AMERICAN UNIVERSITY OF BEIRUT

PHARMACEUTICAL WASTE MANAGEMENT AT THE RESIDENTIAL LEVEL: A CASE STUDY OF ADMINISTRATIVE BEIRUT AREA

by
GHIDA NASSIB CHAMI

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Approved by:

Dr. May Massoud, Associate Professor
Department of Environmental Health — Advisor

Dr. Ibrahim Alameddine, Assistant Professor
Department of Civil and Environmental Engineering — Member

Dr. Mahmoud Al Hindi, Assistant Professor
Chemical Engineering Program — Member

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- John F. Kennedy

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AN ABSTRACT OF THE PROJECT OF

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Global concerns over the improper management of pharmaceutical wastes generated at the residential level have amplified during the past years, bringing about an international awakening on their potential harmful effects on the receiving environment and human health. A multitude of published literature has presented evidence of detectable concentrations of pharmaceutical compounds in treated wastewater and in water resources. Nationally, very scant data, if any, is available on the presence of pharmaceutical chemicals and their concentrations in raw and treated effluent, or surface and groundwater resources from domestic sources.

This research project focuses on the management of human-use pharmaceutical wastes generated at the residential level within the Administrative Beirut Area. It is a first attempt at exploring the most commonly used types and quantities of medications, consumers' behaviors, attitudes and perceptions regarding the management of pharmaceutical waste, and finding factors influencing individuals' behaviors and preferences for future collection programs. The significance of this project resides in providing baseline quantitative information from which further research studies can continue and build on.

Results revealed that the majority of respondents were found to dispose of their unwanted medications, mainly through the domestic solid waste stream. Household yearly expenditure on medications and the respondents' belief in the need for a pharmaceutical waste collection system were found to increase on average the odds of a respondent's willingness to participate in a future collection program. The odds of those who stated a willingness to participate and those who thought there is a need for legislation to regulate household pharmaceutical waste management, were also on average more likely to participate in a future collection program for a fixed fee as compared to those who thought otherwise. Younger respondents were found to be more likely to re-gift their unwanted medication to those in need versus returning medications through a future collection program managed by a public entity. Respondents who stated a willingness to participate in a collection program and/or those who believed in the need for awareness programs on the dangers of improper medical waste disposal tended to favor more collection programs managed by the government as compared to a program run by pharmacies or to the act of re-gifting medication to people in need. Ultimately, collaboration and coordination between concerned stakeholders is key towards developing a successful national collection plan.

Keywords: Pharmaceutical waste, management, collection programs, Administrative Beirut

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ABBREVIATIONS

ABA	Administrative Beirut Area
AIC	Akaike Information Criterion
API	Active Pharmaceutical Ingredient
ATC	Anatomical Therapeutic Chemical
CAS	Central Administration of Statistics (Lebanon)
CEC	Contaminants of Emerging Concern
C.I.	Confidence Interval
DEA	Drug Enforcement Administration (US)
EEA	European Environment Agency
FDA	Food and Drug Administration (US)
GIS	Geographic Information System
IRB	Institutional Review Board (AUB)
LBP	Lebanese Pound
MEC	Measured Environmental Concentration
MoE	Ministry of Environment (Lebanon)
MoPH	Ministry of Public Health (Lebanon)
OR	Odds Ratio
OTC	Over-the-counter
PEC	Predicted Environmental Concentration
POM	Prescription-only Medication
PP	Pharmaceutical Product
PPCP	Pharmaceutical and Personal Care Products
RCRA	Resource Conservation and Recovery Act
RUM	Return Unwanted Medicines Project (Australia)
S.E.	Standard Error
SPSS®	Statistical Package for Social Sciences
USD	United States Dollar
UNDP	United Nations Development Program
USEPA	United States Environmental Protection Agency
WHO	World Health Organization

To
My parents, Nassib and Baria
My sisters, Ghinwa and Rawia
My brother, Wael
Everyone who had faith in me,
Thank you.

CHAPTER I
INTRODUCTION

A. Overview

A pharmaceutical product, as defined by the Food and Drug Administration (FDA), is any therapeutic product derived from organic or inorganic chemicals and used to treat a wide range of medical conditions (Food and Drug Administration, 2012). Pharmaceuticals are categorized into classes depending on their intended purpose (human and veterinary), medical condition (chronic diseases, infections, cancer, allergies, contraceptive uses, etc.), dispensing practice (over-the-counter or prescribed), and their method or route of administration (oral, intravenous, topical) (Becker et al., 2010).

Concerns over the improper disposal of pharmaceutical wastes generated at the residential level have amplified over the past years bringing about an international awakening on their potential harmful effects on the receiving environment and on human health in the long run. Concentrations of pharmaceuticals and pharmaceutical metabolites have been detected in wastewater treatment effluent, groundwater, seawater, surface water resources and in drinking water (De Roode, 2010) bringing about the need to further investigate, assess and take action to prevent and remediate the incurred environmental harms from their presence. Alterations in aquatic life have been investigated as a "prognostic indicator" to the presence of pharmaceuticals in water resources (Becker et al., 2010).

Pharmaceuticals are introduced into the environment through different pathways. Disposal of pharmaceuticals at the household level in the sewage system is one of the main routes where these products are introduced into the natural water

(Bound and Voulvoulis, 2005). Discarding of pharmaceuticals in the municipal solid waste stream, which is deemed to be landfilled as part of national or local solid waste management schemes, is also common and introduces these products and their metabolites into the environment through the generated leachate (Bound and Voulvoulis, 2005). On the other hand, pharmaceuticals also enter the environment through human (and animal) excretions in the form of pharmaceutical metabolites or non-metabolized fractions of pharmaceutical products.

Alternative methods for the management of unwanted medications generated from the residential level include returning of unwanted or expired pharmaceuticals to pharmacies licensed for collection as part of the existing pharmaceutical collection systems. These practices include "take back" and "mail-back" systems and programs that collect unwanted medications generated from the residential level. Several countries including the United States, Canada, the majority of the European Union member states, and Australia have adopted and implemented such programs as an effective and environmentally sound scheme for the management of unwanted medications.

In Lebanon, there is currently no existing national or local-scale legislation for the regulation of pharmaceutical waste management at the residential level. Law N^{o} 12 (dated 1994) titled "Practice of the Pharmaceutical Profession," defines a pharmaceutical product as "any simple or compound substance with therapeutic, preventive, or physiological properties used in human or veterinary medicine and surgery." The Lebanese Reference for Health Professionals MEDICA is the national classification system that categorizes pharmaceutical products intended for human use into 29 classes (Refer to Annex 1), which are further branches into 129 sub-categories.

Presidential Decree N^{o} 13389 (dated 2004) addresses health care waste types and their management generated solely from health care facilities (Refer to Annex 2). Pharmaceutical wastes are addressed as part of the medical waste generated at the level of healthcare facilities; but the Decree fails to account for the waste stream generated at the household level (MoE, 2010). Moreover, MoPH Decision N^{o} 445/1 (dated March 10th, 2012) addresses expired pharmaceutical products by identifying responsible entities and management practices; however, no mentioning is found in its text on expired pharmaceuticals from households (Refer to Annex 3). Unofficial discussions have entertained the idea of incinerating these medical wastes in cement kilns; however no serious step has been taken in this regard till this day.

Additionally, the absence of any legalized and ordered return or "take back" system for the collection of household unwanted pharmaceuticals is expected to contribute to the environmental burden of water resources contaminated from the haphazard and uncontrolled disposal of chemicals. More importantly, uncontrolled or monitored pharmaceutical disposal is expected to promote illegal and uncontrolled distribution and re-distribution of returned pharmaceuticals. This brings about critical public health and safety concerns around those who are receiving these returned and unwanted pharmaceuticals due to the absence of any monitoring or surveillance framework.

B. Project Objectives

This research project focuses on the management of human-use pharmaceutical wastes generated at the residential level within the Administrative Beirut Area. The specific objectives of the project are to:

1. Examine the common methods and attitudes towards the management of pharmaceutical wastes at the residential level.
2. Investigate the most widely used types and quantities of pharmaceuticals at the residential level in Administrative Beirut Area.
3. Examine residents' willingness-to-participate in any future collection or "take-back" programs for household pharmaceutical waste.
4. Identify steps needed to develop a nationally-applicable collection or "take-back" program of pharmaceutical waste generated at the residential level.

C. Study Significance

The lack of a clear and safe pharmaceutical waste management framework in Lebanon for the collection or take-back of unwanted medicinal products is expected to pose potential environmental and public health concerns in the coming few years, particularly given the absence of efficient wastewater and municipal solid waste management national or local schemes. Environmental assessment studies have managed to address the issue of municipal solid waste in general without any focus on the waste fraction of disposed pharmaceuticals. Additionally, national legislation has tackled the classification and management of medical wastes, including pharmaceuticals, from healthcare facilities while overlooking those generated from residences.

Given the aforementioned, this research project focuses on the management of human-use pharmaceutical wastes generated at the residential level within the Administrative Beirut Area. It is a first attempt at exploring: most commonly used types and quantities of medications; consumers' behaviors, attitudes and perceptions

regarding the management of pharmaceutical waste; and finding associations between specific factors that are expected to impact individuals' behaviors and preferences for future collection programs. The significance of this project resides in providing baseline quantitative information from which further research studies can continue and build on. It has tackled an issue that has been foreseen as a potentially significant contributor to environmental degradation, given the current predominant practices of unsanitary solid waste dumping and uncontrolled sewage discharge. The significance of the research resides in the identification of gaps in national environmental and public health legislations by highlighting areas of importance that should be tackled in any forthcoming policy.

CHAPTER II
LITERATURE REVIEW

A. Pharmaceuticals: Definition and Classification

1. Definition of pharmaceuticals

A pharmaceutical product (PP), as defined by the Food and Drug Administration (FDA), is any therapeutic product derived from organic or inorganic chemicals and used to treat a wide range of medical conditions (FDA, 2012). The literature provides several different terms for pharmaceutical products that include medical drugs, medicinal products, or therapeutic drugs, all which refer to products intended for human use. A pharmaceutical product is composed of one or more pharmaceutically active ingredient, which is considered the main ingredient or substance that provides the pharmaceutical therapeutic action. The medicinal product will also contain other inert ingredients involved in formulating the pharmaceutical product and improving its physical qualities (e.g. fillers, binders) and these are known as excipients or inactive ingredients (Guido and McEmber, 2007).

The use or application of different pharmaceutical products intended for human use differ among settings: pharmaceuticals used at hospitals, dispensaries and private clinics, nursing homes and individual households. The US Environmental Protection Agency (USEPA) groups the pharmaceuticals that are used at the residential level with other consumer products under the term Pharmaceuticals and Personal Care Products (PPCPs) (USEPA, 2014a). Personal care products include products like dietary supplements or nutra-ceuticals, cosmetics, fragrances, and household cleaning products (for example, detergents) (The Groundwater Foundation, n.d.).

2. Classification of Pharmaceutical Products (intended for human use)

Pharmaceuticals can be classified according to their: i) intended purpose, whether they are used to treat humans or animals (veterinarian drugs); ii) disease or medical condition ranging from acute conditions to chronic diseases, terminal illness (cancer), or other conditions (example: contraceptive uses); iii) dispensing practice, where medications are dispensed to patients through physician prescriptions (Prescription Only Medication – POM) or provided as over-the-counter (OTC); and iv) method or route of administration (oral, intravenous, topical) (Becker et al., 2010).

The World Health Organization (WHO) Regional Office for Europe recommended since the year 1981, the Anatomical Therapeutic Chemical (ATC) classification system of pharmaceutical products for international drug utilization studies (WHO Collaborating Centre for Drug Statistics Methodology, 2013). The latter was adopted and implemented since year 1996. The ATC classification system of pharmaceutical products was originally established and maintained by the European Pharmaceutical Market Research Association, known as EphMRA, which is responsible for constantly providing updated guidelines on the ATC classification system, and managing new entries, and improvements, in consultation with worldwide pharmaceutical companies (EphMRA, 2014). Table 1 presents the ATC classification of medicinal products and pharmaceuticals intended for human use.

Table 1: ATC Classification of medicinal products, pharmaceuticals intended for human use

Letter Code	Group
A	Alimentary tract and metabolism
B	Blood and blood forming organs
C	Cardiovascular system
D	Dermatologicals

Letter Code	Group
G	Genito-urinary system and sex hormones
H	Systemic hormonal preparations, exc. sex hormones and insulins
J	Anti-infectives for systemic use
L	Antineoplastic and immune-modulating agents
M	Musculoskeletal system
N	Nervous system
P	Antiparasitic products, insecticides and repellents
R	Respiratory system
S	Sensory organs
V	Various

Adopted from*: *Guidelines for ATC classification and DDD assignment, WHO 2013

B. Pharmaceuticals in the Environment

1. Sources and Pathways of Pharmaceutical Products into the environment

Worldwide, pharmaceutical products are manufactured and consumed in gigantic volumes increasingly every year (Bound and Voulvoulis, 2005). "Contaminants of Emerging Concern" (CEC), as defined by the United States Environmental Protection Agency (USEPA) - and in several studies in the literature as emerging contaminants or novel contaminants - are chemicals that are currently being discovered namely in water resources (USEPA, 2014b). These chemicals have either not been previously detected in tested environmental samples, or their Measured Environmental Concentrations – MECs have been shown to exceed specific Predicted Environmental Concentrations (PECs), set for them before testing (USEPA, 2014b). Pharmaceuticals, including personal care products, are considered one of the priority CECs that are currently being investigated by the USEPA. This is mainly due to these compounds physico-chemical and physiological properties and their prevalent distribution in the

environment (Carballa, Omil, and Lema, 2008) as well as to the potential associated risk to public and ecological health (USEPA, 2014b).

Pharmaceuticals and their associated compounds (pharmaceutical by-products or metabolites) enter the environment from the consumption and excretion of these products and from the improper and uncontrolled disposal of unwanted or expired medications via the sewerage network (sinks, toilets) or municipal solid waste stream (household garbage).

Depending on the type of pharmaceutical, dosage, and human physiology, pharmaceutical products either may be fully or partially converted, or enter the environment unchanged. A significant fraction of an administered dose of a pharmaceutical product can be excreted unchanged and in some cases, pharmaceutical metabolites are altered back into the active pharmaceutical compound through the action of certain bacteria (Jones, Voulvoulis, and Lester, 2005a).

As for the disposal of unwanted medications, the latter depends on several behavioral and attitudinal factors of consumers in addition to the inaccuracy or efficiency in physicians' prescriptions to medication, which lead to leftovers of unwanted or unfinished medications (Bound and Voulvoulis, 2005). According to the literature, these pathways are considered as direct pathways of pharmaceuticals into the environment. Disposal of pharmaceuticals at the household level in the sewage system (mostly in urban areas) or within a septic tank or cesspool (rural areas) are one of the main routes where these products are introduced into the natural water (Bound and Voulvoulis, 2005). Discarding of pharmaceuticals in the municipal solid waste stream, deemed to be landfilled as part of national or local solid waste management schemes, is

also common and introduces these products and their metabolites into the environment through the generated leachate (Bound and Voulvoulis, 2005).

The figure below (Figure 1) presents a schematic illustration of the most common identified sources/origins of pharmaceutical products (consumption level) and their by-products pathways into the environment (Mompelat et al., 2009; Bound and Voulvoulis, 2005).

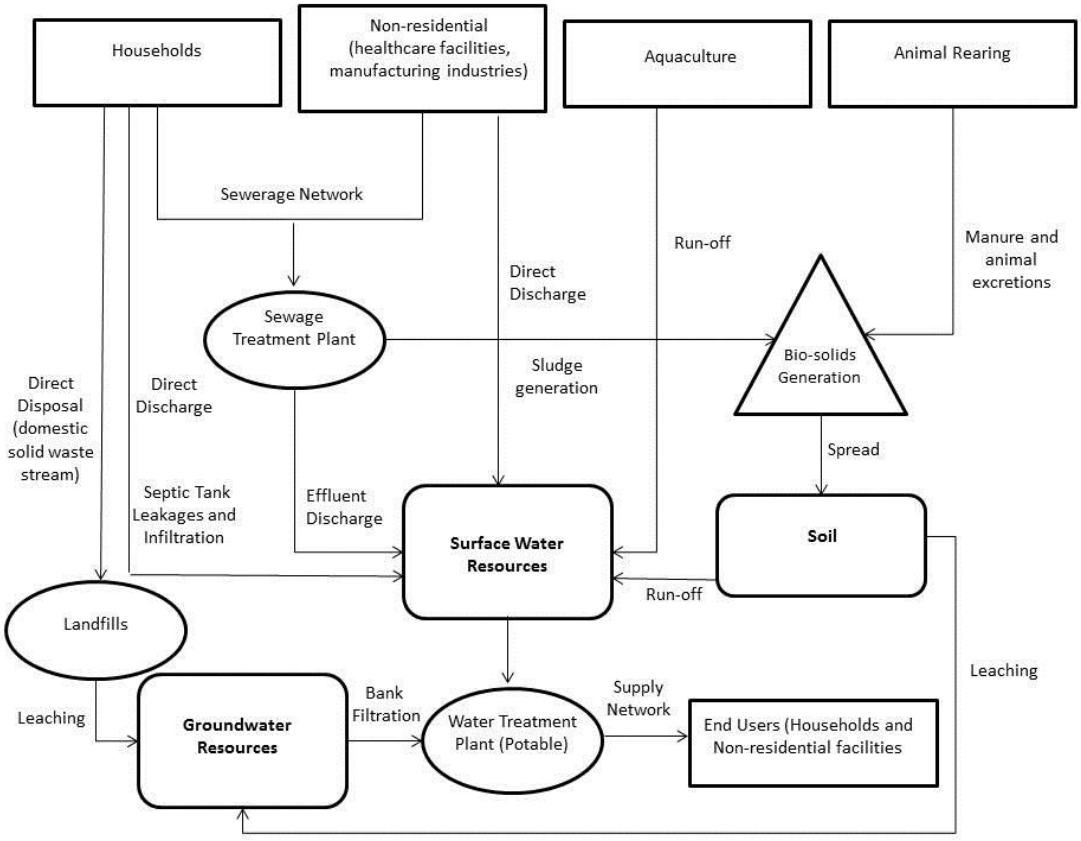

Figure 1: Pharmaceuticals Products (PPs): Sources and Environmental Pathways
(Adopted from: Mompelat et al., 2009; Bound and Voulvoulis, 2005)

2. Occurrence of pharmaceuticals and their associated compounds

After displaying some of the main and significant pathways of how pharmaceuticals and pharmaceutical metabolites/by-products are introduced into the environment, this section presents the fate or occurrence of these chemicals in different environmental compartments, based on main findings in the literature.

- Sewage Treatment Plants and Water Resources

Wastewater treatment technologies showed ineffective results in the removal of all pharmaceutical active compounds (Tong, Barrie, and Braund, 2011). In some cases, the presence of these pharmaceuticals interferes with the biological and chemical treatment processes at these treatment plants, rendering their effectiveness and efficiency (Tong, Barrie, and Braund, 2011). On the other hand, there is considerable potential for the degradation of pharmaceuticals' parent compounds and their metabolites through the action of certain microorganisms in the sewage treatment plant, mainly during the secondary phase of treatment (Jones, Voulvoulis, and Lester, 2005b). Additionally, some pharmaceuticals undergo bio-degradation (degradation by microorganisms) while being collected and transported, before reaching the wastewater treatment plant.

As for countries or areas (commonly rural areas) that lack existing or operational sewage treatment plants, chemicals are expected to be spread into the receiving environment at relatively higher concentrations than effluent that has undergone treatment (Santos et al., 2010).

Treated effluent from sewage treatment plants end up in receiving surface water resources as rivers, estuaries, lakes, etc., and eventually in groundwater resources

(wells and springs), that are used as sources for drinking, human consumption, industrial processes, and irrigation (Santos et al., 2010). The criticality of pharmaceuticals and pharmaceutical by-products in water resources resides not merely in the micro-concentrations at which they are detected, but in their affinity to persist and bio-accumulate in water resources, both ground and surface (Mompelat et al., 2009).

- Soils amended with sludge containing pharmaceuticals

The concentration of pharmaceutical residues in sludge is dependent on biochemical properties of the product, mainly the octanol–water coefficient $K_{OW,}$ which is an indicator of the possibility that a compound is segregated into the solid phase and highly depends on the water solubility of a compound (Bound and Voulvoulis, 2005). Soils that have been conditioned with sludge containing pharmaceutical compounds are expected to give rise to possible soil, surface and groundwater contamination particularly through infiltration and runoff during rainy seasons. Soils amended with sludge containing pharmaceuticals might also affect the livestock reared on contaminated land and agricultural crops (Jones, Voulvoulis, and Lester, 2005b).

- Landfilling of municipal solid waste

Upon the review of relevant literature, few studies have investigated the pharmaceutical waste fraction from the household solid waste stream as compared to the examination of wastewater effluent in terms of presence and concentration of pharmaceuticals and pharmaceutical metabolites in water resources (Musson and Townsend, 2009). When unwanted or expired pharmaceutical products are disposed of from residences - and other healthcare institutions – in the municipal solid waste stream,

these chemicals are expected to end up in landfill leachate in instances where this waste is landfilled (Tong, Barrie, and Braund, 2011).

The direct disposal of pharmaceuticals into the waste stream poses a risk of presenting these chemicals in their unchanged state at concentrations that are expected to be relatively higher than in the wastewater stream undergoing treatment and partial removal (Bound and Voulvoulis, 2005). Pharmaceutical products once present in the solid waste stream are likely to undergo physical and chemical changes like degradation and adsorption (Musson and Townsend, 2009). In a set of conducted studies, landfills have been identified as potential sources of active pharmaceutical ingredients to the receiving environment, however the quantification of the concentration of these ingredients within landfill inputs and their effects on the resulting leachate has not been studied (Musson and Townsend, 2009). This potential source of environmental contamination is expected to be exacerbated in instances where there are no environmentally-engineered landfills with liner and leachate collection systems, open dumping would potentially cause uncontrolled infiltration of leachate into underlying groundwater resources (NRDC, 2009).

C. Environmental and Public Health Impacts

The incidence of pharmaceutical compounds and their associated chemicals in the environment is considered a growing research topic. This has been supported by the continuous advancement in the analytical techniques providing very low detection limits ranging between fractions of nano-grams to micro-grams per one (1) liter of environmental sample, needed for the testing of these “micro-pollutants” in exposed environmental compartments (Kümmerer, 2009).

Worldwide, an estimation of around 3000 different substances are utilized as pharmaceutical ingredients. Nevertheless, a minute fraction of these substances (approximately 5%) have been targeted and examined in environmental studies (López-Serna, et al., 2011). In general, pharmaceutical products utilized for the treatment of chronic diseases like diabetes, cardio-vascular disorders, epilepsy, are expected to be found in concentrations higher than medications used for acute medical conditions, mainly due to the prolonged duration of the consumption of these substances. On the other hand, over-the-counter (OTC) medications – mainly painkillers and anti-histamines – are consumed in high quantities mainly due to their dispensing availability to everyone without the need for a physician's prescription (Bound and Voulvoulis, 2005).

Common prescription and over-the-counter pharmaceutical products consumed by humans are detected in surface and groundwater resources samples at concentrations that are generally considered very minute to induce any risk to humans from the acute exposure to them. However, little is known about the other non-target organisms found in the environment, mainly the aquatic ecosystems in exposed water resources, and the potential effects from the exposure to individual pharmaceutical compounds or a mixture of pharmaceuticals (sometimes termed as "pharmaceutical cocktails") (López-Serna, et al., 2011; Tong, Peake, and Braund, 2011; Ziylan and Ince, 2011).

Potential for resource contamination from the presence of pharmaceuticals and pharmaceutical metabolites and by-products is higher in countries where treated effluent reclamation and reuse is widely practiced. The demand on effluent reclamation and reuse is expected to increase with the increase in demand and pressure on water resources, particularly in cases where alternative methods are sought (Jones, Lester and

Voulvoulis, 2005b). In the United States, for instance, some states reclaim approximately 80% of municipal wastewater that is reused in other applications (Yu, Bouwer, and Coelhan, 2006). As such, increasing the use of reclaimed water is likely to result in increasing the potential for contamination from micro-pollutants like pharmaceuticals. Similar practices of indirect water recycling bring about public health concerns, mainly to downstream receptors, where treated wastewater is discharged into waterways like rivers and streams, which are used as sources of potable water supplies (Jones, Lester, and Voulvoulis, 2005a; b). On the other hand, in cases where developing countries lack the capacity for wastewater treatment or suffer from inefficient or ineffective treatment systems and withstand the shortage of clean and suitable water resources, raw wastewater is used a direct source of irrigation water and is directly discharged into nearby water ways. Having not undergone any form of treatment, the concentrations of pharmaceutical compounds and their metabolites/by-products are expected to be relatively higher compared to the discharge or use of treated effluent.

Several investigations have revealed that synergism among the different pharmaceuticals and pharmaceutical metabolites and by-products present in the environment induce a relatively higher toxic effect than the exposure to individual pharmaceutical products (products from same therapeutic class) (López-Serna, et al., 2011).

A diversity of environmental investigations carried out on the presence of endocrine-disrupting pharmaceutical compounds in the aquatic environment revealed that the most detrimental effects are limited to the feminization of fish that reside near the outlets of wastewater treatment plants (Bound and Voulvoulis, 2005). Such pharmaceuticals are found to act on non-target organisms, in this case fish populations,

by disrupting their endocrine systems even at very minute concentrations (1 nano-gram per 1 liter) (Bound, Kitsou, and Voulvoulis, 2006).

Another eco-toxicological impact from the presence of pharmaceuticals and pharmaceutical metabolites and by-products in water resources includes the potential for pathogenic bacterial resistance, through the creation of pathogenic resistant strains (Bound, Kitsou, and Voulvoulis, 2006) due to the presence of high concentrations of antibiotics in water resources. Not only does the presence of antibiotics promote bacterial resistance, but it also interferes with wastewater treatment that relies on biological processes by inhibiting the action of microbial colonies (Jones, Voulvoulis, and Lester, 2003a; b).

Humans and other organisms are expected to be directly exposed to micro-pollutants, such as pharmaceutical compounds and by-products, in water namely through potable water (ingestion) that has been contaminated with these compounds. Nevertheless, the present literature lacks any proven risks on human health from the exposure to pharmaceutical compounds present in the environment, mainly potable water supplies (Jones, Lester, and Voulvoulis, 2005b). Humans are also indirectly exposed to pharmaceutical compounds in water compartments through skin contact in bathing and swimming waters that are supplied from reused treated effluent sources, or from the ingestion of crops that have been cultivated in sludge-conditioned soils or irrigation water supplied from treated effluent sources (Jones, Lester, and Voulvoulis, 2005a). As for the prevailing public health concerns associated with the presence of pharmaceutical compounds in water resources, namely in drinking water resources, the most suspected consequences of humans' exposure are the development of antibiotic

resistances and the lowering of sperm count in males (Jones, Lester, and Voulvoulis, 2005a).

Over the past decades, concerns revolved around accidental poisoning of children from improper storage of pharmaceuticals. As a result, regulations have focused on the safe use of pharmaceuticals rather than on the methods of disposal and management (Musson et al., 2007). Consequently, pharmaceuticals are commonly flushed down the sewage system or discarded in the garbage. According to Hinchey et al., 2009, pharmaceutical products are considered the most prevalent poisoning exposure category in the United States, where improper storage and disposal (in the solid waste stream) constitute a critical source for accidental poisoning. According to statistics, approximately thirty per cent of children under the age of five die due to unintentional poisoning yearly (Hinchey et al., 2009; Glassmeyer et al., 2005). Moreover, the stockpiling of unwanted and expired pharmaceutical products or their improper storage might lead to accidental ingestion and poisoning in adults, particularly the elderly who are considered the most likely highest consumers of prescription medications (Hinchey et al., 2009; Glassmeyer et al., 2005). Moreover, hoarding of unwanted or expired medication or giving them out to friends or charity, may increase the risk of unintentional poisoning from inadequate medications, particularly prescription ones (Castensson and Ekedahl, 2010). Drug diversion and misuse are also likely to take place due to the unsecured storage and disposal of prescription medications, critically narcotics, which might give rise to health and social adverse outcomes (Hinchey et al., 2009).

D. Household Pharmaceutical Waste Management

Internationally, estimations on the yearly average per capita consumption of human-use pharmaceutical products are approximately 15 grams (in weight). This figure, however, increases significantly in the majority of developed countries to reach approximately 50 to 150 grams of pharmaceutical products per capita per year (López-Serna, et al., 2011).The following sections present a succinct overview of some of the internationally reclaimed countries and unions that have addressed the issue of pharmaceuticals, particularly pharmaceutical wastes from non-healthcare facilities (residential level) and some case studies conducted in developing countries (regional) addressing the issue of household pharmaceutical waste management.

1. Developed countries

- *United States*

In the US, the estimated human use of pharmaceuticals has inclined (doubled) from 2 billion to around 4 billion annual prescriptions between years 1999 and 2009 (Tong, Peake, and Braund, 2011). It is expected that the methods of disposal of unwanted or expired pharmaceutical products are mainly influenced by the regulations set by the U.S. Drug Enforcement Administration (DEA) that has stringent control over the transfer of medications and other controlled substances (narcotics and tranquilizers) (Bound and Voulvoulis, 2005).With the absence of a nationwide pharmaceutical waste take-back scheme in the U.S., 35% of unused pharmaceutical products are being directly discharged into the sewerage network (Vollmer, 2010).

More than 70 different pharmaceutical compounds have been identified in groundwater and surface water resources in the United States, at concentrations ranging between 0.01 and 1 micro grams per liter (µg/l) (Yu, Bouwer, and Coelhan, 2006).

In the United States, unwanted pharmaceutical products resulting from households are generally considered as municipal solid waste and are not regulated as hazardous. Knowing that a specific line of pharmaceutical products falls under the Resource Conservation and Recovery Act (RCRA) for hazardous wastes, however, pharmaceutical waste generated at the residential level are exempted from the RCRA classification (RCRA exemption: "Household Hazardous Waste" at 40 CFR 261.4(b)(l)). Despite this fact, the USEPA has constantly advised that collection schemes for household hazardous wastes (including pharmaceutical wastes) should manage household pharmaceutical waste as hazardous waste, even if not mandated by U.S. legislature. The USEPA has continuously advised the incineration of household pharmaceutical wastes as a method for disposal, as it is considered an option that is relatively safer in terms of environmental concerns (by reducing the presence of these contaminants in water resources) and diversion concerns (use of pharmaceuticals in an illegal way) (USEPA, 2014b).

Additionally, the U.S. White House Office of National Drug Control Policy issued in year 2007, a guidance on the proper disposal of unwanted prescription medications which guides consumers to dispose of their unwanted products along with their domestic solid waste stream or maximize their use of existing pharmaceutical take-back programs instead of disposing unwanted products into the sewerage network (Musson and Townsend, 2009). The National Institutes of Health (NIH) and the Centers for Disease Control (CDC) in the United States have encouraged the development of

new methods for de-activating, neutralizing and de-forming unwanted and expired pharmaceutical products by consumers to assist disposal methods at households (University of Wisconsin Cooperative, 2012). Such an approach is not likely to divert or minimize the potential impacts of pharmaceuticals on the receiving environment, however, is expected to safeguard household residents from accidental or even intentional misuse of leftover medication.

The United States Environmental Protection Agency (USEPA) has taken into account the issue of unwanted and expired pharmaceuticals take-back programs. It defines the latter as "collection methods aimed at reducing the quantity of unused pharmaceuticals entering the environment and reducing the amount of drugs available for diversion, theft, or accidental poisoning" (Thach, Brown, and Pope, 2013).

Non-residential sources of pharmaceutical waste, that may include hospitals, clinics, nursing homes, and pharmacies, are generally managed by entities known as "reverse distributors." Reverse distributers are responsible for sorting returned unwanted pharmaceutical products and secure the adequate disposal methods. In some settings, reverse distributers are responsible for returning unwanted pharmaceuticals to the manufacturer. It is to be noted that such contractors do not accept unwanted pharmaceuticals dispensed to patients or generated from households mainly because the quality of such products might be at question, depending on the proper dealing and storage of individuals, and thus, will render the product as a non-profitable item that they will not be paid for (Musson et al., 2007).

Pharmaceutical take-back programs take the following three main forms:

- One-day events: that require extensive organization and coordination; permanent or continuous collection through drop-off points in authorized places like pharmacies or police stations;
- Deposit systems: where consumers deposit a certain amount of money when purchasing a medication to assure the return of unwanted or expired products for reimbursement; and
- Extended producer responsibility schemes where drug manufacturers organize and implement collection of unwanted and expired pharmaceuticals from participating pharmacies (Dobis, Cosler, and Polimeni, n.d.).

It is to be noted that the latter scheme (extended producer responsibility) has started to gain attention in the United States, as a preferred method of managing "post-consumer drug waste" (Daughton, 2013). However, this type of scheme has been confronted with the opposition of drug manufacturers, mainly due to the liability and high costs such a scheme entails. In 2012, the state of California (Alameda County) was the first to attempt legislating extended producer responsibility for the management of household pharmaceutical waste; however was soon opposed by the pharmaceutical industry stakeholders (University of Wisconsin Cooperative, 2012).

More than thirty permanent pharmaceutical take-back programs and one-day events have been established across the United States (Simons, 2010). According to studies conducted for assessing the efficacy of existing household pharmaceutical take-back programs and schemes, such programs have been confronted with many challenges. Some of the most common challenges include: regulatory and legal challenges, logistical and equipment costs, lack of sustainable resources (financial and

human), low public awareness and consumer resistance, and limited local state capacity for dedicating specialized disposal sites (Simons, 2010; University of Wisconsin Cooperative, 2012).

According to Simons, 2010, the most substantial challenge faced by pharmaceutical take-back programs are the existing laws and regulations that play a restrictive role on some cases (Simons, 2010). With reference to the Controlled Substances Act, the DEA, supported by the USEPA and the FDA regulations, only permits consumers to return controlled medicinal substances to a manufacturer in the event of a recall and not as part of a regular pharmaceutical take-back program (Simons, 2010). This is expected to significantly impair the collection of unwanted and expired controlled medications through mail-back collection events or other take-back schemes. In addition, Federal and State regulations mandate the presence of a local or state law-enforcement officer for the disposal of unwanted and expired controlled medications, impairment in terms of opportunity costs. Several take-back programs involving community pharmacies are incapable of accepting returned controlled substances for disposal due to the before mentioned restrictive DEA regulations (Thach, Brown, Pope, 2013).

Experience has proven that substantial costs need to be invested for establishing a national pharmaceutical collection and disposal program that is readily available to the public consumers (Tong, Barrie, and Braund, 2011). Some planned permanent disposal programs using secured drop-off containers are expected to have capital costs of more than $300,000 (Simons, 2010). The state of Maine in the US has been considered one of the proactive states in terms of establishing and implementing household pharmaceutical take-back programs. The Public Law of 2003, Chapter 679

conceived the Unused Pharmaceutical Disposal Program that comprises a mail-back collection scheme of pharmaceuticals from households. This program, however, still awaits funding resources and needs certain regulatory and statutory requirements (Musson et al., 2007)**.** This is also synonymous for the pharmaceutical waste collection programs in the state of Wisconsin, where these programs are considered unsustainable mainly due to the insufficient funding resources (University of Wisconsin Cooperative, 2012).

Pharmacies also play a limiting role in establishing, participating and sustaining pharmaceutical take-back programs, mainly due to overhead restricting regulations and laws that govern them. The main concerns expressed by pharmacies include: the public perception that pharmacies might reuse returned products, the possibility of disclosing patient confidential information in cases where patient information is written on returned containers, regulations related to the return of controlled medications (like those set by the DEA in the United States), and the possible legal restrictions related to accepting products that have been already dispensed by a different pharmacy (Musson et al., 2007).

- *Canada*

Similarly, a survey carried out in Canada in the year 2008 revealed that 39% of households dispose of unwanted pharmaceuticals through the municipal sewerage network or along with the municipal solid waste stream or even by burying them (Vollmer, 2010). This is reflected on the types and quantities of chemical contaminants entering the water resources of downstream areas. In the 1996 year, the Medications Return Programs were launched by the pharmaceutical industry in Canada and British

Columbia. The Medications Return Programs are considered a safe and practical method for households to dispose of their unwanted pharmaceuticals, diverting them from wastewater streams and landfills. Three classes of medications are enlisted under these Programs and include prescription medications, over the counter medications in oral dosage form and natural health products in oral dosage form (Health Products Stewardship Associated, 2014). In the year 1999, the Health Products Stewardship Associated was registered as a non-profit organization to meet the governmental and environmental concerns on the proper collection and disposal of unwanted and expired pharmaceutical products, and was managed by a board of pharmaceutical manufacturing industries that are held liable for setting up and managing the Medications Return Programs in Canada. (Health Products Stewardship Associated, 2014). As a result of implementation, more than 75% of pharmacies were part of the program accepted expired and unused pharmaceutical products from consumers, thus providing a safe and controlled collection mechanism of such type of waste (Gualtero, 2005).

- *European Union EU*

In general, aging countries, like many countries in Europe, are assumed to have higher concentrations of pharmaceuticals and their by-products, and pharmaceutical waste (unwanted or expired) in the environment compared to countries of young populations (some Middle Eastern countries) (Keil, 2010). It is to be noted that, there is no Europe-wide overview on the quantities or volumes of unused pharmaceuticals or available data on their return rates (Vollmer, 2010). Individual country basis studies have been conducted for estimating the quantities and volumes of pharmaceuticals consumed by the public. For example, the study carried out by Bound and Voulvoulis in

2010, estimates that approximately 100 tons of medications were prescribed in Germany in year 1995 (Bound and Voulvoulis, 2006)

In Europe, the rate of collection of unused/expired pharmaceutical products varies considerably and is influenced by several factors. These include:

- Quantities of dispensed pharmaceutical products,
- Changes in consumers' compliance with the uses of these products,
- Lack of knowledge or awareness regarding the existing take back or return schemes, and their knowledge of the potential environmental impacts the improper disposal of pharmaceuticals might pose (Vollmer, 2010).

According to the findings of a European-wide survey carried out by the European Environment Agency (EEA) in year 2008, most European countries have well-established existing pharmaceutical waste (unused or expired) return schemes that are carried out in cooperation with pharmacies (Vollmer, 2010). Results of the conducted Europe-wide survey revealed that ten European countries have set legal obligation for pharmacies to participate in a household pharmaceutical waste take-back scheme and they are: United Kingdom (UK), Norway, Lichtenstein, Iceland, Lithuania, Estonia, France, Croatia, Denmark and Belgium (Vollmer, 2010).

In Germany, for instance, approximately 1,400 tons out of 4,000 to 7,000 tons of unused pharmaceutical products are disposed of by Vfw-REMEDICA and MEDIrecycling pharmaceutical take-back systems each year. REMEDICA in Germany is a return and disposal system for disposed pharmaceutical products that have exceeded

their expiry dates. A network of approximately 4,000 pharmacies, are participants in this system (RECLAY Group, 2014).

CYCLAMED in France is another example of a take-back system that collects expired and unused pharmaceuticals, where joint efforts were invested between pharmacies, wholesale distributors and pharmaceutical companies to establish a system that has succeeded in diverting large quantities or unwanted and expired medications and transforming them into energy through incineration (Vollmer, 2010). In 2009, energy (in the form of heat and electricity) was recovered from approximately 14,000 tons of leftover medications using 52 incinerators in conformity with the applicable standards (CYCLAMED, 2014).

In the European Union (EU), guidelines for the risk assessment of new pharmaceuticals are being developed. Risk assessment for new pharmaceuticals employs equations that calculates the predicted environmental concentration (PEC) of a certain pharmaceutical active ingredient and compares it against available toxicological data that has been previously acquired through testing (Bound and Voulvoulis, 2006). It is to be noted, however, that both current and proposed guidelines on risk management disregard the pathways of disposal when calculating the Predicted Environmental Concentrations (PECs) of pharmaceutical compounds (Bound and Voulvoulis, 2005).

With reference to the available legislative texts governing the countries within the European Union (EU), pharmaceutical waste generated from households is not defined as hazardous, despite the considerably hazardous characteristics of a wide set of this type of waste on the receiving environment and human health (Vollmer, 2010). Nevertheless, many countries of the EU have individually dealt with pharmaceutical waste as hazardous waste that requires special collection and treatment. Some of the

terms used to define this type of waste include “harmful waste”, “problematic waste”, “special waste”, and “dangerous waste” (Vollmer, 2010). An example of such is the Austrian Land Styria (Steiemark) Government where it publishes its data on non-utilized pharmaceuticals (pharmaceutical wastes) as hazardous wastes (Vollmer, 2010).

- *Australia*

A very successful take back program of pharmaceutical waste from households is the Return Unwanted Medicines (RUM) Project that was established in Australia, where unwanted and expired medications are collected from homes by community pharmacies (approximately 300 tons per year) at no cost. Collected medications are then incinerated at high temperatures as per the USEPA approved method of disposal (RUM Project, 2011).

Operating costs are mostly provided by the Australian Department of Health and Aging in addition to the partial support from the pharmaceutical industry (CalRecycle, 2010). The RUM Project is managed by a national non-profit organization, the National Return and Disposal of Unwanted Medicines Limited that was established solely for the implementation of RUM (Return Unwanted Medicines Project 2011). The Project established protocols related to the management of this type of waste from households (Gualtero, 2005). Beneficiaries from this Project are not required to differentiate or segregate controlled medications from uncontrolled because pharmacies receive both kinds of prescription medications, in contrary to the existing take-back programs in the US, which are restricted by the DEA regulations (CalRecycle, 2010). This is expected to gain acceptance mainly due to the practicality consumers would sense when returning their unwanted pharmaceuticals. The RUM

Project collection costs per capita are comparable to other similar international pharmaceutical take-back programs; however, the Project falls behind these international programs in terms of its per capita collection rate (CalRecycle, 2010). Approximately 30 tons were collected at pharmacies, per month, by the RUM Project in Australia between the period of July year 2003 and June 2004 (Musson et al., 2007).

2. Developing Regional countries

In general, limited resources are made available in developing countries for prioritizing and managing environmental health issues (Orloff and Falk, 2003). Table 2 below succinctly presents examples of studies conducted in some regional countries related to pharmaceutical waste management at the residential level.

Table 2: Summary table on studies conducted in some regional countries related to pharmaceutical waste management at the residential level

Country (Case Study)	Study Objectives	Methods	Main Findings	Author(s), Year
Iran (Isfahan city)	• Type identification and quantity estimations of pharmaceutical products stored in urban households in Iran. • Extent of medication wastage.	• January 2002 – June 2002 • 512 randomly selected households • Survey questionnaire as study instrument	Variables found to have statistically significant relationship with quantities of stored medications within households: • Literacy among fathers; • Presence of one or more chronic medical condition; • Insurance coverage; • Household economic status; and • Household siblings' medically-related jobs. Main factors shown to contribute to unjustifiable increased consumption in pharmaceutical products in Iran include: • Low prices of generic medications; and • An unfastened health care system. Annual mean wastage of pharmaceutical products from households was about 48,000 medicinal products.	Zargarzadeh, Tavakoli, and Hassanzadeh, 2005
Jordan (North, Irbid Governorate)	• Estimation of medication wastage and its economic cost (impact on national economy). • Assessment of the lack of public awareness regarding medication use and storage within households.	• April year 2007 to August 2007 • 435 systematically randomly selected households • Survey questionnaire as study instrument	Findings of the study showed that the tested variables that have a statistically significant relationship with the quantities of medications stored within households are: • Father's level of education; • Number of chronic medical conditions within the household; • Household area; and • Families who have siblings with medically-related jobs.	Al-Azzam, et al., 2012

Country (Case Study)	Study Objectives	Methods	Main Findings	Author(s), Year
			2835 medicinal products were reported during survey: 65.3% were in use, approximately 94% of these products were not expired; about 95% of pharmaceuticals were stored in the refrigerator.	
Saudi Arabia (22 randomly-selected cities) and Gulf countries (4 capital cities)	• Identification of the extent of medication use and wastage among families in the Arabian Gulf countries, with an emphasis on Saudi Arabia	• Year 2001 • 1641 households (1554 in Saudi Arabia and 87 in other Gulf countries) • Survey questionnaire as study instrument	Main contributing factors shown to contributed in an increase in pharmaceutical waste generation at the residential level included self-medication, which is greatly impacted by the household's economic status and patient noncompliance to prescriptions and most importantly, the provision of medications free of charge to people who seek them from governmental health facilities.	Abou-Auda, 2002
Kuwait (public general hospitals)	• Examine the practices and assess the attitude of Kuwaiti patients pertaining to the proper disposal of unwanted pharmaceutical products in Kuwait.	• April – July 2004 • 300 patients/family members • Pre-tested self-administered questionnaire as study instrument	The study came up with results on storage and disposal methods of pharmaceutical waste at the residential level: • Most common method for disposal of unwanted pharmaceutical products was through the garbage (77%) or down the sink (11%). • Most (approximately 50%) preferred disposal method for unwanted medications was the option of having a collection return program to pharmacies.	Abahussain, Ball, and Matowe, 2006

Country (Case Study)	Study Objectives	Methods	Main Findings	Author(s), Year
Sudan	• Examine the rate of household pharmaceutical products and identify community habits in using medications in different parts of Sudan.	• January – February 1998 • 469 household units • Pre-tested self-administered questionnaire as study instrument	The study revealed that the quantity of stored medications in households is most influenced by the educational level. Interviewees with high education levels (university) tended to store medications relatively more than interviewees of lower education levels (secondary and primary). Education was also associated with the level of patient compliance to the medication consumption that is reflected eventually on the quantities of pharmaceutical waste generated.	Yousif, 2002
Sultanate of Oman (public primary health care facilities across 10 different regions)	• Investigate common problems associated with the use of pharmaceutical products for enhancing affordability, and accessibility to appropriate use of medicines by health care providers and the public consumers in Oman.	• Years 2006 - 2007 • 6675 Omani patients interviewed at exits from 75 public primary health care facilities • Cross-sectional pilot-tested questionnaire as study instrument	The study showed that more than 55% of respondents reported storing their medication in the refrigerator while 17% use the stored medications without looking at their expiration dates.41% maintained leftover medication for future use while 12% reported that they return the unused medications back to a pharmacy or health care facility.	Sultanate of Oman Ministry of Health, 2009

CHAPTER III
METHODOLOGY

A. Review of Relevant Literature

A review of published literature was prepared for the comprehensive understanding of the most common types of pharmaceuticals used at the residential level and pharmaceutical waste management (attitudes and behavior of consumption, collection, and disposal) at the international, regional, and national (if available) scales. A review of the relevant international and national legislative and administrative frameworks was also carried out. Residential pharmaceutical waste collection or take back schemes or programs were explored at the international and regional levels.

B. Study Area: Administrative Beirut Area

In principle, the study area was identified based on its representativeness, accessibility and convenience to the research project in question. The Administrative Beirut Area (ABA) constitutes the study area of the pilot project. The ABA is divided into thirteen (13) zones which are: Beirut Central District, Mina El Hosn, Marfa', Ain El Mraisse, Ras Beirut, Msaitbe, Zqaq El Blat, Mazraa, Bachoura, Saifi, Achrafieh, Rmeil, and Moudawar. Three (3) of these 13 zones are nonresidential; Beirut Central District, Mina El Hosn, and Marfa'. Given that the research study targets the management of pharmaceutical waste at a residential level, these 3 zones were excluded from the study area. Figure 2 below presents a map of the ABA with the cadastral limits of each of its zones along with their respective population figures (as per the CAS 2007

Report). Zones excluded from the study (Port, Minet el Hosen and Beirut Central District) are shaded in grey.

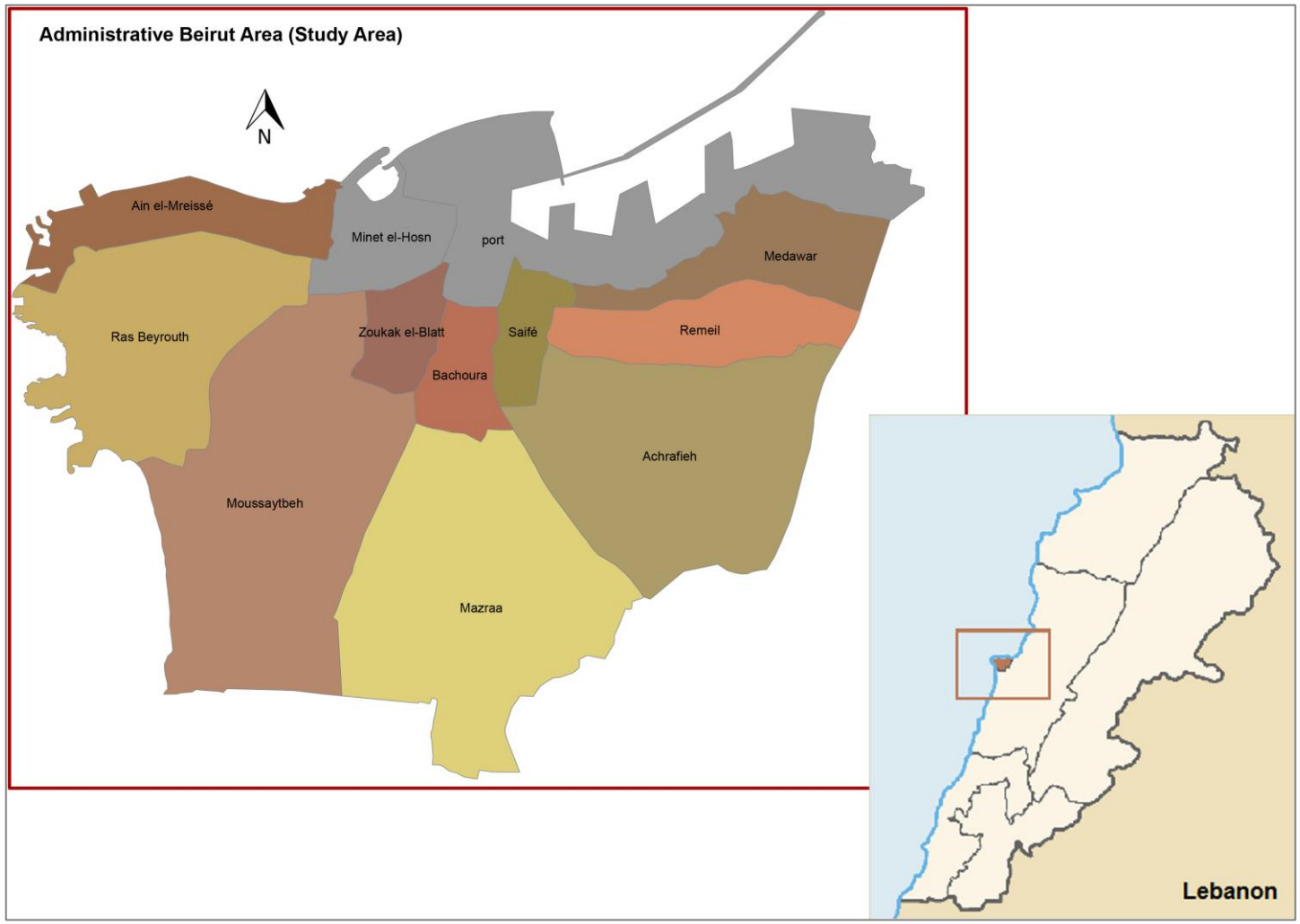

Figure 2: Map of study area: Administrative Beirut Area with respect to Lebanon

C. Study Instrument

A pre-tested survey questionnaire was developed and used for the acquisition and collection of data. It comprises a structured, standardized, closed-ended and coded set of questions (Refer to Annex 4). The questionnaire was structured and developed to meet the set objectives of the study. The questionnaire primarily tackles:

1. Most common pharmaceutical types (uses) and estimated quantities consumed by residents at the household level;
2. Residents' most common practices in terms of pharmaceutical waste management (storage and disposal);
3. Residents' knowledge and perceptions of any potential environmental or public health impacts that may result from residential pharmaceutical waste mismanagement;
4. Residents' knowledge or awareness on proper household pharmaceutical waste management practices;
5. The most common incidents/accidents related to or resulting from mismanagement of residential pharmaceutical waste; and
6. Residents' willingness to participate in any future pharmaceutical waste disposal or collection or "take back" system or program.

D. Study Design

1. Unit of Analysis and Sampling Unit

The unit of analysis (study subject) of the study at hand is the household member (interviewee).

The sampling units that made up the study sample are the residential households in ABA.

2. Sample Size

In principle, it is to be noted that depending on the variables to be tested and on the main objective of the carried out study, a sample size (of household units) is determined. In Lebanon, there is no recent census that can serve as a reference for nationwide population figures. With reference to the population figures provided in the Central Administration of Statistics (CAS) Report for year 2006, ABA is expected to house a population of approximately 400,000 inhabitants (CAS, 2007).

For the calculation of a sample size representative of the ABA and feasible for the purpose and objectives of the research study, and given that the study was set to explore a set of binomial variables, the below formula has been adopted for calculating the sample size:

$$\boldsymbol{n = \frac{t^2 * p\,(1-p)}{m^2}} \qquad \textbf{(Eq. 1)}$$

Where, **n** = required sample size; **t** = confidence level at 95% (standard value of 1.96); **p** = estimated prevalence of the outcome variable of interest; and **m** = margin of error at 5% (standard value of 0.05).

From the review of several international and regional studies pertaining to pharmaceutical waste management at the residential level, the prevalence (percentage) of surveyed individuals (representative of households) who disposed of their unwanted pharmaceuticals (either through the wastewater network or in the garbage stream) was explored. Accordingly, given the absence of any national or local pharmaceutical waste collection or "take-back" program and lack of general awareness among household

residents and the findings of several regional studies on pharmaceutical waste management at the residential level (which might be considered culturally comparable), the expected prevalence of disposal of unwanted pharmaceuticals at the residential level in the urban context of the ABA was initially expected to be 75%. As such, the study sample size was estimated to be equal to 287, rounded to 300 (household units, and was adopted for the purpose of this research study. Having a target sample size of 300 households, and accounting for a non-response rate of 26.66%, a total of 380 questionnaires were distributed for the purpose of this study to meet the set target.

3. Sample Selection Technique

After defining the study area, and based on the population figures for the year 2006 as provided by the Central Administration of Statistics (CAS) 2007 Report for ABA, the distribution percentage of randomly selected houses was calculated per each ABA residential zone, relative to the zone's surface area and population density. The 2006 figures were considered as baseline due to the absence of more recent demographic data of the area under study. Only residential buildings (apartments and standalone houses) were included in the random sample selection process; commercial buildings were excluded from the study sample. Random samples of digitized and geo-referenced residential buildings were taken from each zone to choose the buildings to be targeted. Household units, within each randomly chosen residential building, were then randomly selected. In the event of a non-response, rejection, and inaccessibility, an adjacent left-side building or household unit was selected. Table 3 below presents the population distribution (in percentage) and the surveyed number of households for each residential zone in ABA.

Table 3: Target study survey population based on 2006 baseline figures in ABA

Zone	Baseline Population (Year 2006)*	Population Distribution (%)	Target Survey Population (households)
Medawar	6,498	1.99	6
Ain el-Mreissé	6,754	1.67	5
Ras Beyrouth	48,189	11.95	36
Zoukak el-Blatt	15,587	3.86	12
Saifé	3,168	0.79	2
Rmeil	33,260	8.25	25
Msaitbe	90,437	22.42	67
Bachoura	15,896	3.94	12
Achrafieh	68,514	16.99	51
Mazraa	113,516	28.14	84
	401819	**100**	**300**

**** CAS 2007 Report (CAS, 2007)***

E. Data Management

1. Data Entry

Data was coded and entered for subsequent analysis using a computerized software program, the latest version (v.20.0.0) of Statistical Package for Social Sciences for Windows (Venables and Ripley, 2002). Quality control was applied to the entered data to detect and mitigate for any entry errors or inconsistencies.

2. Data Analysis

Following the primary data collection process, secondary data analysis was carried out. Data processing and analysis was carried out with the use of two software environments for statistical computing: SPSS® (Venables and Ripley, 2002) and the nnet® package in R® (R Core Team, 2013).

Descriptive statistics of the study sample were carried out to present the frequency distribution of the sample's: socio-economic and individual characteristics (health conditions), types of prescription and over-the-counter pharmaceutical products, estimated quantities of prescribed medications, respondents' behavior, attitudes, knowledge and perceptions regarding management of household unwanted medication and their willingness to participate in future. Continuous variables (age, quantities of consumed prescription pills) were reported in terms of mean and standard deviation.

After identifying the main outcomes to be explored by the study and the potentially associated predictors, three (3) statistical models were developed for the purpose of the study.

- Model 1, comprising a set of potentially-significant predictors expected to be associated with the main outcome: "willingness to participate in a future household pharmaceutical waste collection/take-back program" (Outcome 1). Possible associations between predictors and the outcome are tested using this model that will be helpful for future policy making and planning.
- Model 2, made up of a set of potentially-significant predictors expected to be associated with the main outcome: "willingness to participate in a future household pharmaceutical waste collection/take-back program for a fixed fee" (Outcome 2). Factors that are found to affect the tested outcome variable within this model will be useful for future policy and planning considerations.
- Model 3, consisting of a set of potentially-significant predictors that might influence "respondents' preferred choice of a future pharmaceutical waste

collection/take-back program" (Outcome 3). Significant factors found to be associated with the choice preference of one option over the other are expected to be valuable for subsequent related studies.

a. Models 1 and 2: Multivariate Regression Analysis

Statistical analyses were carried out on SPSS® and R to investigate possible associations between predictor variables (independent variables) and the main outcome variables (dependent variables) for each Model. A cut-off point for statistical significance was taken at $\alpha = 0.1$, where a *P*-value less than 0.1 indicates a statistically significant association at the 90% level. Binary logistic regression for univariate analysis was initially performed to test for any significant association between the predictor variables and the respondent variable. Unadjusted Odds Ratio (OR) for each significant predictor variable was obtained at the 90% confidence interval.

Following univariate regression analysis, multivariate logistic regression was carried out for identifying the best combination of predictor variables of each outcome of interest. Backward model selection technique was applied to the full model that was initially constructed, where every step consisted of dropping one variable at a time pruning down the model into a final parsimonious model with the lowest Akaike Information Criterion (AIC) score.

The multivariate regression model, comprising more than one predictor, was calculated using the following formula:

$$\ln\left(\frac{P}{1-P}\right) = \log(\text{odds}) = \alpha + \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n X_n + \varepsilon \qquad \textbf{(Eq. 2)}$$

Where: P is the probability of the event of the dependent variable Y, α is the Y intercept parameter, β_i are the slope parameters, X_i are the predictor independent variables, and $\boldsymbol{\varepsilon}$ is the error term (Rosburg, 2010).

b. Model 3: Multinomial Logistic Regression Analysis

A nominal outcome variable is modeled with the tool of a multinomial logistic regression whereby the odds (or log odds) of the outcome are modeled as a linear combination of the tested predictor variables (Bruin, 2006; Hasan, Zhiyu, and Mahani, 2014). As such, a multinomial logistic regression model was selected in attempt for finding predictors that can explain a respondent's preference towards a given future household pharmaceutical waste collection program. A cut-off point for statistical significance was taken at $\alpha = 0.1$, where a *p*-value less than 0.1 indicates a statistically significant association. The nnet® package in R® was used to fit the multinomial logistic regression. Note that the original five groups of Outcome 3 were re-coded and recombined into 3 main groups: Group 1: "Return to pharmacy"; Group 2: "Public sector intervention" which includes the options "Store in separate bags to be collected by municipality" (originally Group 3) and "Store in separate bags and dispose of in public drop-off points" (originally Group 4); and Group 3: "Give to people in need".

F. Ethical Considerations

The study addressed respondents from randomly-selected households located in the Administrative Beirut Area. Survey questionnaires that were administered to human participants were built in accordance to the guidelines and policies on human participants/subjects for Social and Behavioral Sciences, as set by the International Review Board (IRB) at the American University of Beirut (AUB). Demographic, socio-

economic, medical, behavioral and attitudinal data were collected and aggregated without any use of identifying questions or remarks. Data were solely used for the purpose of the Project and were properly controlled, managed and retained by the Principal Investigator (PI). There are no perceived direct or indirect risks or benefits associated with humans' participation in the Project and respondents' participation was strictly voluntary. An IRB-signed written informed consent, including the Project objectives and all relevant details, was provided to and signed by participants prior to the start of administering the questionnaire. A brief guidance note was prepared outlining some international "agreed upon" proper disposal practices of unwanted medication generated at the residential level (to be considered for dissemination during later stages as per relevant protocol) (Refer to Annex 5). No conflict of interests is declared.

CHAPTER IV
RESULTS AND DISCUSSION

A. Respondents' demographic, socio-economic, and health characteristics

A total survey of 300 household questionnaires was collected from the Administrative Beirut Area (ABA) during the period between February and April 2014. Study response rate was 73.34%. The sample consisted of 51% female respondents versus 49% males (Refer to Table 4 below). The mean age of the surveyed sample was around 49 years (age ranging from 17 to 88 years) with the majority of respondents falling between 18 and 65 years old compared to the general population in Lebanon, where 67.1% of the general population falls within the age range of 15 – 64 years (World Health Organization, 2010). The mean household size (in terms of occupants) was approximately 2 members (mean of 2.24) per household. According to the Multiple Indicators Clusters Survey of year 2009, only 13.7% of the total households in Lebanon are made up of 2 members, while 22.5% comprise of 4 household members (CAS, 2009). The survey and national figures on the mean household size are relatively smaller compared to some regional Arab countries, where the mean household range is around 6.60 members in countries like Saudi Arabia, Kuwait, and Sultanate of Oman (Abu-Auda, 2002). Fifty per cent (50%) of respondents held a university degree or its equivalent (vocational education), while 37% have only attained secondary level school education, and 12.7% have reached elementary education or less. These figures are not considered comparable to the national percentage distribution of residents with respect to attained educational level, where 15.4% of the population have attained university education and 16.2% have secondary education (CAS, 2009). The relatively high

percentage of respondents holding a university degree might be due to the mean age of respondents (49 years), their socio-economic status and the different cultural characteristics compared to rural areas.

Sixty-two per cent (62%) of interviewed respondents were employed by the time of the survey, while the remaining 38% were unemployed and distributed as full-time homemakers, university students, and retirees (Table 4). Approximately 46% of surveyed households had a monthly household income ranging between 1,000 and 3,000 USD, followed by 36% whose household income was less than 1,000 USD (Table 4). According to these findings, the majority of surveyed households have an income higher than the minimum wage of 450 USD (as per Decree N^{o} 7423, 2012). As for an estimation of the yearly household expenditure on medication, 36% of respondents said they spent more than 1,500,000 Lebanese pounds (equivalent to 1,000 USD) per year on medication (Table 4) compared to 64% who spent less than 1,500,000LBP per year. Despite the high prevalence of chronic diseases reported among those who had a medical condition by the time of survey, a relatively small fraction have reported spending less than 1,000 USD annually on medication. This might be due to the fact to the reimbursement of medication provided by the NSSF, which constituted the most common type of health insurance reported by the study respondents (mentioned hereafter). It is worth mentioning that nationally, the country Brief Report prepared by BLOMInvest Bank in year 2012 has stated that Lebanon was found to have the highest pharmaceutical per capita expenditure (approximately 3.2% as a percentage of GDP and approximately 36% as a percentage of Total Healthcare Spending) compared to the Middle Eastern countries (BLOMInvest Bank, 2012).

As for medical coverage, more than three-fourth of total respondents were medically covered. Fifty-one per cent (51%) were covered by public institutions mainly the National Social Security Fund (42%) and the Cooperative for Government Employees in Lebanon (4%). Twenty-five per cent (25%) were covered by a private health insurance company (Table 4). These figures might be considered comparable to the national status regarding the percentage of population covered by public versus private health services. With reference to the statistical figures provided by the Ministry of Public Health (MoPH) for the year 2011, approximately 50% of the population was covered by a public health service or public health insurance or social health insurance, or other public-funded sickness funds, while nearly 8% were covered by a private health insurance (WHO, 2010).

Table 4: Demographic, socioeconomic and medical background of study respondents (N=300)

Characteristics	**Frequency (%)**
Gender	
Male	148 (49.3)
Female	152 (50.7)
Age, *Mean(±SD)*	48.86 *(±15.815)*
Education	
Elementary or less	38 (12.7)
Secondary	112 (37.3)
University (and equivalent) [1]	150 (50.0)
Household Size, *Mean(±SD)*	2.47 *(±0.976)*
Currently Employed	
No	114 (38.0)
Yes	186 (62.0)
Monthly Household Income (in USD)	
<1,000	95 (36.1)
1,000 - 3,000	120 (45.6)
>3,000	48 (18.3)
Yearly Expenditure on Medication (in LBP)	
<1,500,000	185 (64.0)

Characteristics	Frequency (%)
>1,500,000	104 (36.0)
Healthcare Plan	
Public coverage [2]	148 (51.0)
Private insurance	76 (25.0)
None	76 (24.0)

[1] ***University equivalent education including vocational and technical education***

[2]***Includes: National Social Security Fund (42%), Cooperative of Government Employees in Lebanon (4%), other public institutional coverage programs (5%)***

Knowing that a representative sample size of the study was calculated based on the population density of ABA; however, this sample might not be considered representative in its demographic and socio-economic characteristics when compared to Lebanon as a whole; therefore, these statistics are considered representative of the study area as a whole and not the national profile status which combines different geographic, demographic and socio-economic features of both rural and urban contexts.

B. Most commonly used types and quantities of pharmaceuticals in ABA

As mentioned previously, the survey questionnaire was prepared to capture the project objectives, and was divided into sections focusing on each measurable objective. Forty six per cent (46%; n=137) of the interviewed respondents had an existing chronic medical condition, similar to the findings of a study conducted by Abu-Auda (2003) in Saudi Arabia which revealed that 44%, 32%, and 49% of household residents with different nationalities, Saudi, non-Saudi, and other Gulf countries, respectively, had at least one chronic disease (Abu-Auda, 2002). Out of the 46% of respondents who reported having a medical condition, 32% had hypertension / high blood pressure, 21% diabetes mellitus, and 16% cardiovascular disorders (Refer to Table 5 below). These

findings are expected to be somehow representative of the national health profile of Lebanon, where non-communicable chronic diseases prevail among the Lebanese population and are considered the main determinants of morbidity, having 77% of all reported deaths in year 2002 related to chronic diseases (WHO, 2002). According to the WHO factsheet "The Impact of Chronic Diseases in Lebanon," cardiovascular disease alone contributes by 45% to the causes of death (all ages) in Lebanon, followed by 10% from cancer, 5% chronic respiratory disease, and 2% diabetes (WHO, 2002).

Out of the total number of reported prescription medications (202 medications) given by respondents who reported having an existing medical condition, approximately 35% were blood pressure regulators, 14% lipid regulators, 8% blood sugar regulators (control of diabetes), and 8% antihistamines (Table 5). The average quantity of prescription medication consumed by respondents (n=137) was approximately 67 dosage units (in the form of pills) per month. According to Abdollahiasl, et al. (2011), drug consumption per capita in Lebanon has reached 216.9 per year (measured in Standard Unit, which is a single dosage unit of medication), the second highest after the United Arab Emirates (Abdollahiasl, et al., 2011). It is worth noting that the quantities reported by respondents are not considered representative of the quantities consumed per household due to the fact that other household members were not accounted for. In addition, fluctuations in quantities consumed over long periods of time are expected to take place.

The absence of a considerable fraction of antibiotics reported from total consumed medications is considered a peculiar finding compared to the body of literature which provides rather substantial information (around 35 studies) on the most common types and concentrations of antibiotics from human and veterinary sources

(Mompelat et al., 2009; Bottoni et al., 2010). Worldwide, antibiotic concentrations in tested tap water were found to be the second highest after a specific type of anti-inflammatory pharmaceutical products (734 ng/ml MEC of Triclosan antibiotic in tap water in the US) (Mompelat et al., 2009). Some of the possible reasons that might be linked to this finding might be related to the season during which the survey was conducted where consumption of antibiotics due to influenza or bacterial infections is expected to be less during summer compared to the cold winter season (Influenza cases made up only 3% of total reported medical conditions – Table 5 below). Another possible reason for low prevalence of reported consumed antibiotics might be related to the short medicinal course as compared to medications needed for chronic illnesses taken for prolonged and even life-long durations. On the other hand, leftover of antibiotic regimens is not expected to be likely because such medications need to be taken as full course for desired treatment efficacy. And as mentioned earlier, presence of high concentrations of antibiotics and antibiotic metabolites is considered of major concern due to the potential of developing resistant pathogenic bacterial strains in water resources and exposed ecosystems (Bound, Kitsou, and Voulvoulis, 2006; Bottoni et al., 2010).

The questionnaire also addressed the use, storage and disposal of non-prescription medication (over-the-counter OTC drugs) present in households by the time of survey. Out of the total reported OTC medications stored in the surveyed households (469 OTC product), analgesics and pain relievers constituted approximately 55% of total OTC products, which might be due to the fact that many individuals might tend to consume pain relievers for a wide set of medical symptoms, without the need for physician consultation. Other reported common OTC products were antiseptics and

anti-bacterials (23%), and burn treatment ointments and creams (16%) (Table 5). More than half of surveyed respondents said that OTC medications were provided upon consultation with a pharmacist without the need for a physician prescription. It is to be noted that no validation hand checks were performed to confirm self-reports of the medication types and quantities that were provided in the responses of interviewed respondents.

Table 5: Prevalence of medical conditions and the consumption of prescription and nonprescription medication among respondents (N=300)

Characteristics	Frequency (%)
Existing Medical Condition	
No	163 (54.3)
Yes	137 (45.7)
Type of Medical Condition	
Cardiovascular disease	22 (16.0)
Diabetes	29 (21.0)
Hypertension	44 (32.0)
Musculoskeletal as Arthritis	4 (2.9)
Influenza	4 (2.9)
Allergies	13 (9.5)
Psychological Disorders	2 (1.5)
Other [1]	19 (14.0)
Types of consumed prescription medication (total of 202 reported medications)	
Lipid Regulators	28 (13.9)
Blood Pressure Regulators	70 (34.6)
Blood Sugar Regulators	16 (7.9)
Anti-inflammatory	6 (3.0)
Anti-rheumatics	8 (4.0)
Anti-histamines	17 (8.4)
Others [2]	57 (14.1)
Total Quantity of Consumed Prescription Medications (pills/month) [3], *Mean (±SD)*	67.43 *(±50.944)*
Most common types of OTC [4] products stored in household (total of 469 reported medications)	
Antiseptics and anti-bacterials	109 (23.2)
Burn ointments and creams	75 (16.0)
Analgesics and pain killers/relievers	257 (54.8)
Supplements	14 (3.0)
Others [5]	14 (3.0)

[1] Other conditions including: Infections, Post-operation, Hormonal Disruptions, and Musculoskeletal

[2] Other medication including: Analgesics (6%), Hormone Regulators (5.1%), and Anti-depressants (3%)

[3] Quantities reported by interviewed respondent

[4] Over the Counter (non-prescription medications)

[5] Other OTC products including: gastrointestinal medications, antibiotics, antihistamines.

C. Background on current practices and management of household pharmaceutical waste

Section two of the survey questionnaire tackled the management (practices, attitudes, behavior) of pharmaceutical wastes (leftover, unwanted or expired) generated at the household, as reported by the interviewee. When asked if they have any remaining medications at home by the time of the survey, only 19% of respondents said they did (Refer to Table 6 below). Respondents were asked if they dispose of their unwanted or leftover medications and why they did so and how. Ninety-four per cent (94%) of respondents disposed of their unwanted medications. Out of those who reported doing so, 67% disposed them due to medication expiry, followed by 27% due to completion of treatment (Table 6). This is comparable to results obtained from a pilot study conducted by Musson et al. in the Alachua County in Florida - USA, where the main reason for throwing away unwanted medication was due to the expiry of the medicinal product (Musson et al., 2007). However, a study carried out by Braund et al. (2008) revealed that the primary reason for disposal of unwanted medications was due to the shift to another treatment (37%) followed by the second most important reason which is expiry of medication (28%) (Braund et al., 2008). Quantities of disposed unwanted or expired pharmaceuticals were not addressed in the questionnaire mainly because it was found challenging for respondents to estimate and recall (recall bias issue) the quantities of disposed medications as compared to the quantities consumed.

Interviewees who dispose of their unwanted medications were then asked to specify the most common method of disposal of common forms of medication (solid form: tablets, capsules; liquid form: syrups and suspensions; and semi-solid form: creams/ointments). Respondents who reported disposing of their unwanted solid

medications did so primarily through the municipal solid waste stream (78%), followed by 8.5% who usually offer them to a nearby dispensary and to people in need, and 6% who dispose of leftover pills and capsules down the drain (Table 6). Sixty-nine per cent (69%) of respondents who reported disposing of solid unwanted medications considered their practiced method of disposal as best.

Seventy-three per cent (73%) of respondents who dispose of liquid medications throw them along with the household solid waste, followed by 17% who empty leftover bottles into the drain, and 4.4% who give them to a nearby dispensary and to people in need (Table 6). About 71% of respondents considered that they are best disposing of leftover liquid medication the way they reported. As for the disposal of unwanted creams and ointments (semi-solid medications), 87% of respondents get rid of them through the solid waste stream with only 5.5% who empty them in the toilet or sink and around 3% who offer them to a nearby dispensary and to people in need (Table 6). The majority of respondents (72%) considered their practiced method of disposal of semi-solid unwanted medications (creams and ointments) as the best method for getting rid of them.

As per these results, regardless of the form of unwanted medication, the primary disposal method is through the solid waste stream (garbage), which is considered by the majority of respondents the most practical method and the safest. Where no organized pharmaceutical waste collection and disposal schemes exist, as in Lebanon, discarding of unwanted medications in the solid waste stream may appear to be the most acceptable and practical means of disposal at the residential level, mainly due to the absence of other alternative methods or collection programs (Abahussain and Ball, 2007). This fact, however, is considered of critical significance mainly because

medications are being disposed in their original form, where the concentration of active pharmaceutical ingredients are expected to be higher than those present in excreted metabolized pharmaceutical by-products that end up in the sewage system (Bound and Voulvoulis, 2005).

Findings related to the most common disposal methods of household pharmaceutical waste in ABA are comparable to some relevant international and regional studies. According to Bound and Voulvoulis (2005), disposal of unwanted medications through the domestic solid waste stream in the United Kingdom is the most prevalent method of pharmaceutical disposal at the residential level (Bound and Voulvoulis, 2005). Regionally, one study conducted in Cairo, Egypt in year 2009 showed that residences most commonly dispose of their unwanted medications along with the solid waste stream (El-Hamamsy, 2011). Another survey conducted on 300 households in Northern United Arab Emirates found that 84% of consumers, who disposed of expired medications, threw these unwanted products in the garbage (Sharif et al., 2010). Similarly, 97% of respondents practiced the same disposal method in a study conducted in Kuwait (Abahussain and Ball, 2007).

Although the findings of this study showed that disposal in the domestic solid waste stream was the predominant method practiced at households irrespective of the product form (solid, liquid or cream), some studies have shown differences in disposal preferences depending on the form of disposed medication. For instance, a study conducted in New Zealand year 2009 showed that most respondents reported their preference of disposing of unwanted solid and “semi-solid” (creams/emulsions) medications along with the garbage, while unwanted liquid medications were best disposed of in the toilet or sink (Tong, Peake, and Braund, 2011).

Table 6: Respondents practices for the management of unwanted medications at the residential level

Characteristics	Frequency (%)
Dispose of Unwanted Medications (N=300)	
No	18 (6.0)
Yes	281 (94.0)
Reason for Disposing of Unwanted Medications (n=281)[1]	
Completion of Treatment	77 (27.4)
Expiry of medication	188 (66.9)
Other [2]	16 (5.7)
Disposal Methods of Unwanted Medications	
Solids (n=281)	
Toilet/Sink	17 (6.0)
Garbage/Solid waste stream	220 (78.3)
Return to pharmacy	10 (3.6)
Give to nearby dispensary / people in need	24 (8.5)
Other [3]	10 (3.6)
Consider as best method for disposal of solid unwanted medication	
No	87 (30.9)
Yes	194 (69.1)
Liquids (n=270)	
Toilet/Sink	46 (17.0)
Garbage/Solid waste stream	196 (72.6)
Return to pharmacy	4 (1.5)
Give to nearby dispensary / people in need	12 (4.4)
Other [3]	12 (4.4)
Consider as best method for disposal of liquid unwanted medication	
No	79 (29.3)
Yes	191 (70.7)
Creams/Ointments (n=275)	
Toilet/Sink	15 (5.5)
Garbage/Solid waste stream	239 (86.9)
Return to pharmacy	2 (0.7)
Give to nearby dispensary / people in need	7 (2.5)
Other [3]	12 (4.4)
Consider as best method for disposal of cream/ointment unwanted medication (n=275)	
No	76 (27.6)
Yes	199 (72.4)

[1] Participants who reported "do not dispose" (n=18) were not reported in the statistics of "reason for disposal" and "disposal methods"

[2] Other reasons include physical deterioration or damage of medication and the treatment of medical condition.

[3] Other methods include the separation of unwanted medication as specialized waste, burning, or burying of unwanted medication in backyard/garden or planters

In the attempt to capture any possible link between the improper storage and disposal of unwanted medications and the incidence of accidental poisoning from ingestion or misuse, respondents were asked if they recall any poisoning event that took place in their household related to pharmaceutical storage or disposal. The vast majority of respondents (90%) said that they do not recall any incident of poisoning from accidental ingestion or misuse of stored or disposed medications. Such a high percentage of "no-report" might be attributed to the fact that people might feel embarrassed to share such accidents, or because of the fear that the interviewer might judge them for carelessness (social desirability issue) or simply because they do not recall any incident (recall bias issue). As for the respondents who reported an incident related to poisoning from improper storage or disposal (10% of total respondents), 53% were cases of adult poisoning as compared to 33% who reported events of child poisoning, with the remaining 14% who reported different instances like medicine spillages or deterioration.

D. Background on respondents' knowledge, perception of risk and willingness to participate in future intervention programs

The third section of the questionnaire addressed a set of questions related to interviewees': i) knowledge on the proper management of unwanted medications and if they received any kind of awareness regarding this matter; ii) perception of risk pertaining to household pharmaceutical waste management; iii) willingness-to-participate in any future collection or take back program; and iv) choice preference of a future household pharmaceutical waste collection/take back program (Refer to Table 7 below). It is to be noted that answers to questions involving participant behavior,

attitudes, and perceptions might involve a margin of social desirability that might not be accurately matching to reality, where respondents might tend to provide "best-answers" to impress the interviewer.

The majority of respondents (91%) never heard or learnt of any commonly used proper disposal method for pharmaceutical waste generated at the residential level (Table). Forty-three per cent (43%) of the small fraction of those who have heard of commonly used proper disposal methods (9%), learnt about them through the media. Ninety five per cent (95%) of respondents did not receive any kind of awareness or guidance on the proper disposal methods (Refer to Table 7 below). The lack of an informed public and the absence of any awareness or guidance programs might be attributed to the fact that in Lebanon, there are no existing framework, program, or guidelines related to the management of pharmaceutical waste generated at the residential level; therefore, it is expected that there is minimal to nil education or public awareness on such a matter. The majority of interviewees (92%) agreed that awareness and guidance on the proper and safe disposal of unwanted household pharmaceutical products is necessary, and agreed that quantities of generated pharmaceutical waste can be reduced mainly through introducing awareness programs to the end users (46%) and through an accurate prescription of medication by physicians (28%) (Table 7).

Almost all respondents (93%) were not aware of any national legislation regulating the management of household pharmaceutical waste and almost 79% agreed that there should be one (Table 7). These results could be justified by the fact that there is no existing legislation, or draft legislation, related to the management of pharmaceutical waste at the residential level that the majority of residents are expected to have heard of (Abu-Orm, 2014, personal meeting).

Respondents' perception to risk from the improper disposal of household pharmaceutical waste was captured when asked if they consider the improper disposal of unwanted medications as dangerous and as a contributing factor to environmental and public health risks. Eighty-six per cent (86%) perceived the improper disposal of such type of waste as dangerous and 87% believed that such practices might contribute to environmental degradation and potential health impacts (Table 7). According to these findings, it can be inferred that the majority of respondents perceive risk (health- and environment-related) from the current practices related to pharmaceutical waste management at the residential level.

Approximately 87% of respondents thought that there should be a collection/take back program for pharmaceutical waste generated by residences. In countries where the public support of such collection systems was sought, like in the State of Texas – USA, the public demonstrated a welcoming and supportive attitude regarding the introduction of a pharmaceutical take back scheme (Thach et al., 2013). Seventy-five per cent (75%) of respondents who thought there should be a local collection / take back program favored the Lebanese Ministry of Public Health (MoPH) as the prime responsible entity for organizing and steering such a future intervention program (Table 7 below), compared to other entities like the Ministry of Environment and of Social Affairs (10%), individual municipalities (5%), or private institutions like pharmacies, physicians, and specialized collection companies (10%).

Ninety per cent (90%) of respondents said that they are willing to participate in any future collection or take-back program related to pharmaceutical waste generated at the residential level. Seventy-two per cent (72%) of the survey's respondents were willing to participate for a fixed collection fee in any future program (Table 7). One of

the main reasons that might be attributed to the majority of participants' willingness to participate might be related to their perception of danger, environmental and health risks from the currently practiced disposal methods and their conviction that a collection /take-back program should exist. Nevertheless, the proportion of those willing to participate decreased when asked if they were willing to participate for a fee. This can be justified by considering individuals might become deterred or discouraged when fees are involved for several probable reasons, some of those stating that such a service is considered related to their basic human rights, which is health, and that the government should provide it without incurred costs on citizens. Potential factors found to influence respondents' willingness to participate in future household pharmaceutical waste collection program in this study will be explored in the following sections.

When interviewees were asked to choose a preferred future collection program for household pharmaceutical waste, approximately 72% favored the option of a public sector intervention program, where about 42% were in favor of storing unwanted medications in separate bags and disposing of them in public pre-defined drop-off points and around 30% who preferred storing them in separate bags to be collected by the municipality. Around 17% preferred returning them to the pharmacy, followed by approximately 12% who would give them to people they knew in need or to a nearby dispensary (Table 7). Respondents' preferences for a drop-off points collection program in this study converges with the findings of another conducted in Kuwait year 2006, where more than half (54%) of participants believed that returning unwanted household medications to drop-off boxes in assigned pharmacies was considered a practical option, followed by 21% who voted for the option of secured drop-off bin points in shopping malls made available to the public (Abahussain et al., 2006).

Table 7: Respondents perception and knowledge on proper management of unwanted medication

Characteristics	Frequency (%)
Previously heard of proper management of unwanted medication at the residential level	
No	270 (90.6)
Yes	28 (9.3)
Through which means	
Media (TV, radio, magazines, billboards)	12 (42.9)
Internet	4 (14.3)
Word of Mouth	5 (17.8)
Other [1]	7 (25.0)
Have been given awareness/guidance on proper management of unwanted medication at the residential level	
No	280 (94.6)
Yes	16 (5.4)
Awareness / guidance provided by:	
Physician	1 (6.3)
Pharmacist	2 (12.5)
Friend	3 (18.7)
Other [2]	10 (62.5)
Think there should be awareness /guidance on proper management of unwanted medication at the residential level	
No	24 (8.3)
Yes	266 (91.7)
Best way for reducing quantity of unwanted medication at the residential level	
Awareness programs	135 (45.9)
Collection / take back systems	56 (19.1)
Accurate prescription of medication	83 (28.2)
Other [3]	20 (6.8)
Have heard of any law/legislation related to management of unwanted medication at the residential level	
No	278 (92.7)
Yes	22 (7.3)
Think there should be law/legislation related to management of unwanted medication at the residential level	
No	60 (21.4)
Yes	221 (78.6)
Consider improper management of unwanted medication at the residential level dangerous	
No	37 (13.9)
Yes	230 (86.1)
Consider improper management of unwanted medication at residential level poses environmental and public health threats	
No	35 (13.0)
Yes	234 (87.0)

Characteristics	Frequency (%)
Think there should be a collection/take back program for unwanted medication from households	
No	38 (13.3)
Yes	248 (86.7)
Responsible Entity for collection of unwanted medication from households	
Ministry of Public Health	203 (74.9)
Others [4]	68 (25.1)
Willingness to participate in any future household pharmaceutical waste collection/take back program	
No	27 (9.6)
Yes	253 (90.4)
Preferred option of future household pharmaceutical waste collection program (future intervention)	
Return to pharmacy	48 (16.8)
Public sector (governmental) intervention program [5]	205 (71.6)
Give to people in need [6]	33 (11.6)
Willingness to participate in any future household pharmaceutical waste collection/take back program for a fixed fee	
No	72 (28.3)
Yes	182 (71.7)

[1] Other means including mainly: schools, few pharmacies and dispensaries.

[2] Other means including: clinics, dispensaries, Non-Governmental Organizations

[3] Other ways as stated by respondents mainly including: adherence to physician instructions and give to people in need (instead of throwing away unwanted medications).

[4]Others entities including: Ministry of Environment (MoE) and Ministry of Social Affairs (MoSA), municipalities and private companies.

[5] Original sub-categories "Store in separate bags to be collected by municipality"(28.8%) and "Store in separate bags and dispose in public drop-off points" (40.7%) re-grouped into one new sub-category labelled as "Public sector (governmental) intervention program."

[6] Original sub-category labelled as" Others" however, due to the majority of responses recorded related to re-gifting and donating of unwanted medications in need, sub-category was re-coded into "Give to people in need" (irrelevant responses removed).

E. Factors affecting respondents' willingness to participate in and preference of future household pharmaceutical waste collection programs

Using SPSS® and R, statistical analytical tests were executed to quantify the effect of a set of predictor variables on selected binary dependent outcomes / variables related to respondents' willingness to participate in any future intervention program in the form of a household pharmaceutical waste collection program (Outcome 1), and respondents' willingness to participate in case a fixed fee was introduced (Outcome 2).

Two (2) Models were formulated to test each outcome individually against a set of potential predictors.

1. Model 1 - Variables affecting Willingness to Participate

a. Univariate Analysis

Predictor variables for willingness to participate (Outcome 1) were subjected to univariate logistic regression analysis. Annex 6 presents the tables of predictor variables tested for their association with respondents' willingness to participate at the univariate binomial analysis level. Significant parameters, of p-value less than 0.1 (at the 90% Confidence Interval (CI)), are presented below. It is to be noted that significance of association was assessed based on binomial analysis of each individual parameter and Outcome 1.

- *"Age:"* a significant predictor of willingness to participate (OR = 0.974, *P* = 0.059), where with every 1 year increase in age, respondents are, on average, 0.97 times less likely to state a willingness to participate in any future collection program compared to younger respondents.
- *"Need for a collection / take-back program for unwanted pharmaceutical waste at the residential level:"* strong significant predictor (OR = 6.246, *P* <0.001) where those who thought there is a need for a collection waste program are, on average, 6.25 times more likely to be willing to participate in a future collection intervention compared to those who do not consider a need for intervention.
- *"Preferred responsible entity for any future collection program:"* strong significant association with participants' willingness to participate (OR =

2.773, *P* = 0.025) at 95% C.I. where those who preferred the Ministry of Public Health (OR = 2.773, *P* = 0.025) are, on average, 2.77 times more likely to be willing to participate compared to those who chose other responsible entities for collection (ex: Ministry of Environment, municipalities, private contractors).

- *"Need for awareness/guidance programs on the proper management of household unwanted medication:"* a significant parameter for predicting willingness to participate (OR = 2.786, P = 0.090) at 90% C.I. where those who agreed to the need of awareness programs are, on average, 2.79 times more likely to be willing to participate in any future intervention program than those who do not perceive an need for public awareness and guidance.
- *"Perception of danger"* and *"Perception of environmental and health risks"* from the improper management practices of household pharmaceutical waste: strong statistically significant variables (OR = 3.172, P = 0.020 and OR = 4.140, P = 0.003, respectively) at 95% C.I. Those who perceived danger and environmental and health risks are, on average, 3.2 and 4.1 times, respectively, more likely to be willing to participate in household pharmaceutical collection schemes than those who do not foresee any risk associated from current mismanagement practices of this type of waste.
- *"Need for a law/legislation related to the management of unwanted medication at the residential level"*: strong statistically significant factor influencing willingness to participate (OR = 2.855, P = 0.017), where those who agreed to the need of a regulatory legislation are 2.85 times more

likely to be willing to participate in collection programs compared to those who thought otherwise.

b. Multivariate Analysis

Predictor variables found to be significantly associated with respondents' willingness to participate (of *P* value <0.1) at the univariate analysis level were then subjected to a multivariate logistic regression analysis (presented in Table 8 below). This constituted the study's first statistical model (Model 1). As previously mentioned, backward model selection was carried out on the full model to obtain a parsimonious model with the lowest AIC score.

"Age" was found to be a significant predictor of willingness to participate on the multivariate level (OR = 0.967, *P* = 0.050), where with every 10 year decrease in the age, respondents are, on average, 1.404 times more likely to be willing to participate in future collection programs as compared to younger participants. This finding appears to disagree with one of the significant correlations drawn by a study conducted by Kotchen et al., 2009, between age and willingness to participate in pharmaceutical collection programs where elderly individuals were more likely to demonstrate willingness to participate in collection programs. According to Kotchen et al. (2009), respondents of older age made up the highest fraction of participants in pharmaceutical take-back events (Kotchen et al., 2009). Another pilot study carried out by Braund et al. in year 2008 in New Zealand showed that the majority of those who participated in returning their unwanted medications to one of the two assigned collection points, aged between 61 and 80 years old, compared to younger age groups (less than 20 years and age group range of 20 to 60 years) (Braund et al., 2008).

According to the study at hand, younger respondents have stated a willingness to participate relatively higher than older respondents, and this might be attributed to the possibility of younger individuals being proactive in issues related to environmental and health safety and protection within a set management framework, and possibly due to higher educational attainment among younger generations. The lower stated willingness to participate in older respondents might be due priorities and interests other than taking part of a future pharmaceutical waste collection system at the residential level and possibility their lack of knowledge on the possible risks from improper household pharmaceutical waste and gains from collection programs.

"Household yearly expenditure" on medication (in Lebanese Pounds LBP) was another significant factor for predicting willingness to participate in a future household pharmaceutical waste management program (OR = 3.413, $P = 0.038$). Respondents who reported that their household spends more than 1,500,000 LBP yearly on medications are, on average, 3.41 times more likely to be willing to participate in future collection program compared to households who spend less than that. This finding agrees with the pilot study carried out by Braund et al. year 2008 in New Zealand, where patients were found to be more willing to return their unwanted or leftover pharmaceuticals (Braund et al., 2008) because they preferred others to use them instead of wasting them.

Moreover, it is worth noting that in the study done by Braund et al., in 2008, a large portion of the survey participants had some form of prescription subsidy which could have influenced their increased willingness to participate in returning their unwanted medications (Braund et al., 2008). These findings seem to converge with those of the study at hand where approximately 75% of respondents are medically

insured (public and private coverage) where the costs of a list of medications, particularly those for chronic illnesses, are covered and reimbursed by the health insurer.

The *"need/necessity for a collection/take back program for unwanted pharmaceutical waste at the residential level"* (OR = 6.259, P <0.001) was found to be a strong predictor for willingness to participate. Respondents who agreed to the need for a collection/take back program for unwanted household pharmaceutical waste were, on average, 6.26 times more likely to be willing to participate in any future relevant program than respondents who did not. This could be justified that as people become more convinced with the need for collection programs and the possible associated benefits of establishing such programs for the proper management of pharmaceutical waste, their willingness to participate in future collection programs is likely to increase knowing that such a program is meant to lift the potential environmental and health burdens from ongoing mismanagement practices.

Nevertheless, this stated willingness to participate might be influenced by the type of collection program. According to Kotchen et al. (2009), the presence of permanent household pharmaceutical waste collection programs, as opposed to one-day or seasonal events, may result in increased participation as it may be considered more practical and convenient (Kotchen et al., 2009).

Table 8: Multivariate Logistic Regression (Model 1) of significant variables associated with respondents' willingness to participate in future household pharmaceutical waste collection program

Variable	B	S.E.*	EXP (B) / Adjusted Odds Ratio (OR)	90% C.I.**	P-value
Intercept	2.266	1.002	9.640	-	-
Age	- 0.034	0.017	0.967	(0.940 – 0.995)	**0.050**
Yearly Household Expenditure on Medication (in LBP)					**0.038**
<1,500,000			-		
>1,500,000	1.228	0.593	3.413	(1.288 – 9.046)	
Think there should be a collection / take back program for unwanted medication from households					**<0.001**
No			-		
Yes	1.834	0.515	6.259	(2.684 – 14.593)	

**** Standard Error***

***** C.I. Confidence Interval***

Bold values are significant at P < 0.1

2. Model 2 - Variables affecting Willingness to Participate for Fixed Fee

a. Univariate Analysis

Similar to the above analysis of Model 1, predictor variables for willingness to participate for a fixed fee (Outcome 2) were subjected to univariate logistic regression analysis. Annex 6 presents the tables of predictor variables tested for their association with respondents' willingness for a fixed fee to participate at the univariate binomial analysis level. A concise explanation of the significant factors, of p-value less than 0.1 at a 90% Confidence Interval (CI) found to affect respondents' willingness to participate in any future collection program, is provided below.

- *"Age:"* strong significant predictor of willingness to participate for a fixed fee (OR = 0.978, P = 0.020); where with every 1 year increase in age, respondents are, on average, 0.978 times less likely to be willing to participate in a collection program for a fixed fee than younger respondents.
- *"Need for awareness on proper management of unwanted medication at the residential level:"* borderline significant predictor (OR = 2.256, P = 0.102) where respondents who thought that there is a need for public awareness are, on average, 2.26 times more likely to be willing to participate in a future collection scheme for a fixed fee compared to those who thought otherwise.
- "*Need for a law/legislation related to the management of unwanted medication at the residential level*:" strong statistically significant predictor of willingness to participate for a fixed fee (OR = 3.243, P <0.001). As such, respondents who favored the presence of a law are, on

average, 3.24 times more likely to be willing to participate in household pharmaceutical waste collection program for a fee than those who do not consider the need for regulation.

- *"Need for a collection / take-back program for unwanted pharmaceutical waste at the residential level:"* significant parameter influencing outcome variable (OR = 2.402, P = 0.032), where participants who perceive a need for future intervention are, on average, 2.40 times more likely to be willing to participate for a fixed fee in a future collection program compared to those who do not consider a need for intervention.
- "*Willingness to participate in a future household pharmaceutical waste collection program*:" strong predictor in influencing respondents willingness to participate in case a fixed fee was introduced (OR = 6.928, P <0.001), where respondents who stated a willingness to participate are, on average, 6.93 times more likely to be willing to participate even if a fixed fee was introduced as compared to those who did not demonstrate the willingness to participate in the first place.

b. Multivariate Analysis

Significant predictor variables resulting from the univariate logistic regression analysis were then subjected to multivariate logistic regression analysis (Model 2) (Refer to Table 9 below). As previously mentioned, backward model selection was carried out on the full model to obtain a parsimonious model with the lowest AIC score.

The *"need for a law/legislation related to the management of unwanted medication at the residential level"* was found to be a strong significant predictor of willingness to participate for a fixed fee (OR = 2.944, P = 0.002) (Table 9). As such,

respondents who favored the presence of a law are, on average, 2.94 times more likely to participate in a household pharmaceutical waste collection program for a fee as weighed against those who do not believe there is a need for regulation. This might be explained by the fact that respondents who see the need for a legislation to regulate the management of household pharmaceutical waste can help in reducing the mismanagement practices and to reduce potentially-associated environmental and health impacts. Therefore, they have a higher willingness to participate, even for a fixed fee.

Based on the association between the variable *"need for legislation"* and *"willingness to participate"* for a fixed fee of Model 2, having a legislation in place in the future might provide incentives and even mandates to the parties involved, where participation (with for free or for a certain fee) might become obligatory or might act as an incentive (participants might be paid for a certain amount of returned medication).

"Willingness to participate in a future household pharmaceutical waste collection program" was a strong predictor in influencing respondents willingness to participate in case a fixed fee was introduced (OR = 5.995, P = 0.002). Respondents who stated a willingness to participate are, on average, 5.99 times more likely to participate even if a fixed fee was introduced as compared to those who did not demonstrate the willingness to participate in the first place. This finding might imply that respondents who have stated a willingness to participate in any future pharmaceutical waste collection program are still willing to do so even if a fixed fee was introduced, despite the fact that percentage of respondents who stated a willingness to participate (90%) was greater than that compared to those who stated a willingness to participate for a fixed fee (72%) (Refer to Table 7 above). This finding especially agrees with the study of Kotchen et al., 2009, which stated that irrespective of how much

individuals are willing to pay for a collection /take-back program, they may still be willing to participate in one (Kotchen et al., 2008).

"Age" (OR = 0.978, P = 0.032) was found to be a significant predictor variable of willingness to participate for a fixed fee at the multivariate analysis level, where with every 10 year drop in age, respondents are, on average, 1.258 times more likely to be willing to participate in a collection program for a fixed fee (Table 9 below). This finding seems to disagree with the findings of a pilot study carried out by Thach, Brown, and Pope in Texas – USA for the assessment of an existing pharmacy take-back program, where users of an existing collection program were significantly older than non-users, the former having stated favorable attitudes towards paying for the service of collection and disposal as compared to younger non-users (Thach, Brown, and Pope, 2013).

The "Age" variable in both Models 1 and 2 has shown to be a strong statistically significant predictor, even at the 95% C.I. which might imply that the stated willingness to participate and willingness to participate for a fixed fee in a future collection program are expected to be significantly influenced by the age of the involved individuals (stated willingness to participate decreases with increase in age) and should be considered when tailoring a future collection program.

Table 9: Multivariate Logistic Regression (Model 2) of significant variables associated with respondents' willingness to participate in future collection program for a fixed fee

Variable	B	S.E.*	EXP (B) / Adjusted Odds Ratio (OR)	90% C.I.**	P-value
Intercept	- 0.392	0.775	0.676	-	-
Age	- 0.023	0.011	0.978	(0.961 – 0.995)	**0.032**
Think there should be law/legislation related to management of unwanted medication at the residential level					**0.002**
No			-		
Yes	1.080	0.357	2.944	(1.637 – 5.295)	
Willing to participate in future household pharmaceutical waste collection program					**0.002**
No			-		
Yes	1.791	0.570	5.995	(2.346 – 15.318)	

**** Standard Error***

***** C.I. Confidence Interval***

Bold values are significant at P < 0.1

3. Model 3 – Variables affecting respondents' preference of a future household pharmaceutical waste collection program

As previously mentioned in Chapter 3 on Methodology, Section F - Data Management, Model 3 which involves a multinomial logistic regression analysis was solely prepared using the R software. Model 3 explores the predictor variables that are expected to significantly influence the respondents' choice preference of a future household pharmaceutical waste collection program (Outcome 3). As a reminder, choices originally provided under Outcome 3 in the questionnaire were re-grouped and re-named for the purpose of analysis.

The following sections elaborate on the predictors that have shown to be of statistical significance (at 90% C.I – P-value less than 0.1) in influencing respondents' choice preferences of a future household pharmaceutical waste collection program. These are presented in Table 10 below.

According to the results of the multinomial logistic regression (Model 3), the variable "Need for awareness" has negatively and significantly impacted the odds of preferring the option of "Return to pharmacy" as compared to the option of a "Public sector intervention program" (OR = 0.346, P = 0.077 significant at 90% C.I.) (Refer to Table 10 below). Respondents who think there is a need for awareness tend to prefer less the option of "Return to pharmacy" as compared to the option of a "Public sector intervention program" (OR = 0.346). On the other hand, no statistically significant difference was found between the respondents' preference of giving their unwanted medication to people in need and the option of a taking part in a public intervention collection program, given the way they perceive the need for awareness. This might be

explained by the fact that respondents who see a need for awareness programs believe in a bigger governmental role in regulating the sector.

The lower preference of respondents choosing the option of returning to a pharmacy as compared to a public sector intervention program might be attributed to their greater faith in a government-led program versus any other program or their preconceptions related to the possibility of pharmacies illicitly re-selling returned medications. Other studies have found that knowledge and education play a key role in the attitude and behavior of the public towards the management of pharmaceutical waste and in turn, their choice preference of a collection program. According to Wilcox (2013), individuals' choices and preferences of disposal methods seem to be influenced by their awareness on potential safety, health and environmental concerns associated with the ill-management of unwanted pharmaceuticals (Wilcox, 2013). This also converges with a previous pilot study carried out in year 2009 in Albany, New York (USA) where the majority of participants (80%) indicated an intention to dispose of medications by an appropriate method after they were provided with awareness and education on proper management practices of such type of waste by a team of pharmacy students (Abrons et al., 2010).

As for the people who stated "willingness to participate in future household pharmaceutical waste collection program," the odds ratio of preferring the option of "Give them to people in need" versus a "Public sector intervention program" was 0.234. As such, willingness to participate is a significant predictor that negatively influences respondents choice preference of giving to people in need as opposed to the option of a public sector intervention program (OR = 0.234, P = 0.007 significant at the 95% C.I.) (Table 10). It is to be noted that the same predictor appeared to be positively affecting

respondents' preference of choosing to return their unwanted medications to a pharmacy (odds ratio 3.501 times in excess – higher preference) as compared to a public sector intervention program; however, this association was not statistically significant (P = 0.235 at 90% C.I.).

According to these results, individuals who have stated a willingness to participate in a future program would probably prefer managing their unwanted medication in an official framework of a collection program organized by a public sector entity, for instance the MoPH, for their higher faith and trust in a program organized and managed by the government. Another explanation might be that these individuals favor the proper management and safe disposal of their unwanted medications through a public sector intervention program probably because they believe it might be the best option for preventing and mitigating environmental and public health impacts potentially associated with unmanaged pharmaceutical waste disposal. Moreover, liability might be a concern here which for individuals who would prefer avoiding "gifting" to people in need especially in the absence of a supervision and approval of a medical physician.

"Age" was shown to be significant predictor to negatively impact respondents' preference of one future collection program over the other (in this case, the option of "Give to people in need" compared to the option of a "Public sector intervention program." A ten-year decrease in respondents' age is associated with a 0.718 decrease in the odds ratio of preferring to give their unwanted medication to disadvantaged people (people in need) versus favoring a public sector intervention program (OR = 1.034, P = 0.022 significant at 95% C.I.) (Table 10). In other words, the odds of

someone “gifting” their unwanted medications, as compared to taking part in a program organized by the public sector increases with the increase in age.

As per the findings of Model 3, possible reasons that could be attributed to older respondents’ inclination for re-gifting their unwanted medications to people in need might be out of their personal concerns and preferences in the humanitarian aspect of managing unwanted pharmaceuticals rather than the environmental or safety implications of proper management and could be more interested in the re-use of unwanted medications instead of their disposal. Older respondents might also prefer bypassing official channels or programs for pharmaceutical waste collection probably because of their fear that these products might be manipulated or illicitly re-sold. Older individuals are also expected to have a wider and diverse social circle than younger people that would enable them to better select the individuals or place they see righteous to receive their unwanted medications. On the other hand, younger respondents might tend to avoid liability associated with “gifting” remaining medications especially if not examined or approved by a physician.

It is worth noting that some studies have concluded that in general, older respondents are more likely to return their unwanted pharmaceutical products within the framework of existing collection programs as compared to younger individuals, unlike the findings of Model 3. Nevertheless, these studies did not examine the effect of age on respondents’ preferences of different pharmaceutical collection programs as Model 3 has attempted to explain.

Table 10: Multinomial Logistic Regression (Model 3) of significant variables associated with respondents' preference of future household pharmaceutical waste management program

Preferred Choice of Future Household Pharmaceutical Waste Collection Program	Predictor Variable	B	S.E.*	EXP (B) / Adjusted Odds Ratio (OR)	90% C.I.**	*P*-value
Return to Pharmacy	Intercept	- 1.226	1.279	0.293	-	-
	Willing to participate in future household pharmaceutical waste collection program	1.253	1.056	3.501	(1.764 – 5.238)	0.235
	Think there should be awareness on proper management of unwanted medication at the residential level	- 1.061	0.600	0.346	(0.641 – 1.333)	**0.077**
	Age	- 0.008	0.011	0.991	(0.973 – 1.009)	0.444
Give to People in Need	Intercept	- 1.487	1.112	0.226	-	-
	Willing to participate in future household pharmaceutical waste collection program	- 1.451	0.540	0.234	(0.654 – 1.122)	**0.007**
	Think there should be awareness on proper management of unwanted medication at the residential level	- 1.020	0.735	0.360	(0.849 – 1.569)	0.165
	Age	0.033	0.014	1.034	(1.011 – 1.057)	**0.022**

***Reference Group*: Public Sector Intervention which includes: 1) Store in separate bags to be collected by municipality and 2) Store in separate bags and dispose of in pre-defined drop-off points**

**** Standard Error***

***** Confidence Interval***

Bold values are significant at P < 0.1

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Results revealed that the majority of respondents dispose of their unwanted medications, mainly through the domestic solid waste stream, irrespective of the product form. This finding may not seem shockingly surprising however; it is interesting to note that currently practiced disposal methods of unwanted pharmaceuticals do not differ with the form of product (solids/liquids/semi-solids), unlike a handful of studies that presented otherwise. Predominantly, pharmaceuticals are disposed of mainly due to product expiry and the completion of treatment. Little was reported on incidents that have been associated with the storage or disposal of pharmaceuticals. The bulk of respondents never received any awareness on proper disposal methods for pharmaceutical waste generated at the residential level. Awareness programs and physician accurate prescription were considered the best ways for reducing the quantities of unwanted leftover medications.

Household yearly expenditure on medications and respondents' belief in the need for pharmaceutical waste collection program increased the odds of respondents' willingness to participate in a future collection program. Respondents who stated a willingness to participate and those who thought there is a need for a legislation to regulate and organize the management of household pharmaceutical waste were more likely to participate in a future collection program for a fixed fee as compared to those who thought otherwise. Younger participants were found to state a higher willingness to participate and willingness to participate for a fixed fee compared to older participants. On another note, younger respondents were less likely to prefer the future collection

program option of "*Give to people in need*" as compared to the option of a "*Public sector intervention program*."

As for respondents who stated a willingness to participate and those who believed in the need for awareness programs on proper management of household pharmaceutical waste, these were in favor of a collection program managed by a governmental entity (Public sector intervention program) versus a pharmacy return program or giving them to people in need.

As noted earlier in this text, the methodology in selecting the study sample size was focused on obtaining a sample representative of the study area, ABA. Nevertheless, this sample might not be considered typical in its demographic and socio-economic characteristics when compared to Lebanon as a whole; therefore, statistics and associations derived from this study should not be used to generalize and extrapolate to the national scale. These findings should be used as baseline information specific to ABA and from which similar studies should be carried out in different geographic, demographic and socio-economic contexts in other urban and rural areas.

It is recommended that significant contributing factors that have been shown in this study to influence consumers' behavior, attitudes, and perceptions on the management of household pharmaceuticals be considered while identifying the steps needed to develop a nationally-applicable collection program. In order to stir and develop the understanding, knowledge and perception among consumers, awareness and guidance programs should be planned and delivered to the largest possible audience on the possible risks associated with improper domestic pharmaceutical waste management and the potential environmental and public health benefits from proper storage, collection and disposal practices. Factors that have shown to influence individuals'

willingness to participate in a future program and associated with it (household expenditure on medication, need for a future collection program and legislation) should be considered as potential key factors when planning for future interventions. For instance, as per the results revealed herein, individuals or households who tend to spend more than 1,500,000 LBP per year on medication (either due to prolonged consumption of medication for chronic illness treatments or who are not medically insured and reimbursed) might be more willing to take part in future programs, therefore, are expected to constitute a reasonable fraction of future program "users." On another hand, older individuals might not tend to participate in collection programs which might necessitate initiating an incentive mechanism (ex: reduced collection fees, discount on medication, credits for returns) to namely address the older population who have stated lower willingness to participate in future programs as compared to younger individuals, and who preferred giving their unwanted medication to people in need. Other factors that have shown to affect choice preferences of future collection programs should be adjusted for devising a future intervention program that is deemed successful and sustainable.

Common to any local or nationwide planning, coordination and collaboration among all concerned entities, namely the Ministry of Public Health, Environment, and Industry, and the Lebanese Orders of Physicians and Pharmacists, in addition to the pharmaceutical manufacturing sector, are crucial for developing national or local collection programs steered by the public sector. Physicians and pharmacists should focus on measures to reduce over-prescribing and over-dispensing of medications and emphasize on the need for patient compliance, in order to minimize the quantities of generated household pharmaceutical waste (source reduction). This, however, is

specifically challenging given the absence of any regulatory text that regulates and monitors physicians' prescriptions of medication. National pharmaceutical manufacturers are also advised to consider producing and packaging a list of common medications that are prescribed in different treatment regimens (dosages or dosage units).

Most importantly, a well-tailored future intervention program should be pilot tested for feasibility, accessibility, acceptability and practicality to its beneficiaries to ensure its success and sustainability.

Annexes

ANNEX 1

MEDICA: Lebanese Reference for Health Professionals (1999)
Classification of Pharmaceuticals

MEDICA Lebanese Reference for Health Professionals

Classification of Pharmaceutical Products (1999)

Therapeutic Categories (29)		
Allergology	Gastroenterology	Otology
Analgesics	Hematology	Parasitology
Anesthesiology	Hemostasis	Rhinology
Anti-Infectives	Hepatology	Rheumatology
Anti-Inflammatory	Immunology	Stomatology
Antispasmodics	Metabolism and Nutrition	Toxicology
Cardiology and Angiology	Neurology and Psychiatry	Urology and Nephrology
Diagnostic	Oncology	Dietetic Products
Endocrinology	Ophthalamology	-

Source: Status of Pharmaceutical Industry in Lebanon – Chapter 4 (Table 9; pg. 22)

ANNEX 2

Presidential Decree 13389 (2004) on Health Care Waste Management

تحديد انواع نفايات المؤسسات الصحية وكيفية تصريفها

مرسوم رقم 13389 – صادر في 2004/9/18

تعديل المرسوم رقم 8006 تاريخ 2002/6/11
(تحديد انواع نفايات المؤسسات الصحية وكيفية تصريفها)

ان رئيس الجمهورية،
بناء على الدستور،
بناء على القانون رقم 387 تاريخ 1994/11/4 (الاجازة للحكومة ابرام معاهدة بازل بشأن التحكم في حركة النفايات الخطرة عبر الحدود والتخلص منها)،
بناء على القانون رقم 216 تاريخ 1993/4/2 (احداث وزارة البيئة) المعدل بالقانون رقم 667 تاريخ 1997/12/29، لا سيما المادة الثانية منه،
بناء على القانون رقم 88/64 تاريخ 1988/8/12 (المحافظة على البيئة ضد التلوث من النفايات الضارة والمواد الخطرة) لا سيما المادة السابعة منه،
بناء على القانون الصادر بمرسوم رقم 8377 تاريخ 1961/12/30 (تنظيم وزارة الصحة العامة) وتعديلاته،
بناء على القانون الصادر بمرسوم رقم 9826 تاريخ 1962/6/22 والمعدل بالمرسوم الاشتراعي رقم 139 تاريخ 1983/9/16 (المستشفيات الخاصة)،
بناء على المرسوم رقم 8006 تاريخ 2002/6/11 (تحديد انواع نفايات المؤسسات الصحية وكيفية تصريفها)،
بناء على اقتراح وزراء البيئة، الصحة العامة، الزراعة، والصناعة،
وبعد استشارة مجلس شورى الدولة (الرأي رقم 2003/42 - 2004 تاريخ 2003/12/2)،
وبعد موافقة مجلس الوزراء في جلسته المنعقدة بتاريخ 2004/7/27،
يرسم ما يأتي:

الفصل الاول – احكام عامة

المادة 1- التعريفات

يفهم بالتعابير الواردة في هذا المرسوم ما يلي:
1- المؤسسات الصحية: هي المؤسسات الطبية العامة والخاصة بما فيها على سبيل التعداد وليس الحصر المستشفيات، المختبرات الطبية، العيادات الطبية بما فيها طب الاسنان، مختبرات الاسنان، المستوصفات، عيادات الاطباء البيطريين، مستودعات الادوية، الصيدليات، معاهد التعليم العالي ومراكز الابحاث.
2- نفايات المؤسسات الصحية:
كل النفايات التي تشملها اللائحتان في الملحقين 1 و2 من هذا المرسوم على سبيل التعداد لا الحصر، بالاضافة الى جميع النفايات التي تتولد في المؤسسات الصحية المعرفة في الفقرة 1 من هذه المادة.

3- النفايات الخطرة غير المعدية الناتجة عن المؤسسات الصحية: نفايات المؤسسات الصحية المذكورة في الملحق رقم 2 والتي تشملها لائحة النفايات الخطرة المنوه عنها في الملحق رقم 3.

4- النفايات الخطرة والمعدية الناتجة عن المؤسسات الصحية:
تعني النفايات التالية:
4-1 كل النفايات المتولدة من اقسام المصابين بالامراض المعدية، حيث هناك خطورة الانتقال الحيوي الهوائي (aerial biological transmission)، ومن اقسام العزل حيث يوجد مرضى يعانون من امراض تسببها عوامل مرضية حيوية.
4-2 النفايات المذكورة في الملحق رقم 1 من هذا المرسوم، والتي تتميز بواحدة على الاقل من الميزات التالية:
4-2-1 نفايات متولدة في اقسام عزل المرضى المصابين بأمراض معدية والتي كانت على تماس بأي مواد بيولوجية مبرزة أو مفرزة من المرضى المعزولين.
4-2-2 دم أو أي سائل حيوي آخر يحتوي على كمية مرئية من الدم.
4-2-3 مبرزات أو بول (faeces or urine)، اذا تحقق الطبيب المعالج بأن المريض الذي يعالجه يعاني من اي مرض يمكن انتقاله بواسطة هذه المبرزات.
4-2-4 سائل منوي (seminal fluid)، أو افرازات مهبلية (vaginal secretions)، أو سائل مخي شوكي (cerebrospinal fluid) أو سائل المفاصل المصلي (synovial fluid)، أو سائل جمعي (plural fluid)، أو سائل بريتوني (peritoneal fluid)، أو سائل تأموري (pericardial fluid) أو سائل امنيوني (amniotic fluid).
4-3 النفايات المتولدة عن النشاطات البيطرية التي تكون:
4-3-1 ملوثة بعوامل ممرضة (injurious pathogens) تصيب الانسان أو الحيوان.
4-3-2 على تماس مع أية سوائل حيوية مبرزة أو مفرزة، بحيث يرى الطبيب البيطري المختص خطرا من مرض قابل للانتقال بواسطة هذه السوائل.

5- النفايات غير الخطرة المماثلة للنفايات المنزلية الناتجة عن المؤسسات الصحية:
وهي النفايات غير المذكورة في الفقرتين «3» «4» من هذه المادة، والتي لا يؤدي التعامل بها الى اية خطورة على صحة الانسان وسلامة البيئة، والمرتبطة بالطريقة المعتمدة لادارة النفايات المنزلية وهي:
5-1 نفايات متولدة من مطابخ المؤسسات الصحية والتي تنتج عن تحضير وحفظ وتغليف وتعبئة الطعام وفائض الطعام باستثناء بقايا طعام المرضى المصابون بأمراض معدية حيث يتحقق الطبيب المعالج من قابلية انتقال هذه الامراض بواسطة هذه النفايات.
5-2 زجاج، ورق، كرتون، لدائن، معادن، كل انواع المغلفات، والمواد كبيرة الحجم وغير المغلفة التي يمكن التخلص منها عبر الجمع العادي أو المنفصل والتي يمكن اعادة استعمالها، أو تدويرها، أو استيرادها.
5-3 العوادم (inter materials)

5-4 نفايات الاقمشة التي ترمى بعد الاستعمال لمرة واحدة باستثناء الاقمشة الملوثة بالدماء أو البراز أو الافرازات.
5-5 نفايات من نشاطات البستنة (gardening) والتي تقع داخل المؤسسات الصحية.
5-6 نفايات اللصقات والجبس، الفوط الصحية، حفاضات الاطفال والبالغين.

6- نفايات المؤسسات الصحية، التي تحتاج الى طرق خاصة للادارة: وتشمل الفئات التالية:
6-1 الادوية منتهية الصلاحية وغير الصالحة للاستعمال وضمنا المواد المضادة لنمو السرطان المعدة للاستعمال البشري والبيطري.
6-2 الاعضاء غير المميزة والاجزاء التشريحية المذكورة في الملحق رقم 1 من هذا المرسوم.
6-3 الحيوانات المستعملة في التجارب والمذكورة في الملحق رقم 1 من هذا المرسوم.
6-4 الادوية وغيرها من المستحضرات المستعملة في العلاج النفسي.

7- التطهير (disinfection): الاختزال الحاد للجراثيم عبر استعمال مواد مطهرة.
8- التعقيم (sterilization):
القضاء على الجراثيم بطريقة تضمن الحد الادنى من مؤشر مستوى تأكيد التعقيم (sterility assurance level)) والذي لا يقل عن جزء من مليون نشاط ميكروبي (not lower than 10° microbial activity). يتم التعقيم وفق المقياس الدولي أيزو 11134: 94، الطبعة الاولى سنة 1994، وتعديلاته الصادر عن منظمة المقاييس الدولية، أو باستعمال طرق بديلة من شأنها أن تؤمن شروط تعقيم مشابهة لتلك المطلوبة في المقياس المذكور.

9- المعقمات (sterilizers): تجهيزات مخصصة حصرا لتعقيم نفايات المؤسسات الصحية الخطرة والمعدية وذات مواصفات تتلاءم مع المقياس الدولي رقم 11134 الطبعة الاولى سنة 1994 المذكور سابقا.

10- تقييم الأثر البيئي (Environmental Impact Assessement): تحديد وتقدير وتقييم آثار مشروع مقترح على البيئة وتعيين التدابير اللازمة للتخفيف من الآثار السلبية وزيادة الآثار الايجابية على البيئة والموارد الطبيعية وذلك قبل اعطاء القرار بالموافقة على المشروع أو رفضه.

المادة 2- الهدف ومجال التطبيق

يهدف هذا المرسوم الى تنظيم ادارة نفايات المؤسسات الصحية المعرف عنها في المادة الاولى من هذا المرسوم وذلك بغية الحفاظ على سلامة البيئة والحرص على المصلحة العامة حيث يجب ادارة نفايات المؤسسات الصحية بطريقة تخفف الخطر على الصحة وتشجع تخفيف تولدها واعادة استعمالها (reuse) وتدويرها (recycling) واستردادها (recovery)، وتنظم جمعها ونقلها والتخلص منها ضمن برنامج ادارة بيئية سليمة.

المادة 3- الآلية العامة للوصول الى الهدف

1- يجب على جميع الادارات والجهات المعنية والمؤسسات الصحية العامة والخاصة القيام بنشاطات تهدف الى اتخاذ اجراءات وقائية والى تخفيف تولد النفايات من خلال القيام بما يلي:
1-1 تنظيم دورات تدريبية للعاملين في المؤسسات الصحية حول الادارة السليمة لنفايات المؤسسات الصحية مع التركيز على تفادي تلامس المواد غير الملوثة بالمصادر المحتملة للتلوث، والتقليل من تولد النفايات الملوثة (المعدية).
1-2 الفرز الدقيق لنفايات المؤسسات الصحية المماثلة للنفايات المنزلية والتي تتولد في المؤسسات الصحية.
1-3 تنظيم توريد واستعمال الكواشف (reagents) والادوية بهدف تخفيف تولد النفايات الخطيرة غير المعدية الناتجة عن المؤسسات الصحية، وكذلك النفايات غير الخطرة الناتجة عن المؤسسات الصحية.
1-4 استعمال المستحضرات (products) والكواشف التي تحتوي على نسب قليلة من المواد الخطرة حيث يمكن اعتماد ذلك تقنيا.
1-5 استعمال المواد البلاستيكية التي لا تحتوي على الكلورين حيث يمكن اعتماد ذلك تقنيا.
1-6 تنظيم توريد المواد الغذائية بغية تخفيف تولد النفايات الناتجة عنها.
2- على المؤسسات الصحية ادارة نفاياتها وفق معايير السلامة والامان (health and safety requirements) والمبادئ التي يتضمنها هذا المرسوم.

المادة 4- تصنيف نفايات المؤسسات الصحية

تصنف نفايات المؤسسات الصحية وفقا للفئات الاربع التالية:
1- النفايات غير الخطرة المماثلة للنفايات المنزلية الناتجة عن المؤسسات الصحية (similar to municipal waste) والتي تتولد غالبا من الاقسام الادارية والمطبخية.
2- النفايات الخطرة والمعدية الناتجة عن المؤسسات الصحية (hazardous infections) والنفايات الخطرة غير المعدية الناتجة عن المؤسسات الصحية (hazardous non infectious)
3- النفايات التي تحتاج الى طرق خاصة للتخلص منها والناتجة عن المؤسسات الصحية (special waste).
4- النفايات المشعة (radioactive waste) المتولدة من المؤسسات الصحية والتي يخضع امر معالجتها الى تشريع خاص بها.

المادة 5- ضوابط مسؤولية ادارة نفايات المؤسسات الصحية

1- اذا كانت خدمات الاشخاص الصحيين العاملين في المؤسسات العامة والخاصة قد تمت خارج هذه المؤسسات، فيجب اعتماد نفس قواعد التنظيم في مكان تولد نفايات المؤسسات الصحية. يكون نقل هذه النفايات من المكان الذي تمت فيه تلك الخدمات الى المؤسسة الصحية على نفقة ومسؤولية القائم بتنفيذ الخدمة الصحية، الذي اتم الخدمات المذكورة، وذلك خلال 48 ساعة من تولد النفايات.
2- تعتبر نفايات المؤسسات الصحية المتولدة في غرف الجراحة اللامركزية التابعة للمؤسسة الصحية نفايات متولدة من قبل المؤسسة المرجعية، باستثناء تلك النفايات المماثلة للنفايات المنزلية التي سبق تعريفها.

المادة 6- فرز المواد الصالحة لاعادة الاستعمال، و/أو التدوير، و/أو الاسترداد من نفايات المؤسسات الصحية.
تلزم المؤسسات الصحية، من اجل تخفيف كمية نفاياتها بفرز المواد الصالحة لاعادة الاستعمال، و/أو التدوير، و/أو الاسترداد والقيام بالجمع المنفصل للفئات التالية من النفايات:
1- الحاويات الزجاجية المستعملة لحفظ الادوية والاغذية والمشروبات ومحاليل النقع، والمعلبات وابر الحقن، باستثناء حاويات محاليل الادوية المضادة للجراثيم، أوالحاويات الملوثة بوضوح بمواد حيوية، أو الحاويات المشعة، أو تلك المستعملة من قبل مرضى تحت العزل بسبب اصابتهم بأمراض معدية.
2- نفايات اخرى من غلافات زجاجية أو ورقية أو كرتونية أو بلاستيكية أو معدنية باستثناء النفايات الخطرة المعرف عنها في المادة الرابعة.
3- النفايات المعدنية غير الخطرة.
4- نفايات البستنة.
5- نفايات تحضير الاغذية الاتية من مطابخ المؤسسات الصحية.
6- سوائل فضية مستهلكة (silver depleted liquids) للتثبيت الاشعاعي.
7- زيوت طبية وزيوت وشحوم نباتية.
8- بطاريات وخلايا
9- احبار.
10- الزئبق (mercury waste)
11- افلام فوتوغرافية وصفائح.

المادة 7- النفايات السائلة الآتية من النشاطات الصحية.
يجوز ان يرمى البراز والبول والدم في اقنية المجاري التي تصب في شبكة مربوطة بمحطة معالجة للمياه المبتذلة شرط ان تكون قد خضعت لعملية معالجة أولية تخفف من انشطتها الحيوية وذلك وفقا للقيم الحدية (discharge limits) للمياه المبتذلة عند صرفها في شبكة الصرف الصحي المحددة من قبل وزارة البيئة بالقرار رقم 1/8 تاريخ 2001/1/30.
كما ان المياه المبتذلة الناتجة عن النفايات السائلة الاتية من النشاطات الصحية والتي لم تخضع لعملية معالجة لا يمكن استخدامها في ري المحاصيل الزراعية المستخدمة في طعام الانسان والحيوان.

الفصل الثاني – النفايات غير الخطرة المماثلة للنفايات المنزلية الناتجة عن المؤسسات الصحية

المادة 8- ادارة النفايات غير الخطرة المماثلة للنفايات المنزلية الناتجة عن المؤسسات الصحية
تخضع عملية ادارة النفايات غير الخطرة المماثلة للنفايات المنزلية الناتجة عن المؤسسات الصحية المعرفة في المادة الاولى، البند /5/ للطرق المعتمدة محليا لادارة النفايات المنزلية.

المادة 9- معالجة النفايات الخطرة والمعدية الناتجة عن المؤسسات الصحية
1- ان المؤسسات الصحية ملزمة بتعقيم النفايات الخطرة والمعدية المعرفة في المادة الاولى، البند «4» خلال 24 ساعة من تولدها، وبتجميعها في حاويات خاصة توصف لاحقا.
تعقم هذه النفايات وفق المواصفات التقنية الواردة في المقياس الدولي ايزو 94:11134 وتعديلاته الصادر عن منظمة المقاييس الدولية أو باستعمال طرق بديلة من شأنها ان تؤمن شروط تعقيم مشابهة لتلك المطلوبة في المقياس المذكور.
2- يتم تعقيم هذا النوع من النفايات في منشآت متخصصة مرخصة من وزارة البيئة بعد ان تكون هذه المنشآت قد حصلت على الموافقة على دراسة تقييم الاثر البيئي ضمن الشروط التي تحددها وزارة البيئة ويصدر هذا الترخيص البيئي بقرار من وزير البيئة مع مراعاة الاحكام القانونية المتعلقة بالمحلات المصنفة.
3- تحتاج منشآت تعقيم النفايات الواقعة في حدود المؤسسة الصحية الى ترخيص خاص، ويحق لها ان تعالج النفايات المتولدة في المركز ذاته كما يحق لها معالجة النفايات المتولدة من منشآت اخرى لامركزية مرتبطة به تنظيميا ووظيفيا.
4- تكون ادارة المؤسسة الصحية أو ادارة المؤسسة المسؤولة عن عمليات التعقيم مسؤولة تجاه القانون عن تنظيم وادارة قسم تعقيم النفايات وعن فعالية عمليات التعقيم في كل مراحلها.
5- يبلغ عن انشاء قسم تعقيم النفايات داخل المؤسسة الصحية رسميا الى السلطة المعنية في المنطقة أو المحافظة كي تتم اعمال الرقابة الدورية.
6- يجب على كل مؤسسة صحية الحصول على ترخيص لقسم التعقيم قبل البدء بتشغيله. اما بالنسبة للمنشآت القائمة والعاملة فيجب الحصول على الترخيص خلال مدة 120 يوما من دخول هذا المرسوم حيز التنفيذ. يعاد تجديد الترخيص كل سنة خلال او ثلاث سنوات ومن ثم كل سنتين وكذلك في كل مرة تتم فيها اعمال صيانة استثنائية وذلك وفق المعايير والمؤشرات المذكورة في الملحق رقم /4/ من هذا المرسوم.
7- يتم التحقق من فعالية عملية التعقيم بشهادة يصدرها مدير المؤسسة الصحية أو المكتب التقني للمركز الطبي.
8- يخضع قسم التعقيم لاعمال الرقابة الدورية التي تقوم بها السلطات الصحية والبيئية المختصة.
9- يجب على المؤسسة الصحية ايضا تأمين سجل بالوثائق مرقمة بالتسلسل وتتضمن المعلومات التالية:
أ – الرقم التعريفي لحلقة التعقيم (Sterilization cycle)
ب– الكميات اليومية ونوع النفايات التي خضعت لعمليات التعقيم.
ت– تاريخ عملية التعقيم.
تحفظ الوثائق لمدة خمس سنوات في المؤسسة الصحية على ان تكون متاحة للكشف عند الطلب من قبل السلطات الصحية والبيئية المختصة.

المادة 10- التخزين المؤقت للنفايات الخطرة والمعدية الناتجة عن المؤسسات الصحية وجمعها ونقلها قبل التعقيم.
1- بغية ضمان حماية الصحة وسلامة البيئة تستعمل غلافات مرنة (flexible packaging) مميزة باللون ومناسبة تستعمل لمرة واحدة فقط ممكن اغلاقها بإحكام وتحمل العبارة التالية:

«نفايات خطرة ومعدية» بالاضافة الى رمز الخطورة الحيوية (bioligical hazard) المشار اليه في الملحق رقم /5/ وذلك خلال التخزين المؤقت لهذه النفايات وحركتها داخل المؤسسة الصحية وجمعها ونقلها.
وفي حال احتواء هذه النفايات على مواد حادة أو قاطعة يحتفظ بها في مستوعب مصنوع من البلاستيك (sharps box) صلب عازل ومناسب يغلق بإحكام بطريقة لا يمكن فتحها ويستعمل لمرة واحدة ويحمل العبارة التالية «نفايات خطرة ومعدية تحتوي على مواد حادة» يوضب هذا المستوعب في مستوعب خارجي اخر صلب قابل للاستعمال لمرات عدة بعد اخضاعه لعمليات تعقيم جيدة بعد كل استعمال. يجب ان يحوي هذا المستوعب ملصقا مكتوب عليه العبارة التالية: «نفايات خطرة ومعدية».

2- يجب ان يكون مستوعب التوضيب الخارجي المشار اليه في البند الاول مقاوم للصدمات ومضاد للهريان والتمزق لتفادي وقوع الحوادث اثناء عملية النقل والحركة.
يجب ان يكون لون المستوعب الخارجي مميزا عن المستوعبات الاخرى التي تحتوي على انواع اخرى من النفايات.

3- فيما عدا البندين الاول والثاني من هذه المادة، تخضع عملية التخزين المؤقت للنفايات خطرة والمعدية الناتجة عن المؤسسات الصحية وعمليات وضعها في المستوعبات وجمعها ونقلها للمعايير العامة والقوانين المتعلقة بالنفايات الخطرة المعرفة في الاطار التشريعي العام للنفايات الخطرة.

المادة 11- التخزين المؤقت للنفايات المعقمة الناتجة عن المؤسسات الصحية وجمعها ونقلها، بعد التعقيم.

1- تجمع النفايات المعقمة الناتجة عن المؤسسات الصحية، التي تتوافق مع احكام هذا المرسوم. وتنقل بشكل منفصل عن النفايات المنزلية، وتحفظ في مستوعبات واجهزة معرفة بوضوح ومرخصة من وزارة البيئة. من اجل ضمان حماية الصحة وسلامة البيئة، يجب ان تتم عمليات التخزين المؤقت للنفايات المعقمة وحركتها الداخلية ضمن حدود المؤسسة الصحية، وجمعها ونقلها، باستعمال مستوعبات لينة تستخدم لمرة واحدة وتحمل لونا يمكن تمييزه بسهولة عن المستوعبات المستعملة للنفايات المنزلية وغيرها من نفايات المؤسسات الصحية وخاصة غير المعقمة.
يجب ان تحمل هذه المستوعبات العبارة التالية «نفايات معقمة»، اضافة الى تاريخ التعقيم.

المادة 12- التخلص النهائي من النفايات الخطرة والمعدية الناتجة عن المؤسسات الصحية، بعد التعقيم.

1- بعد تعقيم النفايات الخطرة والمعدية باستخدام طرق معترف بها ومرخص لها وفق احكام هذا المرسوم، يمكن التخلص منها بنفس طرق التخلص من النفايات المنزلية شرط الامتناع عن رميها في المستوعبات العامة المعدة لجمع النفايات المنزلية، بل نقلها مباشرة من موقع التعقيم الى المطمر الصحي الشرعي الخاص باستقبال النفايات المنزلية وفق سجلات بالكميات ووثائق استلام وتسليم تحفظ لدى الادارة.

2- في حال الاضطرار لتخزينها في موقع التعقيم قبل نقلها مباشرة الى موقع التخلص النهائي منها وجب تنفيذ احكام المادة الحادية عشرة من هذا المرسوم.

الفصل الرابع – النفايات الخطرة غير المعدية الناتجة عن المؤسسات الصحية

المادة 13- ادارة النفايات الخطرة غير المعدية الناتجة عن المؤسسات الصحية
تخضع عملية ادارة النفايات الخطرة غير المعدية الناتجة عن المؤسسات الصحية في المادة الاولى، الفقرة «3» للمعايير العامة المتعلقة بالنفايات الخطرة المعرفة في الاطار التشريعي العام للنفايات الخطرة.

الفصل الخامس – نفايات المؤسسات الصحية التي تحتاج الى عملية خاصة للتخلص منها

المادة 14- تصريف نفايات المؤسسات الصحية التي تحتاج الى عملية خاصة للتخلص منها.

1- يجب ان يتم التخلص من النفايات المذكورة في المادة الاولى، البند «6»، في منشآت متخصصة بالترميد أو مطامر صحية أو باستعمال تقنيات بديلة تثبت فعاليتها لمعالجة هذا النوع من النفايات، على ان تكون مرخصة من وزارة البيئة ومتخصصة ومحصنة تبنى وفق مواصفات خاصة لهذا النوع من النفايات ومنفصلة عن اماكن التخلص من اي نوع اخر من النفايات. يجب ان تجهز هذه المنشآت بنظام تقني مناسب لهذا النوع من النفايات من شأنه ان يضمن حماية الصحة وسلامة البيئة، مع الانتباه الشديد لتفادي حصول اي تماس مباشر مع العمال ومن اجل تفادي تسرب هذه النفايات أو سقوطها خارج الاماكن المخصصة لها.

2- يجب ان تدار النفايات المذكورة في المادة الاولى البند 6-2 والتي تحتاج لعملية تخلص خاصة وفقا لنفس السبل المعتمدة لادارة النفايات الطبية الخطرة والمعدية مع الزامية التعقيم قبل اي ادارة لها.

الفصل السادس – التدابير النهائية

المادة 15- الشخص المسؤول عن المؤسسة الصحية.
ان ضمانة مراقبة التدابير المذكورة في هذا المرسوم تقع على عاتق الشخص المسؤول عن المؤسسة الصحية العامة أو الخاصة.

المادة 16- تلغى النصوص المخالفة لاحكام هذا المرسوم أو التي لا تأتلف مع مضمونه.

المادة 17- ينشر هذا المرسوم ويبلغ حيث تدعو الحاجة.

بعبدا في 18 أيلول 2004
الامضاء: اميل لحود
صدر عن رئيس الجمهورية

رئيس مجلس الوزراء
الامضاء: رفيق الحريري

وزير البيئة بالوكالة
الامضاء: ميشال موسى

وزير الصحة العامة
الامضاء: سليمان فرنجية

وزير الزراعة
الامضاء: علي حسن خليل

وزير الصناعة
الامضاء: الياس سكاف

ملاحق

الملحق رقم 1
انواع نفايات المؤسسات الصحية وتصنيفها

التركيب	نوع النفايات	الفئة
نفايات محتملة انتقال العدوى	ادوات الطبابة (شاش، دكات، عصبة، اسار، انابيب)....	خطرة ومعدية
	اكياس لنقل الدم، مناغرة بولية (urine stomy التغذية بالحقن)	خطرة ومعدية
	انابيب التهاب الوريد (tubes of phleboclysis)	خطرة ومعدية
	الادوات الاوتوماتيكية المستخدمة لمرة واحدة فقط في التقطيب (suture)	خطرة ومعدية
	الاسنان والاجزاء التشريحية الصغيرة غير المميزة	خطرة ومعدية
	الاشرطة اللاصقة والعصبات (plasters and bandages)	خطرة ومعدية
	الاوردة الملتهبة المعدية (infected phleboclysis)	خطرة ومعدية
	الاوعية الفارغة	خطرة ومعدية
	الاوعية الفارغة والتي احتوت لقاحات مستضدة حية (antigen live vaccins)	خطرة ومعدية
	الحيوانات المستعملة في التجارب المخبرية ومحتويات اقفاصها	خطرة ومعدية
	الرفادات الصحية (sanitary pads) رفادات السلس (Pediatric napkins) ومناديل الاطفال (incontinence pads)	خطرة ومعدية
	القثطار (مثالي، وريدي، شرياني، ونزح الجبنة ...)، التحويلة والمجس والمسبار Cathers (vesical, venous, arterial, for pleural drainages), Shunts, sounds	خطرة ومعدية
	القفازات ذات الاستعمال لمرة واحدة فقط (disposable gloves)	خطرة ومعدية
	القني والنزح cannulus and drainages	خطرة ومعدية
	اللصقات البصرية (ocular sticks) غير المعقمة	خطرة ومعدية
	المراكن ذات الاستعمال لمرة واحدة فقط والمستخدمة في الخزع الرحمي (disposable cuvettes for endometrial biopsy)	خطرة ومعدية
	المسبار أو المجس المستقيمي أو المعوي (gastral rectal and sounds)	خطرة ومعدية
	المسبار والمجس الصغير للشفط القصبيي (little sounds for nasografic for broncho aspiration, oxygen therapy)	خطرة ومعدية
	المنظار المستخدم لمرة واحدة فقط (auricular throwaway speculum)	خطرة ومعدية
	المواد ذات الاستعمال لمرة واحدة فقط: القناني، الانابيب الماصة، انابيب الاختبار، القماش: الاقنعة الصغيرة، النظارات الشراشف، غطاء الاصابع، غطاء الاحذية، المرايل البيضاء	خطرة ومعدية
	دارات للدوران خارج الجس (circuits for extra corporal circulation)	خطرة ومعدية

	فرشاة القثطار المستخدم للرسم الخليوي ,Brushes catheters for cyctologic drawing	خطرة ومعدية
	فلاتر الديال، فلاتر عوادم من خزان سحب الدخان (filter dialysis & exhausted filters from hoods)	خطرة ومعدية
	لصقات العين (TNT ophthalmic sticks)	خطرة ومعدية
	مجموعة المصل	خطرة ومعدية
	منظار رحمي Vaginal Speculum	خطرة ومعدية
	نفايات الوجبات الغذائية المتولدة من اقسام الامراض المعدية	خطرة ومعدية
	نفايات من غرف العناية الطبية بالاسنان	خطرة ومعدية
	القطع القطنية المستخدمة في عملية منظار المهبل، عنق الرحم واختبار بنانيكولاو (colposcopy and pap test)	خطرة ومعدية
	قمامة (rubbish/ garbage)	مماثلة للنفايات المنزلية
نفايات من الابحاث والتشخيص من	طبق بتري (Petri dish)، اوساط الزرع (Culture media) وغيرها من الدفاعات المستخدمة في الميكروبيولوجي وملوثة	ادارة خاصة
من دراسات البكتيريا نفايات مماثلة للنفايات المنزلية	بعوامل مرضية (pathogenic agents) نفايات من تحضير الوجبات الغذائية	مماثلة للنفايات المنزلة
نفايات المواد الحادة	الابر (needles) المستخدمة لمرة واحدة فقط، المحقنات (syringes) الشفرات، قطع الزجاج، سنانات البصمات (finger pricking lancets) ابر القني (venflon cannulus needles)، الحلاقات والمبضع (bistouries)	خطرة معدية
نفايات المواد الحادة غير المستعملة نفايات التشريح	الابر، المحقنات، الشفرات، الحلاقات (shavers) الاعضاء وغيرها من نفايات التشريح غير المميزة textus, organs and non recognizable) (anatomic parts	ادارة خاصة/ صناعية عادية ادارة خاصة
الاوعية الفارغة	أ- اوعية الادوية الفارغة، الادوية البيطرية، المنتجات المحتوية على مساحيق مطهرة، الادوية البيطرية المصنعة والجاهزة، اللقاحات المستضدة غير الناشطة، محاليل الامصال	- ادارة خاصة
	ب- خليط الغذاء المستخدم كدواء، الغذاء والشراب	**- مماثل للنفايات المنزلية**
نفايات الادوية المواد الكيميائية المتلفة ونفايات	الادوية المنتهية الصلاحية، الادوية المرتجعة من اجنحة المرضى الادوية منتهية الصلاحية، المواد الكيميائية المتلفة من عيادات الطب البيطري	ادارة خاصة/ خطرة ادارة خاصة/ خطرة

الادوية من الخدمة
البيطرية

الملحق رقم 2
لائحة بالنفايات الخطرة غير المعدية الناتجة عن المؤسسات الصحية

البطاريات والمراكمات المستعملة (spent batteries and accumulators)
الزيوت المستعملة (spent oils)
الكواشف المذيبة (solvent reagents)
الكواشف غير العضوية النشطة الصلبة (inorganic solid active reagents)
المثبتات (fixers)
المحاليل المائية العضوية (water organic solutions)
المحاليل المحتوية على معادن ثقيلة (solutions containing heavy metals)
المحاليل والكواشف الحمضية (acid solutions)
المحاليل والكواشف القلوية (alkaline solutions)
النفايات الملوثة بالزئبق
خليط المذيبات العضوية (organic solvent mix)
خليط المذيبات المهلجنة وغير المهلجنة (halogenated and not halogenated solvent mis)
فلاتر الاستشراب الرملية وغيرها من المواد المماثلة (chromatography filtration, sand)
مظهر الافلام (film developers)
مواد الحرير الصخري العازلة - الاسبستوس (insulating asbestos material)
نظام الانارة بالغاز (gas lighting systems)

ملحق رقم 3
قائمة الخواص الخطرة

المواد القابلة للانفجار(explosives)	المادة القابلة للانفجار هي مادة أو نفاية (أو مزيج من مواد أو نفايات) صلبة أو سائلة قادرة بذاتها على ان تنتج بواسطة تفاعل كيميائي غازي على درجة من الحرارة وعلى قدر من الضغط والسرعة تؤدي الى الحاق الضرر بالوسط المحيط.
المواد أو النفايات المعرضة للاحتراق التلقائي (liable to spontaneous combustion)	المواد أو النفايات المعرضة للسخونة التلقائية في الظروف العادية التي تواجه اثناء النقل، أو المعرضة للسخونة عند ملامسة الهواء، فتكون عندئذ قابلة للاشتعال.
المواد السامة ذات الآثار الحادة poisonous-acute	المواد أو النفايات القابلة للتسبب في الوفاة أو الضرر الخطير أو الاضرار بصحة الانسان اذا ابتلعت أو استنشقت أو لامست الجلد.
المواد التي تطلق غازات سامة عند ملامسة الهواء أو الماء	المواد أو النفايات التي يمكن ان تطلق غازات سامة بكميات خطيرة عند تفاعلها مع الهواء أو الماء.
البروكسيدات العضوية organic peroxide	المواد العضوية أو النفايات التي تحتوي على البنية ثنائية التكافؤ أ - أ هي مواد غير مستقرة حراريا وقد تتعرض لتحلل متسارع ذاتيا طارد للحرارة.
السوائل القابلة للاشتعال flammable liquids	السوائل القابلة للاشتعال هي سوائل، أو مزائج من سوائل، أو سوائل تحتوي على مواد صلبة من محلول أو مستعلق (مثل انواع الطلاء والورنيش وطلاء اللك) تطلق بخارا قابلا

	للاشتعال في درجات حرارة لا تزيد عن 60.5م في اختبار الكأس المغلق (closed cup test) أو لا تزيد عن 65.6م في اختبار الكأس المفتوح (open cup test)
المؤكسدات (oxidizing)	هي مواد أو نفايات قد لا تكون هي نفسها قابلة بالضرورة للاحتراق، ولكنها بصفة عامة قد تسبب أو تسهم في احراق المواد الاخرى عن طريق انتاج الاوكسيجين.
المواد أو النفايات التي تطلق غازات قابلة للاشتعال عند ملامسة الماء	المواد أو النفايات المعرضة لأن تصبح قابلة للاشتعال بكميات خطيرة عند تفاعلها مع الماء.
المواد الاكالة corrosives	المواد أو النفايات التي تسبب، عن طريق تفاعل كيميائي، ضررا جسيما قد يمكن أو لا يمكن علاجه عند ملامستها للانسجة الحية، أو التي قد تؤدي في حال تسربها، الى الحاق ضرر اساسي ببضائع اخرى أو بوسائل النقل أو حتى الى تدميرها، وقد تسبب ايضا مخاطر اخرى.
المواد السامة (ذات الآثار المتأخرة أوالمزمنة toxic) (delayed or chronic	المواد أو النفايات التي قد ينطوي استنشاقها أو ابتلاعها أو نفاذها من الجلد على آثار متأخرة أو مزمنة، من بينها التسبب في السرطان
المواد السامة للبيئة (ecotoxic)	المواد او النفايات التي يسبب أو قد يسبب اطلاقها اضرار فورية أو متأخرة للبيئة بفعل تراكمها في الكائنات الحية و/أو آثارها السامة على النظم الاحيائية.
المواد الصلبة القابلة للاشتعال	هي المواد الصلبة أو النفايات الصلبة غير تلك المصنفة متفجرات، والتي تكون قابلة للاحتراق تحت ظروف تواجه خلال عمليات النقل أو التي قد تسبب أو تسهم، عن طريق الاحتكاك، في
(fammable solids) اندلاع حريق المواد المعدية Infectious substances	المواد أو النفايات المحتوية على كائنات دقيقة قادرة على الحياة أو تكسيناتها المعروفة بتسبيبها للمرض لدى الحيوان أو الانسان أو المشتبه في تسببها له.
مواد اخرى	المواد القادرة، بوسيلة ما، بعد التخلص منها، على انتاج مادة اخرى، ومن امثلتها المواد التي قد تنتج عن الرشح وتكون متميزة بأي من الخواص المدرجة اعلاه.

الملحق رقم 4 - التثبت والتحقق من فعالية نظام وعملية التعقيم

يجب ان يتم التثبت من نظام التعقيم وفقا للمعايير والمؤشرات المذكورة في المقياس الدولي 94:11134 وتعديلاته الصادر عن منظمة المقاييس الدولية وتعديلاته وملحقاته.
يجب ان يتم التحقق من فعالية نظام وعملية التعقيم خلال الادارة العادية، كل ثلاثة اشهر، أو كل 100 دورة من استعمال هذا النظام على الأكثر. اذا كان معدل استعمال هذا النظام كبيرا يتم التحقق من فعاليته باستعمال المؤشرات الحيوية المتلائمة مع نظام التعقيم المعتمد.
تستعمل هذه المؤشرات الحيوية على الاقل مرة كل 200 لتر من الحجم المستخدم لغرفة التعقيم.
يجب استعمال 3 مؤشرات حيوية على الاقل.
يجب ان تتم التدقيقات المذكورة اعلاه، تحت رقابة المدير المسؤول عن قسم التعقيم في المؤسسة الصحية.

في حال كان نظام التعقيم موضوعا خارج المؤسسة الصحية يجب ان تتم التدقيقات تحت رقابة الجهاز الفني المسؤول عن هذه المنشآت.
يجب ان يحتفظ بالوثائق المتصلة بسجلات العمل ومؤشرات النظام بها لمدة 5 سنوات على الاقل وان تكون متاحة للكشف عند الطلب من قبل السلطات المختصة.

ANNEX 3

Ministry of Public Health Decision N^{o} 445/1(2012)

Management of Expired Pharmaceuticals in Lebanon

I.R

الجمهورية اللبنانية
وزارة الصحة العامة

الوزير
رقم المحفوظات: ع/ص/٢٠١٢/١٦

بيروت في: ١٠ نيسان ٢٠١٢

قرار رقم ٤٤٥/١

يتعلق بمعالجة الأدوية المنتهية الصلاحية في لبنان

ان وزير الصحة العامة،

بناء على المرسوم رقم ٥٨١٨ تاريخ ٢٠١١/٦/١٣ (تشكيل الحكومة)،

بناء على قانون مزاولة مهنة الصيدلة في لبنان رقم ٣٦٧ تاريخ ١٩٩٤/٨/١،

بناء على المرسوم رقم ١٣٣٨٩ تاريخ ٢٠٠٤/٩/١٨ (تعديل المرسوم رقم ٨٠٠٦ تاريخ ٢٠٠٢/٦/١١)،

بناء على اقتراح مدير عام وزارة الصحة العامة،

يقرر ما يأتي

المادة الأولى: يتوجب على الصيدليات ومستودعات الأدوية والمستوصفات وجميع المؤسسات الخاصة والرسمية التي يتواجد لديها أدوية ومستحضرات صيدلانية أخرى، إبلاغ وزارة الصحة العامة/ دائرة التفتيش الصيدلي عن كل كمية فور إنتهاء صلاحيتها.

المادة الثانية: يقوم التفتيش الصيدلي بالكشف على هذه المواد ووضعها في مكان بعيد عن التداول وإعداد لوائح بمضمونها تبين نوعها، كميتها وتاريخ انتهاء صلاحيتها.

المادة الثالثة: يتم نقل هذه المستحضرات للتجميع في مخزن مركزي تابع لوزارة البيئة تحت إشراف دائرة التفتيش الصيدلي وعلى نفقة صاحب العلاقة.

المادة الرابعة: تقوم وزارة البيئة بفرز هذه المواد ومعالجتها وفقاً للمادة الرابعة عشر من المرسوم رقم ١٣٣٨٩ تاريخ ٢٠٠٤/٩/١٨.

المادة الخامسة: يبلغ هذا القرار حيث تدعو الحاجة.

وزير الصحة العامة

علي حسن خليل

يبلغ:
- المديرية العامة لوزارة الصحة
- المديرية العامة لوزارة البيئة
- نقابة مستوردي الأدوية/ نقابة صيادلة لبنان
- تجمع مصنعي الأدوية في لبنان
- نقابة المستشفيات/نقابة الأطباء
- مديرية الوقاية الصحية
- مصلحة الصيدلة والدوائر التابعة لها
- مصالح الصحة في المحافظات وأطباء الأقضية
- المستوصفات بواسطة أطباء الأقضية
- المحفوظات.

المتحف-بناية حسين منصور - بيروت لبنان ,هاتف: ٦١٥٧١٦ - ٦١٥٧١٧ - ٦١٥٧١٨ -١- ٩٦١ - فاكس: ٦١٥٠٢٠ - ١ - ٩٦١- البريد الالكتروني: minister@public-health.gov.lb

ANNEX 4

Institutional Review Board IRB–Approved

Informed Consent and Questionnaire

موافقة (شفهيّة) للإشتراك في البحث

حضرة السيد / السيدة؛

نطلب منك المشاركة في دراسة بحثية علمية والتي تنطبق فقط على منطقة بيروت الإدارية، حيث يتم إجراء الدراسة. يرجى قراءة المعلومات الواردة أدناه، وعدم التردد في طرح أية أسئلة قد تكون لديك.

تشمل الأهداف الرئيسية للدراسة البحث في الطرق /الأساليب والمواقف تجاه إدارة النفايات الصيدلانية (نفايات الأدوية) على المستوى المنزلي؛ التحقيق في أنواع وكميات النفايات الصيدلانية (نفايات الأدوية) الأكثر استخداما على نطاق واسع، واستكشاف الآثار الصحية العامة المحتملة الناجمة عن سوء إدارة النفايات الصيدلانية (نفايات الأدوية) على المستوى المنزلي.

ينطوي العمل على دراسة بحثية. يهدف المسح لأغراض أكاديمية فقط. سوف يتم اختيار المشاركين في المسح الدراسي بشكل عشوائي ما زال مقيما في منطقة بيروت الإدارية وسيتم الاتصال بك مباشرة.. وللحفاظ على المعلومات المقدمة من قبل المستجيبين بشكل آمن ومجهول المصدر، يمتنع الباحثين المدربين عن استخدام أي أسئلة قد تحدد او تكشف بشكل مباشر أو غير مباشر عن هويتك أو معلوماتك الشخصية. لن يطلب اسمك على الاستمارة وذلك للحفاظ على السرية الخاصة بك. لا توجد مخاطر أو منافع مباشرة أو غير مباشرة من المشاركة في هذه الدراسة البحثية. سيتم جمع البيانات والإبلاغ عنها بشكل مجموع. قد يتم نشر النتائج والاستنتاجات من هذه الدراسة واستخدامها في العروض التقديمية الأكاديمية.

الوقت المقدّر لإتمام هذه الدراسة يقارب حوالى ٢٠ دقيقة. مشاركتك هو طوعي تماما وإذا قررت المشاركة الآن، باستطاعتك تغيير رأيك والتوقف في أي وقت. ألأمتناع عن المشاركة لن يؤثر على علاقتك بلجامعة ألأميركية او المركز الطبي.

لالسجل الخاص بك أو أي استفسار آخر، سوف يتم إعطاء نسخة من هذا النموذج الذي ينطبق فقط على منطقة بيروت الإدارية، حيث يتم إجراء الدراسة.

نود أن نشكرك مسبقا على مشاركتك. في حال كانت لديك أية أسئلة أو إيضاحات أو تعليقات فيما يخص هذه الدراسة، لا تتردد في الاتصال بنا على العناوين التالية:

د. مي مسعود
الجامعة الأميركية في بيروت
كلية العلوم الصحية
قسم الصحة البيئية
البريد: 11-0236
هاتف: 01-350000,Ext 4628
البريد الألكتروني: maymassoud@aub.edu.lb

غيدا الشامي
الجامعة الأميركية في بيروت
كلية العلوم الصحية
برنامج الصحة البيئية
هاتف: 03-464304
البريد الألكتروني:

في حال وجود أي مخاوف أو شكاوى، يرجى الاتصال بمجلس المراجعة المؤسساتي (IRB) في الجامعة الأميركية في بيروت على العنوان التالي:

هاتف: 01-350000, Ext 5445
irb@aub.edu.lb

البريد الألكتروني:

موافقة الباحث:

لقد شرحت بالتفصيل للمشترك في المسح _____ (اسم المشترك) طبيعته ومجرياته وتأثيراته السلبية. ولقد أجبت على كل أسئلته بوضوح على خير ما أستطيع. وقد أعطي الوقت الكافي للتفكير بالمشاركة وإبداء موافقته.

_____ _____

إسم الباحث **توقيع الباحث**

_____

التاريخ والتوقيت

Institutional Review Board
American University of Beirut
19 NOV 2013
APPROVED

Interviewer Initials				Questionnaire Serial #		
Interviewer #						

معلومات حول الاستمارة		
المنطقة		
اسم الشارع		
رقم الشارع		

ملاحظات: _____

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول استهلاك الأدوية على المستوى المنزلي			
HH00	هل تعاني حاليًا من اي مشكلة صحّية؟	1	نعم
		0	لا
		2	لا جواب
HH01	ما هي حالتك الصحّية / الطبيّة؟	1	مرض القلب
		2	داء السكري
		3	ارتفاع ضغط الدّم
		4	مرض كلوي
		5	داء المفاصل
		6	زكام / انفلونزا
		7	إلتهاب
		8	ما بعد الجراحة
		9	حساسيّة
		10	إضطرابات هرمونيّة
		11	إختلال نفسي
		12	غيره:
	إختر كل ما هو مناسب	13	لا جواب
HH02	هل تأخذ أدوية لهذه الحالة الصحّية / الطبيّة لديك؟	1	نعم
		2	لا (انتقل الى WM00؟)
		3	لا أعرف
HH03	ما انواع الأدوية التي تأخذها للحالة الصحّية / الطبيّة لديك؟	1	منظمات دهنيّة
		2	منظمات لضغط الدّم
		3	مضادات إلتهاب
		4	مضادات إلتهاب المفاصل او الروماتيزم
		5	مضادات للحساسيّة
		6	مضادات الإكتئاب
		7	مسكنات الألم
		8	منظمات هرمونيّة
	إختر كل ما هو مناسب	9	غيره:
HH04	ما هي مدّة المعالجة بواسطة هذه الأدوية؟	1	قصيرة الأمد
		2	طويلة الأمد (مدى الحياة)

رمزالسؤال	السؤال	رمز الجواب	الجواب
معلومات حول استهلاك الأدوية على المستوى المنزلي			
		3	غيره: _____
		99	لا اعرف
HH05	منذ متى وانت تأخذ هذه الأدوية؟	1	اقل من اسبوع واحد (١)
		2	اقل من ثلاثة اشهر
		3	ستة اشهر
		4	اكثر من سنة
		5	لا اذكر
HH06	بناء على وصفة / نصيحة من تأخذ / تشتري هذه الأدوية؟	1	الطبيب
		2	الصيدلي
		3	الانترنت
		4	التلفيزيون / الراديو
		5	صديق
		6	غيره:
HH07	ما هي الكميّة المستهلكة شهريّا (عدد الأقراص في كل علبة) من كل نوع دواء؟ *كرّر لكل دواء*		دواء ١ # من حبوب لكل علبة/ مل لكل قارورة # من علب / قوارير
			دواء ٢ # من حبوب لكل علبة/ مل لكل قارورة # من علب / قوارير
HH08	هل لدى أحد افراد الاسرة حالة صحيّة / طبيّة؟	1	نعم
		0	لا (إنتقل الى HH17)
		2	لا جواب
HH09	ما هي حالتك الصحيّة / الطبيّة؟	1	مرض القلب والاوعية الدمويّة
		2	داء السكري
		3	ارتفاع ضغط الدم
		4	مرض كلوي
		5	داء المفاصل
		6	زكام / انفلونزا
		7	إلتهاب
		8	ما بعد الجراحة
		9	حساسيّة
		10	إضطرابات هرمونيّة
		11	إضطرابات نفسيّة
		12	غيره:
HH10	هل يأخذ / تأخذ أدوية لهذه الحالة الصحيّة / الطبيّة لديهم؟	١	نعم
		0	لا
HH11	ما انواع الأدوية التي يأخذها / تأخذها للحالة الصحيّة / الطبيّة لديهم؟	1	منظمات دهنيّة
		2	منظمات لضغط الدم
		3	مضادات إلتهاب
		4	مضادات إلتهاب المفاصل او الروماتيزم
		5	مضادات للحساسيّة
		6	مضادات الإكتئاب
		7	مسكنات الألم
		8	منظمات هرمونيّة

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول استهلاك الأدوية على المستوى المنزلي			
		9	غيره:
HH12	ما هي مدة المعالجة بواسطة هذه الأدوية؟	1	قصيرة الأمد
		2	طويلة الأمد (مدى الحياة)
		3	غيره:
		4	لا اعرف
HH13	منذ متى وهم يأخذوا هذه الأدوية؟	1	اقل من اسبوع واحد (١)
		2	اقل من ثلاثة اشهر
		3	ستة اشهر
		4	اكثر من ستة
		5	لا اذكر
HH14	بناء على وصفة / نصيحة من اخذوا هذه الأدوية؟	1	الطبيب
		2	الصيدلي
		3	الانترنت
		4	التلفيزيون / الراديو
		5	صديق
		6	غيره:
HH15	ما هي الكمية المستهلكة شهريا (عدد الأقراص في كل علبة) من كل نوع دواء؟ *كرّر لكل دواء*		دواء ١ _____# من حبوب لكل علبة/ مل لكل قارورة _____# من علب / قوارير
			دواء ٢ _____# من حبوب لكل علبة/ مل لكل قارورة _____# من علب / قوارير
HH16	ما هي الانواع الاخرى من الادوية التي تحتفظ بها في المنزل (ما عدا الادوية لمعالجة الحالة الصحية الحالية)؟	1	مطهرات
		2	مراهم للحروق
		3	مسكنات
		4	مكملات غذائية
		5	معالجات لمشاكل الجهاز الهضمي (مسهلات – مضادات للإسهال...)
		6	غيره: _____
HH17	بناء على وصفة / نصيحة من اخذوا هذه الأدوية؟	1	الطبيب
		2	الصيدلي
		3	الانترنت
		4	التلفيزيون / الراديو
		5	صديق
		6	غيره: _____

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول ادارة نفايات الادوية على المستوى المنزلي			
WM00	هل لديك من اي ادوية متبقية / غير المستعملة / منتهية الصلاحيّة؟	1	نعم
		0	لا
		99	لا ادري
WM01	هل عادة تحتفظ / تخزّن هذه الادوية المتبقية / غير المستعملة / منتهية الصلاحيّة ؟	1	نعم
		0	لا (إنتقل الىWM04)
WM02	اين تحتفظ / تخزّن هذه الادوية غير المرغوب فيها؟	1	المطبخ
		2	الحمّام
		3	غرفة النّوم
		4	خزانة الادوية
		5	غرفة الجلوس
		6	غيره:
WM03	لماذا تحتفظ / تخزّن هذه الادوية غير المرغوب فيها؟	1	انتقلت الى دواء آخر
		2	عوارض جانبيّة
		3	معالجة الحالة الصّحيّة
		4	الادوية المتبقية ما بعد العلاج
		5	انتهاء مدّة الصّلاحيّة
WM04	هل تتخلّص من أيّة ادوية غير مرغوب فيها؟	1	نعم
		0	لا (إنتقل الىWM04؟)
WM05	متى تتخلّص عادة من الادوية؟	1	عند انتهاء العلاج
		2	عند انتهاء مدة صلاحيّتها
		3	عندما تتلف
		4	عند معالجة / زوال الحالة الصّحيّة
		5	لا اتخلّص منها
		6	غيره: _____
WM06	كيف تتخلّص عادة من الادوية الصلبة المنتهية الصلاحيّة / غير المرغوب فيها (كالأقراص مثلا)؟	1	في المرحاض / المغسلة
		2	مع النفايات المنزليّة
		3	مع النفايات الخاصة بالادوية
		4	اعيدها الى الصّيدليّة
		5	اعطيها لمستوصف قريب
		6	اعطيها لمن يحتاج اليها
		7	ادفنها في حديقة المنزل
		8	احرقها
		9	اخزّنها بمكان ما في المنزل
		10	غيره: _____
WM07	هل تعتقد انّ هذه الطريقة هي الافضل من اجل التخلص من نفايات الادوية الصّلبة؟	1	نعم
		0	لا
WM08	كيف تتخلّص عادة من الادوية السائلة المنتهية الصلاحيّة / غير المرغوب فيها (كالأقراص مثلا)؟	1	في المرحاض / المغسلة
		2	مع النفايات المنزليّة
		3	مع النفايات الخاصة بالادوية
		4	اعيدها الى الصّيدليّة
		5	اعطيها لمستوصف قريب
		6	اعطيها لمن يحتاج اليها

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول ادارة نفايات الادوية على المستوى المنزلي			
		7	ادفنها في حديقة المنزل
		8	احرقها
		9	اخزّنها بمكان ما في المنزل
		10	غيره:_____
WM09	هل تعتقد انّ هذه الطريقة هي الافضل من اجل التخلص من نفايات الادوية السائلة؟	1	نعم
		0	لا
WM10	كيف تتخلص عادة من ادوية المراهم / الكريمات المنتهية الصلاحيّة / غير المرغوب فيها؟	1	في المرحاض / المغسلة
		2	مع النفايات المنزليّة
		3	مع النفايات الخاصة بالادوية
		4	اعيدها الى الصّيدليّة
		5	اعطيها لمستوصف قريب
		6	اعطيها لمن يحتاج اليها
		7	ادفنها في حديقة المنزل
		8	احرقها
		9	اخزّنها بمكان ما في المنزل
		10	غيره:
WM11	هل تعتقد انّ هذه الطريقة هي الافضل من اجل التخلص من نفايات ادوية المراهم / الكريمات؟	1	نعم
		0	لا
WM12	هل تذكر اي حادثة تضمّنت الادوية المستعملة في المنزل؟	1	نعم
		0	لا
		99	لا اذكر
WM13	ما كانت هذه الحادثة؟	1	تسمّم الصغار جرّاء اخذ الادوية
		2	تسمّم الكبار جرّاء اخذ الادوية
		3	انسكاب ادوية سائلة
		4	غيره:_____
WM14	ما نسبة تكرّر هكذا الحادثة؟	1	نادراً
		2	مرّة في السّنة
		3	شهريّا
		4	ابدا
		5	لا اذكر
WM15	ما كان / كانت السبب / الاسباب لحصول هكذا حادث؟	1	تخزين خاطئ (قريب من متناول الاطفال)
		2	تخلص غير صحّي من الادوية
		3	غيره:_____
WM16	هل سبق وسمعت / عَلِمت بالطّرق المستخدمة للتخلص السّليم من الادوية ونفاياتها على المستوى المنزلي؟	1	نعم
		0	لا(انتقل الىWM17؟)
WM17	كيف سمعت عن هذه الطّرق؟	1	الاعلام: التلفاز / الراديو / المجلات
		2	الانترنت
		3	الاعلانات
		4	من الغير
		5	غيره، حدّد:_____
WM18	هل سبق وحصلت على ارشاد / توعية / تثقيف	1	نعم

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول ادارة نفايات الادوية على المستوى المنزلي			
	حول الطرق السليمة للتخلص من نفايات الادوية؟	0	لا (انتقل الى WM20؟)
WM19	من قدم لك برنامج التوعية / التثقيف هذا؟	1	الطبيب
		2	الصيدلي
		3	المستشفى / العيادة / المستوصف
		4	جمعية غير حكومية
		5	صديق
		6	غيره: _____
WM20	هل تعتقد ان برامج التوعية حول طرق التخلص من نفايات الادوية يجب ان تتم على المستوى السكني / الشعبي؟	1	نعم
		0	لا
		99	لا اعرف
WM21	برأيك، ما هي الطريقة / الطرق المناسبة لخفض كميات الادوية المرمية؟	1	برامج توعية
		2	جمع / انظمة اعادة الادوية
		3	وصفة دقيقة حول الكمية المطلوبة من الدواء / الادوية
		4	غيره: _____
WM22	هل سبق وسمعت عن اي قانون متعلق بإدارة نفايات الادوية الداخلية؟	1	نعم
		0	لا
WM23	هل تعتقد بضرورة وجود قانون ما لتنظيم طرق التخلص من نفايات الادوية الداخلية على المسوى السكني / الشعبي؟	1	نعم
		0	لا
		99	لا اعرف
WM24	هل تعتقد نفايات الادوية السكنية خطيرة؟	1	نعم
		0	لا
		99	لا اعرف
WM25	هل تعتقد بأن الرمي غير السليم للادوية غير المرغوب فيها من المنازل قد يسبب مشاكل بيئية وصحية؟	1	نعم
		0	لا
		99	لا اعرف
WM26	هل تعتقد بضرورة وجود نظام لجمع / إعادة الادوية غير المرغوب بها من المنازل؟	1	نعم
		0	لا
		99	لا اعرف
WM2	من، برأيك، يجب ان يكون مسؤول عن جمع الأدوية غير المرغوب بها من المنازل؟	1	وزارة الصحة العامة
		2	وزارة البيئة
		3	وزارة الشؤون الإجتماعية
		4	البلدية
		5	الاطباء
		6	الصيدليات
		7	المستشفيات / العيادات / المستوصفات
		8	شركات الادوية
		9	شركات خاصة مرخصة
		10	غيره: _____
WM	هل انت مستعد للمشاركة في اي برنامج مستقبلي لجمع / اعادة الادوية غير المرغوب بها من المنازل؟	1	نعم
		0	لا
		99	لا اعرف

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول ادارة نفايات الادوية على المستوى المنزلي			
WM29	برأيك، اي من الطرق التالية هي الانسب من اجل التخلص من الادوية غير المرغوب بها او المنتهية الصلاحية؟	1	اعادتهم الى الصيدلية
		2	اعادتهم الى الطبيب
		3	حفظهم في اكياس خاصة من اجل جمعها من المنازل من قبل البلدية
		4	جمع ووضع الادوية غير المرغوب بها في نقاط جمع مخصصة (مثلا: محطات البنزين / السوبرماركت ...)
		5	غيره: _____
WM30	في حال وجود برنامج مستقبلي من اجل جمع / اعادة الادوية غير المرغوب بها من المنازل قد يتوجب عليك دفع رسم معيّن، هل لا تزال مستعدّ للمشاركة بهكذا برنامج؟	1	نعم
		0	لا
		99	لا اعرف

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول الوضع الاقتصادي والاجتماعي			
SE00	العمر		أو ____(بالسنوات) ي/ي ش/ش س/س/س/س
SE01	الجنس	0	ذكر
		1	انثى
SE02	الوضع الاجتماعي	1	اعزب
		2	متزوّج
		3	مطلق
		4	ارمل
		5	غيره:
SE03	مستوى التعليم	1	ابتدائي
		2	متوسّط / ثانوي
		3	جامعي
		4	معهد مهني
		5	لا جواب
		6	غيره:
SE04	عدد سكان المنزل		_____
SE05	علاقة سكان المنزل	1	عائلة
		2	اصدقاء
		3	شركاء السكن
		4	غيره:
SE06	هل انت تعمل حاليًا؟	1	نعم
		0	لا (انتقل الى SE10)
SE07	العمل / المهنة	1	موظف
		2	موظف حرّ
		3	طالب
		4	موظف حكومي
		5	استاذ
		6	رجل دين
		7	فنان

رمز السؤال	السؤال	رمز الجواب	الجواب
معلومات حول الوضع الاقتصادي والاجتماعي			
		8	طبيب
		9	محامي
		10	مهندس
		11	رجل عسكري
		12	سائق تاكسي (أجرة)
		13	مزارع
		14	حرفي
		15	غيره:
SE08	ما هو المدخول المنزلي الشهري (بالدولار الاميركي)؟	1	اقلّ من ٥٠٠
		2	الى ١٠٠٠ من ٥٠٠
		3	الى ٣٠٠٠ من ١٠٠٠
		4	من ٣٠٠٠ الى ٥٠٠٠
		5	من ٥٠٠٠ الى ١٠٠٠٠
		6	اكثر من ١٠٠٠٠
		7	لا جواب
SE09	كم تنفق سنويّاً على الادوية؟	1	اقل من500,000ل.ل
		2	500,000 – 1,500,000ل.ل
		3	اكثر من1,500,000
SE10	ما هو مخطط التأمين الصحّي الذي تستفيد منه؟	1	لا يوجد
		2	الضّمان الاجتماعي
		3	تعاونيّة الموظّفين
		4	تأمين طبّي خاص
		5	غيره:

ملاحظات عامة:

ANNEX 5

Guidance Note on Disposal Methods of Household Pharmaceutical Waste

This document serves as a simple educational tool for clarifying some of the expected common behaviors regarding the disposal of unwanted household pharmaceuticals (pharmaceutical waste). The below instructions were adopted from international guidelines for the proper and safe disposal of household pharmaceutical wastes.

Given the national situation regarding municipal waste management in Lebanon and the common practices of pharmaceutical waste disposal at the residential level and due to the absence of national legislations or programs for the management of these type of waste generated at the household level, proper disposal of pharmaceuticals is crucial for reducing potential environmental impacts that might be caused from the mismanagement of this type of waste and for preventing and limiting potential accidents that might take place at the household level. Infants and children are relatively more prone to accidental poisoning mainly from the ingestion of improperly stored pharmaceuticals and pharmaceutical wastes. Therefore, it is very important to control and safely dispose of the unwanted pharmaceutical waste that is generated at the household level.

Below are a few instructions may be considered as potential solutions for the proper and safe management of pharmaceutical waste generated at the household level, in the absence of a national household pharmaceutical waste take-back program.

Liquid Pharmaceutical Wastes (ex: cough syrups)

- Follow any specific disposal instructions on the label or patient information leaflet provided with the pharmaceutical product – if available.
- DO NOT FLUSH OR POUR unwanted liquid medications (ex: syrups) down the sink or drain (unless indicated by the label or patient information).
- Pour unwanted liquid pharmaceuticals in an unwanted hard plastic container (ex: empty bleach or detergent container), jar, or sealable plastic bag.
- Add unpalatable substance like coffee grounds, sawdust, or cat litter to thicken and absorb the unwanted liquid pharmaceuticals.
- Properly seal the cap of the plastic container or bag and place inside the trash.
- Consult your pharmacist for any questions or clarifications for the proper disposal of unwanted pharmaceuticals

Solid Pharmaceutical Wastes (ex: pills, capsules, tablets)

- Follow any specific disposal instructions on the label or patient information provided with the pharmaceutical product – if available.
- DO NOT FLUSH unwanted solid pharmaceuticals (ex: pills, capsules, and tablets) down the sink or drain.
- Remove the unwanted solid pharmaceuticals from their original containers including pills in blister foil and place them in a unwanted hard plastic container, jar, or sealable plastic bag.
- Crush the unwanted solid pharmaceuticals inside sealable plastic bag.
- Add unpalatable substance like coffee grounds, sawdust, or cat litter to the crushed unwanted pharmaceuticals.
- Properly seal the sealable plastic container or bag and place inside the trash.
- Consult your pharmacist for any questions or clarifications.

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تعتبر هذه الوثيقة كأداة تعليمية بسيطة لتوضيح بعض السلوكيات ا المتوقعة فيما يتعلق بالتخلص من الأدوية غير المرغوب فيه (النفايات الصيدلانية) على المستوى المنزلي. واعتمدت التعليمات التالية من المبادئ التوجيهية الدولية للتخلص السليم والآمن من النفايات الصيدلانية المنزلية.

التخلص السليم من الأدوية هو أمر اساسي للحد من الآثار البيئية المحتملة التي قد يسببها سوء إدارة هذا النوع من النفايات والمنع والحد من الحوادث المحتملة التي قد تحدث على المستوى المنزلي. الرضع والأطفال هم نسبيا أكثر عرضة لحوادث التسمم من تناول الأدوية المخزنة بطريقة غير سليمة والنفايات الصيدلانية. ولذلك، من المهم جدا التخلص الآمن من النفايات غير المرغوب فيها الأدوية التي يتم إنتاجها على المستوى المنزلي.

نظرا للواقع المحلي بشأن إدارة النفايات المنزلية الصلبة في لبنان والممارسات الشائعة للتخلص من النفايات الصيدلانية على المستوى المنزلي، ونظرا لغياب التشريعات الوطنية أو برامج ٢إدارة هذا النوع من النفايات المتولدة على المستوى المنزلي، فقد تعتبر التعليمات التالية بمثابة حلول ممكنة من أجل الإدارة السليمة والآمنة للنفايات الصيدلانية الناتجة عن الاستهلاك المنزلي.

النفايات الصيدلانية السائلة (مثلا: شراب السعال)

- اتبع أية إرشادات محددة على الملصق أو المعلومات المريض التي ترافق المنتجات الصيدلانية - إذا كانت متوفرة.
- لا تسكب الأدوية السائلة غير المرغوب فيها (مثلا: شراب السعال) في المغسلة (ما لم يرد من قبل التسمية أو معلومات المريض).
- صب الأدوية السائلة غير المرغوب فيها في وعاء من البلاستيك الصلب (مثلا: حاوية منظفات بلاستيكية) أو كيس من البلاستيك قابل للغلق.
- إضافة مادة غير مستساغة مثل القهوة ، اونشارة الخشب ، أو فضلات القطط لامتصاص الأدوية السائلة غير المرغوب فيها.
- اغلاق باحكام غطاء وعاء البلاستيك او الكيس ووضعه داخل سلة المهملات .
- استشارة الصيدلي لأية أسئلة أو إيضاحات عن التخلص السليم من الأدوية غير المرغوب فيها.

النفايات الصيدلانية الصلبة (مثلا: حبوب، وكبسولات ، وأقراص)

- اتبع أية إرشادات محددة على الملصق أو المعلومات المريض التي ترافق المنتجات الصيدلانية - إذا كانت متوفرة.
- لا تسكب الأدوية السائلة غير المرغوب فيها (مثلا: شراب السعال) في المغسلة (ما لم يرد من قبل التسمية أو معلومات المريض).
- إزالة الأدوية الصيدلانية الصلبة غير المرغوب فيها من عبواتها الأصلية ووضعها في وعاء غير المرغوب فيها من البلاستيك الصلب أو في كيس من البلاستيك قابل للغلق.
- سحق الأدوية الصيدلانية الصلبة غير المرغوب فيها داخل الوعاء او الكيس البلاستيك القابل للغلق.
- إضافة مادة غير مستساغة مثل القهوة ، اونشارة الخشب ، أو فضلات القطط إلى الأدوية غير المرغوب فيها.
- اغلاق باحكام غطاء وعاء البلاستيك او الكيس ووضعه داخل سلة المهملات .
- استشارة الصيدلي لأية أسئلة أو إيضاحات عن التخلص السليم من الأدوية غير المرغوب فيها.

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ANNEX 6

Univariate Logistic Regression Analysis

Models 1 and 2

MODEL 1

Univariate Binomial Logistic Regression of predictor variables expected to be associated with respondents' willingness to participate in future household pharmaceutical waste collection program

Variable	Unadjusted Odds Ratio (OR)	90% C.I.	*P*-value
Age	0.974	(0.952 – 0.997)	**0.059**
Think there should be a collection / take back program for unwanted medication from households			**<0.001**
No	1		
Yes	6.246	(2.935 – 13.296)	
Responsible Entity for future collection/ take back program for unwanted medication from households			**0.025**
Other [1]	1		
Ministry of Public Health (MoPH)	2.773	(1.312 – 5.860)	
Think there should be awareness programs on proper management of unwanted medication at the residential level			**0.090**
No	1		
Yes	2.786	(1.032 – 7.519)	
Consider improper management of unwanted medication at the residential level dangerous			**0.020**
No	1		
Yes	3.172	(1.403 – 7.172)	
Consider improper management of unwanted medication at the residential level poses environmental and public health threats			**0.003**
No	1		
Yes	4.140	(1.874 – 9.148)	
Think there should be law/legislation related to management of unwanted medication at the residential level			**0.017**
No	1		
Yes	2.855	(1.385 – 5.886)	
Best way for reducing quantity of unwanted medication at the residential level			

Variable	Unadjusted Odds Ratio (OR)	90% C.I.	*P*-value
Awareness programs	1		
Collection / take back systems	0.783	(0.305 – 2.014)	0.671
Accurate prescription of medication	1.000	(0.413 – 2.421)	1.000
Other [2]	0.333	(0.101 – 1.098)	0.129
Dispose of unwanted medications at the residential level			0.218
No	1		
Yes	2.298	(0.757 – 6.979)	
Reason for disposing of unwanted medication			
Completion of Treatment	1		
Expiry of medication	1.476	(0.689 – 3.160)	0.401
Do not dispose	0.578	(0.170 – 1.961)	0.460
Other [2]	1.733	(0.282 – 10 .653)	0.618
Have been given awareness / guidance on proper management of unwanted medication at the residential level			0.182
No	1		
Yes	0.403	(0.132 – 1.235)	
Gender			0.624
Male	1		
Female	0.819	(0.419 – 1.601)	
Education			
Elementary or less	1		
Secondary	1.239	(0.444 – 3.456)	0.731
University	1.654	(0.602 – 4.547)	0.413
Household Size	1.098	(0.749 – 1.608)	0.688
Household Monthly Income (in USD)			
<1,000	1		
1,000 – 3,000	1.661	(0.733 – 3.764)	0.307

Variable	Unadjusted Odds Ratio (OR)	90% C.I.	*P*-value
>3,000	2.785	(0.751 – 10.333)	0.199
Household Yearly Expenditure on Medication (in LBP)			0.308
<1,500,000	1		
>1,500,000	0.605	(0.269 – 1.361)	
Presence of Existing Medical Condition			0.759
No	1		
Yes	0.883	(0.453 – 1.720)	
Total Quantity of Consumed Prescription Medications (pills/month) [3]	1.001	(0.992 – 1.009)	0.919

Bold values are significant at P < 0.1

[1] ***Other entities that include: Ministry of Environment (MoE), Ministry of Social Affairs (MoSA), pharmacies, physicians, hospitals, dispensaries and clinics***

[2] ***Other ways include using them for plantation (garden), giving them to needy people (as charity)***

[3] ***Quantities reported by interviewed respondent***

MODEL 2

Univariate Binomial Logistic Regression of significant variables associated with respondents' willingness to participate in future collection program for a fixed fee

Variable	Unadjusted Odds Ratio (OR)	90% C.I.	*P*-value
Willing to participate in future household pharmaceutical waste collection or take-back program			**<0.001**
No	1		
Yes	6.928	(3.133 – 15.318)	
Think there should be law/legislation related to management of unwanted medication at the residential level			**<0.001**
No	1		
Yes	3.243	(1.877 –5.602)	
Think there should be a collection / take back program for unwanted medication from households			**0.032**
No	1		
Yes	2.402	(1.225 – 4.709)	
Think there should be awareness on proper management of unwanted medication at the residential level			***0.102***
No	1		
Yes	2.256	(0.996 – 5.111)	
Age	0.978	(0.963 – 0.994)	**0.020**
Consider improper management of unwanted medication at the residential level dangerous			0.149
No	1		
Yes	1.821	(0.920 –3.608)	
Consider improper management of unwanted medication at the residential level poses environmental and public health threats			0.131
No	1		

Variable	Unadjusted Odds Ratio (OR)	90% C.I.	*P*-value
Yes	1.880	(0.945 – 3.742)	
Dispose of unwanted medications at the residential level			0.682
No	1		
Yes	0.759	(0.251 – 2.298)	
Reason for disposing of unwanted medication			
Completion of Treatment	1		
Expiry of medication	0.893	(0.512 – 1.557)	0.737
Do not dispose	1.185	(0.363 – 3.872)	0.813
Other [2]	0.640	(0.227 – 1.801)	0.478
Best way for reducing quantity of unwanted medication at the residential level			
Awareness programs	1		
Collection / take back systems	1.609	(0.824 – 3.145)	0.243
Accurate prescription of medication	1.016	(0.589 – 1.756)	0.961
Other [2]	0.953	(0.336 – 2.699)	0.939
Have been given awareness / guidance on proper management of unwanted medication at the residential level			0.716
No	1		
Yes	0.795	(0.283 – 2.238)	
Responsible Entity for future collection/ take back program for unwanted medication from households			0.702
Other [3]	1		
Ministry of Public Health (MoPH)	1.134	(0.660 – 1.947)	
Gender			0.904
Male	1		
Female	0.967	(0.612 – 1.529)	
Education			
Elementary or less	1		
Secondary	1.011	(0.473 – 2.158)	0.982

Variable	Unadjusted Odds Ratio (OR)	90% C.I.	*P*-value
University	1.421	(0.676 – 2.988)	0.437
Household Size	0.986	(0.781 – 1.244)	0.919
Household Monthly Income (in USD)			
<1,000	1		
1,000 – 3,000	1.610	(0.939 – 2.761)	0.146
>3,000	1.268	(0.643 – 2.503)	0.565
Yearly Household Expenditure on Medication (in LBP)			0.948
<1,500,000	1		
>1,500,000	1.020	(0.625 – 1.665)	
Presence of Existing Medical Condition			0.609
No	1		
Yes	0.867	(0.547 – 1.374)	
Total Quantity of Consumed Prescription Medications (pills/month) [1]	1.000	(0.994 – 1.006)	0.970

C.I. Confidence Interval

Bold values are significant at P < 0.1

[1] ***Quantities reported by interviewed respondent***
[2] ***Other ways include using them for plantation (garden), giving them to needy people (as charity)***
[3] ***Other entities that include: Ministry of Environment (MoE), Ministry of Social Affairs (MoSA), pharmacies, physicians, hospitals, dispensaries and clinics***

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