water that is contaminated with trace concentrations of pharmaceuticals⁶. As more tests are conducted by federal agencies, a wide range of pharmaceuticals compounds including anticonvulsants, mood stabilizers, antibiotics and hormones have been discovered in the drinking water of at least 46 million Americans. The main concern is that even trace quantities of pharmaceuticals in drinking water could lead to detrimental health impacts for humans such as abnormal hormonal effects among teenagers, antibiotic resistance, allergies and more^{1,3}.

2.1.2 HOW PHARMACEUTICAL POLLUTION HAPPENS- FOCUS ON IMPROPER MEDICATION DISPOSAL

There are several sources behind the introduction of pharmaceuticals in the environment⁷. These include non-personal consumption sources such as drug manufacturing industry, agriculture and healthcare institutions. Personal-use of medications is another significant source contributing to this pollution. A major factor is, of course, the human excretion of consumed pharmaceuticals and their metabolites into the sewage⁸. However, another significant factor contributing to this, is the disposal of waste medications (for the purpose of this work, any undesired pharmaceutical product that a person throws away for whatever reason). Improper medication disposal methods such as flushing them down the toilet/sink or trashing them into the general garbage are a significant factor contributing to the presence of pharmaceutical compounds in the environment⁹. Here we demonstrate some of the common improper disposal practices of waste medications in the United States and the United Kingdom as an example for first world disposal practices.

U.S - in 2018, Kinrys et al. reviewed and summarized the findings of several studies and surveys that have been conducted in the U.S. about medication disposal practices and awareness as shown in Table 1¹⁰. Overall, findings suggested that the typical American medicine cabinet is full of unused and expired drugs, only a fraction of which get disposed of properly. Big proportion of Americans continue to employ incorrect methods of medication disposal such as flushing waste medications in the toilet or discarding them in the general garbage. Those improper ways of disposal might be apparently the result of little awareness to the guidelines and importance of medication disposal, and most importantly the lack of motivation and interest in doing so.

U.K- two big studies conducted in the United Kingdom shows that about 75% of the participants dispose unused medications improperly, either by discarding them in the household waste (63.2%) or emptying them into the sink or toilet (11.5%). Only about 21.8% return them to the pharmacist for proper disposal¹¹. Most of these medications are thrown away because symptoms have disappeared (42.5%) or the treatment was changed or had unwanted side-effects (30%)¹². **That means that most of the products thrown away are good, valid medications that could potentially be used, had there been a system in place to utilize it.**

Table 1-Summary of articles exploring medication disposal practices in the United States

Authors	Sample	Key findings
Kuspis et al (1996)	500 callers to poison control center	35.4% of patients reported flushing medications down sink or toilet. 1.4% reported returning medications to pharmacy
Seehusen et al (2006)	301 patients at an outpatient pharmacy	54.2% of patients reported having unused/expired medications in their household. 53.8% of patients reported flushing unused medications down a toilet
Bates et al. (2011)	275 patients undergoing urology surgery	92.2% of patients reported receiving no instruction on proper disposal of leftover pain medications. 90.8% of patients kept leftover medications.
McCullagh et al. (2012)	138 hospice home care nurses	64% reported disposing of unused or expired medications by mixing them with noxious substance. 37% reported disposing by flushing down the toilet. 18% reported rinsing down a sink
Maeng et al. (2016)	721 Medicare Advantage members	25.2% reported having unused medication in households for no later use. 55% of the medications remained in cabinet and 14% were thrown in garbage
Tai et al. (2016)	142 community-based pharmacists	38% did not recall receiving medication disposal education in pharmacy school. 67.9% supplied medication disposal recommendations once a month or less frequently

In conclusion, the data coming from first world countries teaches us about the significant contribution of individual improper disposal of waste medication to the pharmaceutical pollution. In the next chapter we demonstrate that a big proportion of this medication waste is usable, emphasizing the need and the opportunity for intervention to convert pollution into reuse.

2.1.3 VOLUME OF WASTE MEDICATIONS AND ECONOMIC IMPACT ESTIMATION

In order to evaluate the extent of the problem (volume of waste medications in developed countries) and estimate its economic impact, we utilized a very careful study conducted in 2010 by The School of Pharmacy, University of London and the York Health Economics Consortium¹⁰. The study was conducted to estimate the scale, causes and costs of waste medicines in the National Health Service in England.

In this comprehensive study, and in order to estimate the scale of unused prescription medicines, a public survey was coupled with the audit of medicines returned to community pharmacies. The estimation suggests that over 20% of individuals living in private dwellings in the UK have waste medicines in their homes. The types of the waste medications vary as indicated in Table 2. In the majority of cases (60%), the waste medicines found had been prescribed within the last year shown in Table 3. **This indicates that over 60% of the waste medicines might be still within the**

expiration date and might be reusable. Around 30% of interviewees estimated that three quarters of the original package remained unused and around 19% estimated that it was completely remained unused, as shown in Table 4. **This suggests that significant amount of the prescribed medicine packages is meant to be disposed.** The reason behind not completing the course of medication also varies, as shown in Table 5. More than 40% of waste medicines were discontinued because the participants' symptoms had disappeared. Other key reasons include a change of medication from the GP and discontinuation due to side-effects or problems with the medication itself indicating vindicated stop. That means that lack of adherence to the treatment is **not** a major cause for accumulating waste medications. The reasons for not completing a course of medication varied substantially according to the type of drug involved. For the majority of indications, particularly those categorized by intermittent symptoms such as gastrointestinal, skin and infections, the disappearance of symptoms was the main reason for stopping therapy (Data not shown). The study shows that 21.5% of the waste medicines were kept at household because people forgot to throw them away and 10% of the people do not know what to do with them as indicated in Table 6.

Table 2-categories of waste medications

Category of unused medicines	Percent
Other	16.1%
Gastrointestinal	12.4%
Skin	11.2%
Pain	10.5%
Cardiovascular	10.3%
Central nervous system	8.8%
Respiratory	7.3%
Infections	6.2%
Eye / ear / nose / throat	6.0%
Nutrition / blood	4.3%
Endocrine	2.8%
Mental Health	2.1%
Can't remember	1.9%
Total	100.0%

Table 3- waste medication prescription time

Period	Percent	Accumulating %
In the last month	6.70%	6.70%
In the last 3 months	11.60%	18.30%
In the last 6 months	18.50%	36.80%
Last year	26.60%	63.40%
Two years	15.20%	78.60%
3 years	8.60%	87.20%
5 years	4.50%	91.70%
More than 5 years	6.40%	98.10%
Don't know	1.90%	
Total	100%	

Table 4- Amount of waste medication remaining unused

Amount of medicine remains unused	Percent
Can't estimate	3.60%
Almost gone	18.70%
Half remaining	29.80%
Three quarters remaining	29.40%
Never used	18.50%
Total	100%

Table 5- reasons for not completing the course of medication

Reason	Percent
Symptoms disappeared	42.50%
Consultant changed medication	16.30%
Side-effects of medication	13.90%
Didn't want to take the medicine	6.90%
Found it didn't help	6.00%
Take as needed	4.30%
Over prescription	1.70%
Forgot to finish the course	1.10%
Found it difficult to take it	1.20%
Other	6%

Table 6- Reasons for keeping waste medication

Reason	Percent
Use again	58.60%
Forgot to throw out	21.50%
Don't know what to do with it	10.10%
Intends to dispose of it	6.00%
Other	3.90%
Total	100%

In the same study, an audit of community pharmacies was conducted to estimate the volume, the reasons, and the types of the waste medications being returned to local pharmacies. The mean number of items returned per pharmacy per month was not high and it varied from 57 to 143. As indicated before, a significant proportion of people do not know what to do with waste medicines, forget to return them and find it easier to throw them in bin or to flush them down the toilet.

According to this study, medicines waste in England was estimated to cost the National Health Service (NHS) £300m per year, including £90m worth of unused prescription medicines stored in households, £110m returned to community pharmacies, and up to £50m from care homes.

In conclusion, this suggests that:

1. the majority of unused medications is not disposed in a proper way, ending up polluting the environment, causing health problems and costing a lot of money.
2. The majority of medications being disposed is still valid and useable.
3. A major and significant reason for improper disposal is lack of awareness to the problem and lack of knowledge regarding the proper disposal methods.

Therefore, we are positive that putting an efficient and rewarding system for waste medication disposal in place, along with education and raising awareness to the problem, could generate a profound volume of valid, reusable medications.

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2.2 LACK OF ACCESS TO BASIC MEDICATIONS- A GLOBAL HEALTH CHALLENGE

2.2.1 LACK OF ACCESS TO BASIC MEDICATIONS

The leap forward in science, technology and medicine have alleviated a profound number of health conditions, especially in the field of transmittable diseases. These have turned from life-threatening to a temporal inconvenience in most cases or were eradicated completely thanks to the discovery of vaccines and antibiotics.

However, not all humanity enjoys the fruits of this progression equally.

Nearly 2 billion people – 30% of the world's population- have no access to basic medicines¹.

According to the WHO definition, basic or essential medicine is defined as “20 essential medicines, which are continuously available and affordable at a health facility or medicines outlet, within one hour's walk from the patients' home”².

This situation is more prominent in low- and middle- income regions and is mostly concentrated in Africa and India².

2.2.1.1 PNEUMONIA AS A CASE-STUDY

Pneumonia, an acute infection of the lungs (also termed 'lower respiratory tract infection'), is the number one killer of children worldwide^{3,4}. It kills around a million children under the age of five every year, which is 18% of annual children death rate (Figure 2).

Causes of death in under 5 years, Global, 2017

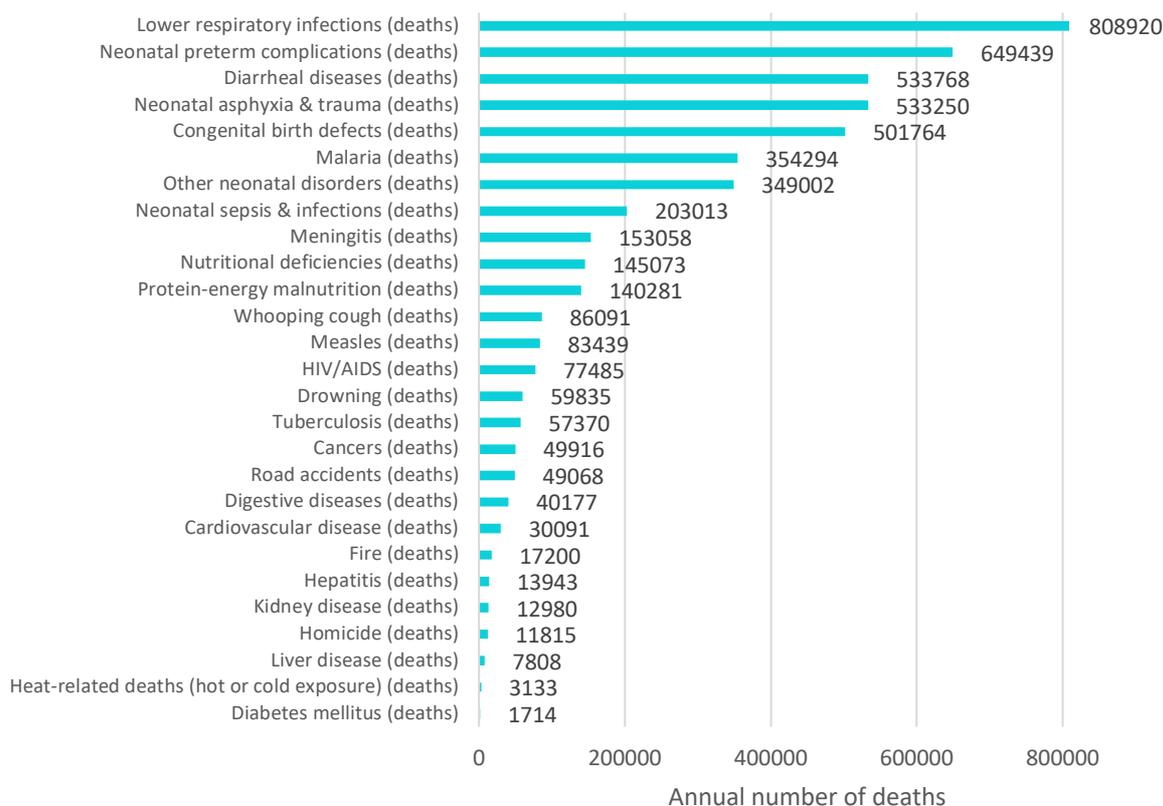


Figure 2-causes of death in under 5 years, world, 2017. Source: IHME, Global burden of disease

This disease is easily preventable by children vaccination and can also be treated easily using oral antibiotics. However, looking at the death case number by region highlights the lack of access to those basic means of prevention and treatment in low-income countries (Figure 3).

6 out of 10 childhood pneumonia deaths are concentrated in 10 countries

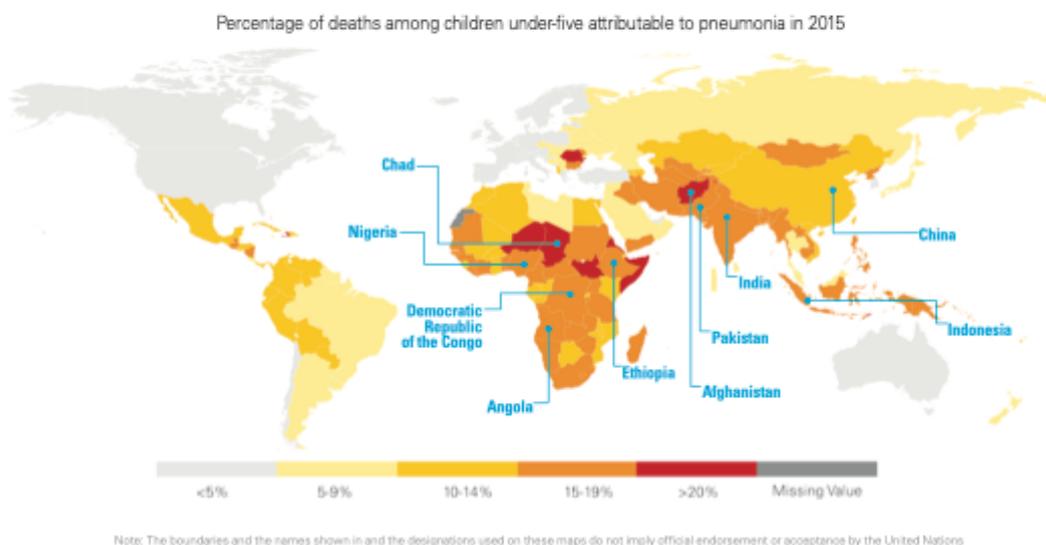


Figure 3-Global deaths by pneumonia among children under 5.Source: World Pneumonia Day 2015 infographic, WHO.

Besides being the major children death cause in low income countries, pneumonia is also the number one death cause in low income countries among the general population (Figure 4).

Top 10 causes of death in low income countries in 2016 (Crude death rate- per 100,000 population)

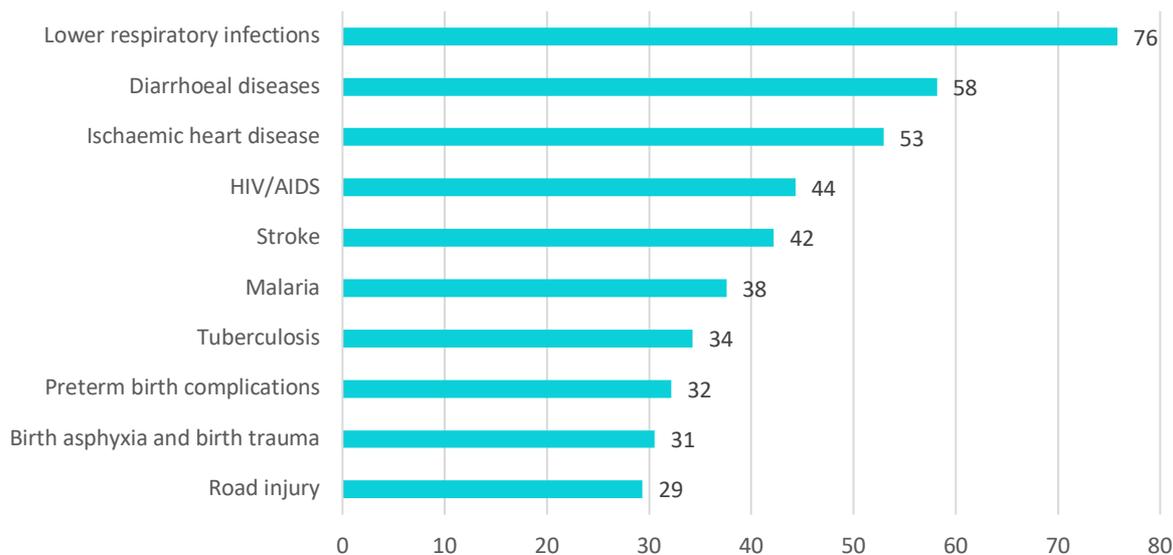


Figure 4 - top 10 causes of deaths in low-income countries in 2016. Source: Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, World Health Organization; 2018.

Pneumonia is not alone. Diarrhea, the 3rd biggest children killer worldwide and the second biggest killer in low income countries, is responsible for around 600,000 death cases of children under 5 worldwide⁴ (Figure 2, Figure 4).

As with pneumonia, diarrhea is also easily preventable and treatable. And as with pneumonia, children in low income countries do not get to enjoy this privilege⁴.

The reason these countries are so heavily affected by these diseases is in big part financial: full-course vaccination for pneumonia costs 200\$^{5,6}, while the average annual income per capita in sub-Saharan Africa is around 700\$⁷. The cost of antibiotic treatment ranges between 2-42\$, depends on the treatment⁸, but even then, for most households in sub-Saharan Africa it is either too expensive or inaccessible. Due to low government financing, a lot of basic, lifesaving medications such as antibiotics do not even reach these areas in sufficient quantities.

Another obstacle in the way of getting proper medications is the abundance of falsified medications, discussed extensively in **section 2.2.1.2**.

These factors comprise 3 out of 4 key elements defined by WHO as required to allow proper access to medications (Figure 5).

The access framework



Figure 5-Key factors influencing access to essential medicines. Source: The World Medicines Situation, WHO 2004.

2.2.1.2 FALSIFIED MEDICATIONS

According to the World Health Organization (WHO), An estimated 1 in 10 medical products in low- and middle-income countries is substandard or falsified ("falsified")⁹, and are responsible for an estimate of 100,000 deaths per year.

According to WHO:

- **Substandard** also called "out of specification", these are authorized medical products that fail to meet either their quality standards or specifications, or both.
- **Falsified** medical products that deliberately/fraudulently misrepresent their identity, composition or source.

Falsified medical products may contain no active ingredient, the wrong active ingredient or the wrong amount of the correct active ingredient.

Antibiotics are among the most commonly reported falsified medications. They can be found in street markets, in pharmacies and even in clinics and hospitals. This is due to the fact it is hard to tell the difference between them and real medications.

for most African people it is impossible to differentiate.

In the best case, these medications are ineffective. but in worse cases they can be toxic, contaminated with bacteria, and even be lethal.

In addition, they contribute to pathogen antibiotic resistance, which leads to development of even more violent, drug-resistant pathogens.

To demonstrate the extent of the problem, between 2012-2017, the WCO (world customs organization), together with the Institute of Research against Counterfeit Medicine (IRACM), has intercepted more than 750 million falsified medications in Africa's ports.

In 2016, in a ten days operation, 113 million falsified pharmaceutical items were seized in 16 countries¹⁰.

When combining the lack of access to proper medications together with the falsified medications problem, it is easy to understand how and why relatively easy-to-treat diseases get out of control and threaten so many lives.

The current situation is a vicious cycle – improper treatments leads to disease spread and more resistance, that makes it even harder to treat, and in turn requires even more funding and more available medications.

2.2.1.3 DISEASE BURDEN AND ARREST OF DEVELOPMENT

Besides posing a serious health and life threat, disease burden is a key limiting factor of development and growth.

Africa has a tremendous potential for growth and development. It is currently the second most populated continent, with over 1 billion people and is expected to grow to around 4 billion by the end of the century, more than 30% of humanity¹¹. It relies mostly on a young population, and together with slow but steady uptake of technology, it may pose itself as one of the major engines of economic and demographic growth in the world¹¹.

However, disease burden is a major limiting factor for this growth. unhealthy population is less productive and generates less productive adults. The financial burden of disease comes at expense of investment in infrastructure, education, equality and development.

Increased access to proper health services and medication can help generate a more productive society, a major contributor to the world's economy and reduce the amount of investments required from other nations in the world.

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3 THE SOLUTION- ReMedic

The ReMedic solution is based first of all on government / regulator directed policy. We strongly believe that this is the most suitable engine to drive change in the direction we suggest. The first section therefore provides support for this claim (section 3.1), to help better understand the solution model, described in section 3.2.

3.1 GOVERNMENT REGULATION AS A CHANGE-DRIVING ENGINE

Government regulation is a powerful tool in driving change in companies and customers' behavior.

It allows putting the interests of the country's citizens – clean environment, better health – in front of the interests of companies and non-government organizations (NGOs), which usually sum up to profit.

In addition, it creates a shift in public understanding of the additional cost (“externalities”) in environmental pollution caused by the product.

In the last four decades we are witnessing a change in the field of environmentalism: it is no longer a caprice of few, but an actual problem with severe consequences. This is why governments started to step in and the field of “environmental law” was born.

Today, more and more of these laws are an effective measure in the battle of preserving a healthy, safe and pleasant environment for humanity to live in.

This is of course an anthropocentric point of view; however, it is the only one that was proven to be effective in making a change¹.

Environmental legislation has changed a lot since its first introduction in the 1970s: in summary, around the mid-late 1990s it was already clear that voluntary mechanisms are not effective, and regulation is fundamental¹.

The Clinton- Gore administration in 1995 based its agenda on win-win outcomes that combine environmental and economic goals^{2,3}. Most of the regulation we see today in the environmental field stems from this approach. Regarding effectiveness, according to a number of surveys, the single most important driver of improved environmental performance is regulation⁴.

As an example, we bring the case study of bottles recycling in Israel.

3.1.1 CASE-STUDY: BEVERAGE CONTAINER RECYCLING IN ISRAEL

In 1999, Israel legislated the “Beverage Container Deposit Law”⁶.

In short, this law determines that for each drink's container (other than plastic bags and cardboard containers), the manufacturer will pay the government around 8 US cents. This additional cost in its turn will be rolled on to the customer as a deposit- if the customer returns the container to a collection point, he will get those 8 cents back (see Figure 6).

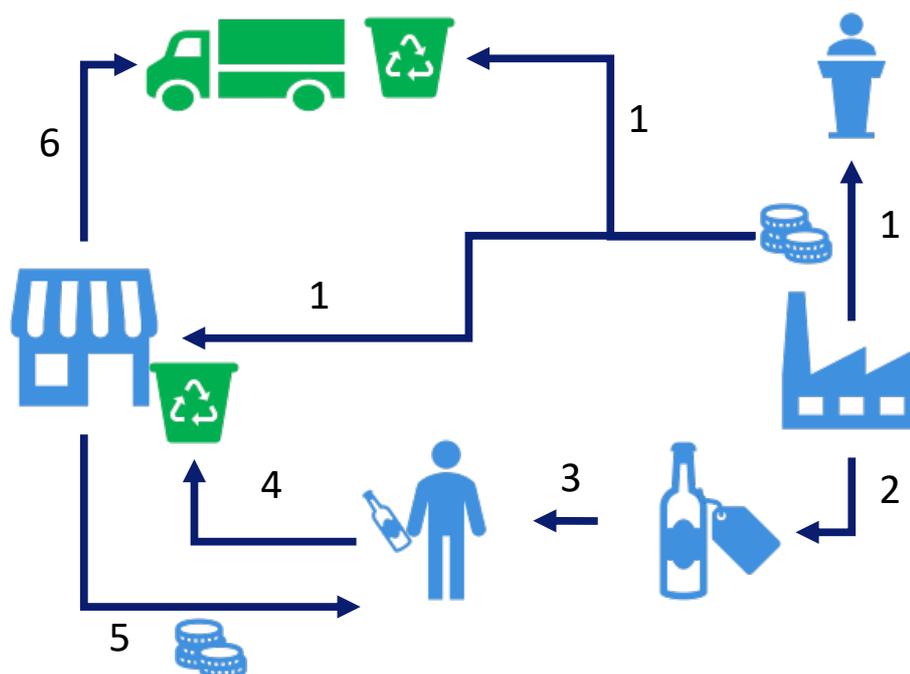


Figure 6- Bottle recycling process in Israel: 1. The manufacturer pays 8 cents to the government through taxes. This money is used to pay back to the customer and to establish a non-profit recycling organization. 2. The price of the bottle is now +8 cents. 3. The customer buys the bottle. 4. The customer returns the bottle to a collection point. 5. The customer gets 8 cents back. 6. The bottle is sent for recycling.

The law in its current form represents a hybrid logical framework combining the direct responsibility of the manufacturers together with civil education and responsibility for the environment⁵.

It also represents the win-win framework of Clinton-Gore administration: environmental and economic goals.

According to the ELA recycling cooperation in Israel, a total of 64% of the plastic containers in Israel are recycled, more than in the EU (60%) and USA (30%)⁷.

Using this framework, the only player with no direct benefit is the manufacturer. It is obligated to act according to the law. Otherwise, this framework could not exist, as there is no profit-related benefit in recycling⁵.

Similar laws exist outside of Israel, such as in Germany, Britain, Spain, Switzerland, Australia, South Africa and more.

This demonstrates the power and strength of government regulation as a change-driving engine.

Therefore, in ReMedic, we chose to utilize this power and apply a similar framework, described in **section 3.2**.

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3.2 ReMedic MODEL

ReMedic provides a sustainable solution for the challenges mentioned above, tackling both aspects of extensive use of medication in developed countries.

Figure 1 demonstrates the solution workflow, described in this section in detail. Numbering below refers to process number as demonstrated in Figure 7.

1. The starting point of this holistic solution requires a conceptual reform on the part of the state: as part of the regulation on the pharmaceutical industry, the state will require companies to **deposit** a certain amount of money (changes between countries, depending on the economy) in the hands of the state for each product they sell (Fig. 7.1). For the purpose of this example, the deposit is equal to 1\$.

In addition, the state will require the companies to place a **temperature sensitive sticker** that changes color to indicate an improper storage of the medicine, on every medication package.

2. In order to cover the deposit, the pharmaceutical companies will charge an extra 1\$ for each product from the pharmacies/distributors that buy the medication from them (Fig. 7.2).
3. The pharmacies will then sell the product to the consumer with additional payment of 1\$, already included in its price (Fig. 7.3). However, this 1\$ will be returned later to the consumer in exchange for unused, old medications, as detailed next.
4. A consumer that possess unused medications, will have the opportunity to hand them over to a nearby pharmacy, and get 1\$ worth nutritional/health supplements, free of additional charge – covered by the deposit already paid when buying the medicine. (Fig. 7.4). The supplements should be health-promoting, and can include vitamins, minerals, amino acids, probiotics and more. The costumer will be able to choose it preferable supplement out of a verity of options. .The deposit's worth can be accumulated.

It is important that the reward will not be in the form of money. It can lead to an undesirable situation where people, mainly from low socioeconomic status, will not follow up with their medical treatment to gain money. However, health-promoting supplements are mostly not affordable to low socioeconomic populations, and this kind of reward is beneficial to both them and the state's health system.

5. The pharmacies will then transfer the unused medication to designated sorting centers. For every product they hand over, they will get 1\$ to cover their losses. The money will be given to them by the deposit transferred to the state in step

1 (Fig.7.5). funding for necessary investment in sorting centers will come in part from the deposit – as many products will be used fully and not returned.

6. The sorting center will sort the products according to their expiry date, storage conditions and demand in areas in need such as 3rd world countries: expired or sub-conditionally stored medications will be disposed according to the regulations of each state. Medications appropriate for reuse will be transferred to health organizations/international aid and be delivered to the populations in need (Fig. 7.6).

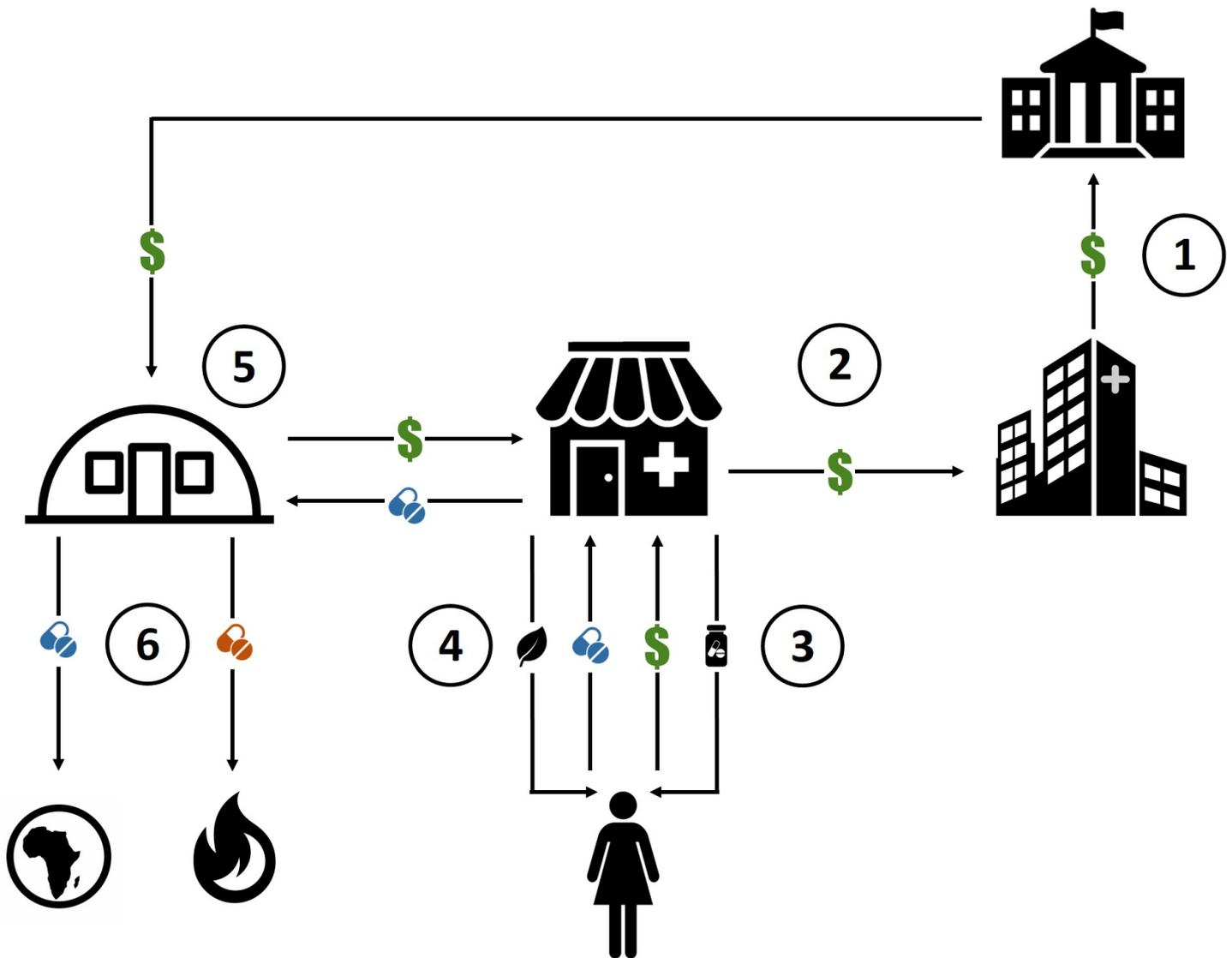


Figure 7- A schematic model of the solution. 1. The state charges an extra 1\$ deposit from the pharmaceutical companies for every medication they sell. 2. The pharmaceutical companies charge an extra 1\$ from the pharmacies for every medication they buy. 3. The pharmacies charge an extra 1\$ from the customer for every medication they buy. 4. Customers return unused medication to a nearby pharmacy, in exchange for nutritional supplements in 1\$ worth. 5. The pharmacy delivers the unused medications to a designated sorting center, and gets a 1\$ payment for every unused medication from the state. 6. The sorting center sorts the medications for disposal or reuse in developing countries

The uniqueness of this solution is that it is a zero-sum game for most of its players - the money is being transferred from one player to another with monetary profit for none of them, as demonstrated in Table 7 and Figure 8.

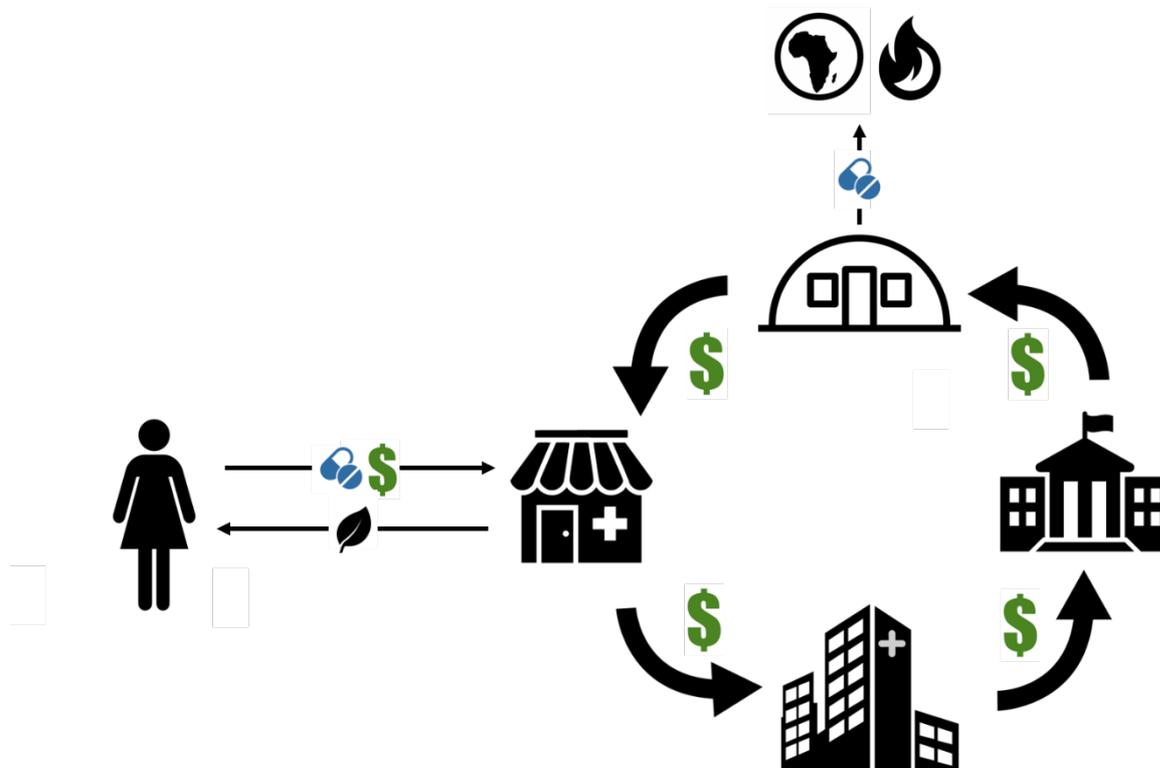


Figure 8- ReMedic cycle scheme. The bottom line of the ReMedic equation is that the consumer buys a medication and returns its leftovers in exchange for supplements. The medication will either go through a proper disposal or sent to areas in need. In-between, the money changes hands in a cycle between the state, the pharmaceutical companies and the pharmacies.

Table 7-The economical balance of the key players in every step of the solution

Step	Description	Economical Balance				
		State	Pharmaceutical company	Pharmacy	Sorting center	consumer
1	The state charges an extra 1\$ deposit from the pharmaceutical companies for every medication they sell	+1\$	-1\$	0	0	0
2	The pharmaceutical companies charge an extra 1\$ from the pharmacies for every medication they buy.	+1\$	0	-1\$	0	0
3	The pharmacies charge an extra 1\$ from the costumer for every medication they buy	+1\$	0	0	0	-1\$
4	Costumers return unused medication to a nearby pharmacy, in exchange for nutritional supplements in 1\$ worth	+1\$	0	-1\$	0	0
5	The pharmacy delivers the unused medications to a designated sorting center, and gets a 1\$ payment for every unused medication from the state.	0	0	0	0	0
6	The sorting center sorts the medications: <ol style="list-style-type: none"> 1. Unexpired medication will be transferred through world health organizations/international aid to developing countries. 2. Expired or sub-conditioned medications will be properly disposed. 	0	0	0	0	0

3.3 REMEDICS PLAYERS' MOTIVATION OVERVIEW

Although our solution is a zero-sum game in a way, it benefits some of its key players. Those benefits are the justification for the program's existence and will motivate its components to persist it. In order to examine this, we need to ask why each player continues to play its roll - what are its motivations to keep ReMedic cycle running?

An overview of each player's motivations in Table 8 answers this question:

Table 8- ReMedic Players' motivations

Player	What it needs to do	Why do it
The state	<ol style="list-style-type: none"> 1. Promote a legislation/regulation that enforces pharmaceutical companies to deposit certain amount of money for each product they sell and place thermo-sensitive stickers that indicate storage conditions. 2. Promote a legislation/regulation that enforce the pharmacies to collect unused medications from the costumers (mostly exists today, however barely used) and provide them with supplements in exchange. 3. Promote an educational campaign raising public awareness the environmental, health-related and moral importance of this project. 4. Adjust sorting centers and transportation arrays to collect the medications from the pharmacies (centers like that exist today, however require some adjustments to fit the ReMedic sorting criteria). 	<p>As discussed in previous chapters, the economic, health and environmental damages caused by improper disposal of medications in developed countries is enormous. Investment in a solution that solves these problems will be beneficial for the state – in both environmental and economic aspects.</p>
Pharmaceutical companies	<ol style="list-style-type: none"> 1. Deposit certain amount of money for each product in the hands of the state. 2. Place thermo-sensitive stickers that indicate storage conditions. 	<ol style="list-style-type: none"> 1. They are obligated by the regulation to cooperate. 2. They do not lose money: they charge the deposit sum from the pharmacies to cover their losses. 3. They can leverage their participation in this program to

		<p>promote their ecological and “green” image.</p> <p>4. Thermo-sensitive stickers can also be a sales-driving engine, as people will replace improperly stored medications instead of using them.</p>
Pharmacies	<p>1. Collect the unused medications from the customer (mostly existing today) and provide them supplements in exchange.</p>	<p>1. They are obligated by the regulation to cooperate.</p> <p>2. They do not lose money: The money invested by them to provide the nutritional supplement is paid back to them by the state in exchange for the medications leftovers.</p>
The consumers	<p>Return unused medications to a nearby pharmacy.</p>	<p>1. They are rewarded. Although it’s a small reward, it is important to provide it. Rewards motivate people to take action.</p> <p>2. Moral conscience: whether due to the ecological or health importance of proper disposal of medications or the will to donate to developing countries – it is the right thing to do.</p> <p>3. Education: similar to previous campaigns, such as bottle recycling for example, public education and emphasizing the importance of their actions, increases the chances they cooperate.</p>

3.4 RISK ANALYSIS

The following table presents potential risks identified, mitigation measures and the risk severity according to the matrix below.

Risk Analysis Matrix - risk severity rating considering mitigating measures:

		Severity of Impact		
		Minor	Moderate	Major
Probability	Probable	Medium	High	High
	Possible	Low	Medium	High
	Unlikely	Insignificant	Low	Medium

Risk	Mitigation measures	Risk severity
<p>Low customer cooperation: the project's success depends on customer cooperation and willingness to return their excessive medications.</p>	<ul style="list-style-type: none"> • Reward in the shape of health supplements in return to excess medication. • Raising awareness of the problem in keeping excessive medications and of improper disposal. • Assuring return process is as easy and effortless as possible. • Use of social media tools to turn medication returning into a trendy social phenomenon. 	Low
<p>Public/insurance companies' objection to raise medication prices: medications should be as accessible as possible. For insurance companies this means higher expenses.</p>	<ul style="list-style-type: none"> • Deposit will be relatively small and constant (does not depend on the medicine price). • Deposit will be returned in the shape of additional health products such as supplements, therefore providing benefit for the customer. 	Medium

<p>Funding for sorting stage and advertisement: the project will require funding for operation of mediator stage and for public awareness campaigns and advertisement.</p>	<ul style="list-style-type: none"> • Funding will come from the deposit paid to the government by the manufacturers. • Advertisement will be based on creative, cost-effective tools such as social media campaigns and volunteers. Therefore, it will not require a lot of funding. • 	<p>Low</p>
<p>Pharmaceutical companies' objection to the deposit: This is an additional cost to the manufacturers; whose main motivation is to maximize profit and minimize loss.</p>	<ul style="list-style-type: none"> • Deposit cost is rolled to the customer. • Deposit will be relatively small. 	<p>Medium</p>
<p>Pharmaceutical companies' objection to put the quality sticker: Pharmaceutical companies may see the project as a threat to their sales, especially to international aid organizations. Therefore, they may refuse to put the quality sticker on packages.</p>	<ul style="list-style-type: none"> • ReMedic utilizes government regulation to turn the quality sticker into a requirement from the pharma companies. We will use both the environmental and public health angles to promote this regulation. • Marketing the quality sticker as a sales engine by using it as an indicator for medications that need to be replaced. • Provide a positive PR platform for participating companies that will use the quality sticker, as socially involved and environmental. 	<p>Medium</p>
<p>Acceptor trust: it is necessary that the acceptor will learn how to identify ReMedic products from falsified drugs.</p>	<ul style="list-style-type: none"> • Make use of clear external symbols to allow identification of products of ReMedic-quality sticker <p>Advertisement in local clinics, schools and community center via aid organizations</p>	<p>Low</p>

4 CONCLUSIONS

In conclusion, ReMedic is a win-win-win solution that benefits everyone, promotes public health and environmental protection, advancing education and helps return the balance to the medicine equation between the first and the third world.

ReMedic tackles these two global health issues using an integrative approach- solving two problems at once. With the right policy in place, ReMedic model is undoubtedly achievable.

With ReMedic, we will turn excess into access.

5 ADVISORS AND CONSULTANTS

Name	Profession/Field of expertise	Fields of consulting
Mr. Yaakov Kedmi.	<ul style="list-style-type: none"> • V.P marketing, “Willi-Food,” food import company. • Former V.P and senior manager in different organizations (Orange mobile, Eden, Maariv publishing and more). 	Government regulation, Logistics, distribution systems, marketing and advertisement, business strategy, consumer behavior.
Sefi Ben-Hemo, M.Sc.	Pharmacist, Pharmacy Manager.	Pharmaceutical regulations, consumer habits.
Mr. Chen Goldstein	Communication strategist for biotech companies.	Communication strategy, consumer behavior.
Dr. Chamutal Gur	Attending physician, specialist in internal medicine.	Pharmaceutical regulations at hospitals.