Role of Community Pharmacists in Household Pharmaceutical Waste Management in Alexandria Governorate

Thesis

Presented to High Institute of Public Health,
Alexandria University
In partial fulfillment of the requirements for the degree of

Doctor of Public Health Sciences
In

Environmental Health

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High Institute of Public Health
Alexandria University
2017

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ACKNOWLEDGEMENTS

First I would like to thank God for helping me finishing this thesis

No words could never express my profound gratitude and appreciation to ***Prof. Dr. Aleya El Zouka****, Professor of environmental Health, High Institute of Public Health, for her great help, endless effort, sincere advices to me from the day I came to the institute. She always gave me the power and encouragement to carry on and proceed in all the phD steps and helped me to overcome all the obstacles I faced during the thesis work.*

I am also really grateful for ***Prof. Dr. Moahmed Darwish El Borgy*** *Professor of Health Education and Behavioral Sciences, High Institute of Public Health for his great support, his kind words and his valuable suggestions in correcting my errors and reviewing my thesis.*

I should never forget ***Prof. Dr. Mohamed Hussein*** *Professor of Biostatiscs, High Institute of Public Health for helping me in the statistical analysis of my thesis and spending his time and effort guiding me during the data entry and the analysis of the results.*

My great thanks go to all ***the community pharmacists*** *who helped me in achieving the interviewing questionnaire part and to* ***my professors and colleagues*** *in Faculty of Pharmacy, Pharos University in helping me in implementing the educational program*

This work could never have been achieved without the support of my family and friends, particularly ***my great parents*** *who have all the credit in building every achievement in my life ,****my beloved husband*** *for his all time support, care and encouragement and* ***my lovely son*** *whose smile sooth every difficulty in my life.*

My great appreciation is extended to
all those who shared either practically .
or morally in the accomplishment of this work.

LIST OF CONTENTS

List of Tables

List of Figures

LIST OF ABBREVIATIONS

APIs	**:**	Active Pharmaceutical Ingredients
AphA	**:**	Alberta pharmaceutical Association
CBZ	**:**	Carbamazepine
EME	**:**	The European Medicines Agency
EPA	**:**	Environmental Protection Agency
EPV	**:**	Echopharmacovigilence
EU	**:**	European Union
FDA	**:**	Food and Drug Administration
GERD	**:**	Gastroesophageal Reflux Disease
IPWR	**:**	Indirect Potable Water Reuse
KAP	**:**	Knowledge ,Attitude ,Practice
MOH	**:**	Ministry Of Health
NHP	**:**	National hypertension Project
NHS	**:**	National Health Service
ONDCP	**:**	Office of Natural Drug Control Policy
PDFC	**:**	Partnership for a Drug-Free Canada
Ppb	**:**	part per billion
PPCP	**:**	Pharmaceutical and Personal Care Products
PWM	**:**	Pharmaceutical Waste Management
OTC	**:**	Over The Counter
OWCs	**:**	Organic Wastewater Contaminants
PDFC	**:**	Partnership for a Drug-Free Canada
STPs	**:**	Sewage Treatment Plants
UK	**:**	United Kingdom
UMs	**:**	Unused medicines
UN	**:**	United Nations
USA	**:**	United States Of America
WHO	**:**	World Health Organization
WWTP	**:**	Waste Water Treatment Plant

INTRODUCTION

Medications, when used correctly, can have very positive and beneficial effects for patients, such as managing health conditions, warding off disease, and even curing illness. However, unintended exposure to small or trace amounts of drugs that are not medically necessary can have a detrimental, long-term effect on plants, animals, and humans. Despite high yearly prescription sales, many of these prescriptions will go unused for various reasons such as improved patient condition, the inability to tolerate adverse effects of the drug, changes in dosage or medication regimen, death, or medication expiration.[1]

Community pharmacists have the greatest interaction with consumers regarding prescription and over-the-counter medications and are therefore, in an excellent position to influence the use of medications and, by extension, drug disposal.[2]They offer a trusted environment in which to reduce medication errors and improve safety, while reducing costs and improving the quality of care.[3]Often, the unwanted or expired medications are just stored at home indefinitely or disposed of via the sink, flushed down the toilet, or tossed in the garbage.[1, 4]The storage and the disposal of unwanted or expired medications in this way poses hazardous effects on human health as well as on the ecosystem.[5]

The World Health Organization recommends that unwanted medications should always be considered as pharmaceutical waste and need to be disposed appropriately.[6]Many poisoning cases have been reported to Poison Control Centers in the United States due to accidental intake of left over medicines in residential areas.[7]

Antibiotic resistance is becoming a major problem for treatment of life threatening infections caused by the microbial pathogens. Even though many routes are relayed to the development of antibiotic resistance, improper way of disposal of drugs is also considered as major concerns.[8, 9]

Some prescripted and non prescripted drugs and their metabolites were detected in water.[10]Besides, pilot study of analyzing wastewater treatment plants effluents showed the presence of 10 different pharmaceutical compounds, which could be discharged in groundwater in Germany.[11] The existence of pharmaceuticals and their metabolites in water has been recognized as potentially dangerous. Acetaminophen, verapamil, and estradiol are just a few of the chemical routinely found in American waterways.[12]Unfortunately, current water treatment systems do not remove many pharmaceuticals from drinking water, usually the concentration of these medications is negligible; however, long term exposure to even low levels of multiple medications could be hazardous.[10, 12]

Concentrations of unused pharmaceuticals compounds may be responsible for environmental effects such as vitellogenin induction in male fish,[13]genital abnormalities in fish[14] and even population collapse.[15]Endocrine disruption is an example of a mode of action that is exacerbated by exposure to mixtures of chemicals. Feminization of fish exposed to estrogenic chemicals has been studied most widely. [16]

Medication waste associated with unfilled, abandoned, and unused prescription medications is a significant burden on the Healthcare System. Medication use process starts when a physician writes a medication prescription and ends by patients using or not using their dispensed medications. In USA, Patients who don't fulfill their role in the medication use process cause a considerable amount of monetary wastage estimated by $30.4 billion. Instead of being wasted, money spent on these avoidable costs could be used to treat a large number of patients.[17]

This study will be done to shed the light on the role of community pharmacists in household pharmaceutical waste management in Alexandria Governorate.

LITERATURE REVIEW

1. Impact of medications and the reasons for leftover drugs.
2. Effect of leftover drugs on human health and the ecosystem.
2.1. Effect of leftover drugs on human health.
   2.1.1. Drug poisoning and diversion.
   2.1.2 Antibiotic resistance.
2.2. Impact of leftover drugs on the ecosystem.
   2.2.1.Feminization of fish.
   2.2.2. The presence of pharmaceuticals in waterways.
   2.2.3.The presence of pharmaceuticals in the sewage system.
   2.2.4. The presence of pharmaceuticals in drinking water.
3.Risk assessment of the presence of pharmaceuticals in drinking water.
4. The economic aspect of leftover drugs.
5. International Guidelines of disposal of unused medications.
   5.1.The European Union (EU).
   5.2. United Kingdom.
   5.3. New Zealand.
   5.4. United States of America.
   5.5. The FDA and the leftover drugs.
   5.6. Drug return program in Alberta, Canada.
   5.7. Kuwait's guidelines by the Ministry of Health.
   5.8. Lithuania and unwanted medications.
   5.9. Germany and the leftover drugs.
6. Improper use of medications as a main reason of leftover drugs.
7. Patients'education and pharmaceutical care.
8. Influence of educational program on raising the KAP of community pharmacists.
9. Studies made in Egypt.

1. Impact of medications and the reasons for leftover drugs

Everyone use medications, whether for prevention or treatment of a condition or even for symptomatic relief of a pain. Many of the prescription or non prescription drugs are considered leftover drugs and there are many reasons for the presence of unused medicines at home. In a study made in Barcelona,[18] the most common reason for the presence of leftover drugs was that the treated condition had improved and there was no further need for the drug. These returns could have been avoided, for example, by reducing the dispensed package size or by adapting the pack to the most frequent dosages or even by dispensing through an individualized dosing system, depending on each prescription. However, Spanish pharmacies dispense medicines in the original package produced by the pharmaceutical industry and package sizes are often too big for the therapy required. On the other hand, non-compliance with the treatment could have been masked by such answers as ‘‘he didn’t need it anymore’’ or ‘‘he was cured’’ and this is another reason for the presence of unused medications at home.[19]

In a study made in Swedish pharmacies to explain the reasons why medicines are returned to pharmacies, four reasons made up >75% of all reasons for the medicines being returned unused. They were that the medicines were too old/ had expired; the patient had died; the condition had improved or there was no need to take the drug anymore and that there had been therapy changes due to adverse drug reactions or lack of effect or deterioration of the condition. Few of the packs returned because of change in therapy concerned a new treatment or new prescription. Deceased patients constituted 14% of the patients and accounted for 30% of all returned packs. One-third of the medicines returned after the patients had died were from ‘‘former treatment’’ which had been terminated previously. Medicines that were returned unused owing to the death of the patient therefore constituted about 20% of all returned packs.[20]

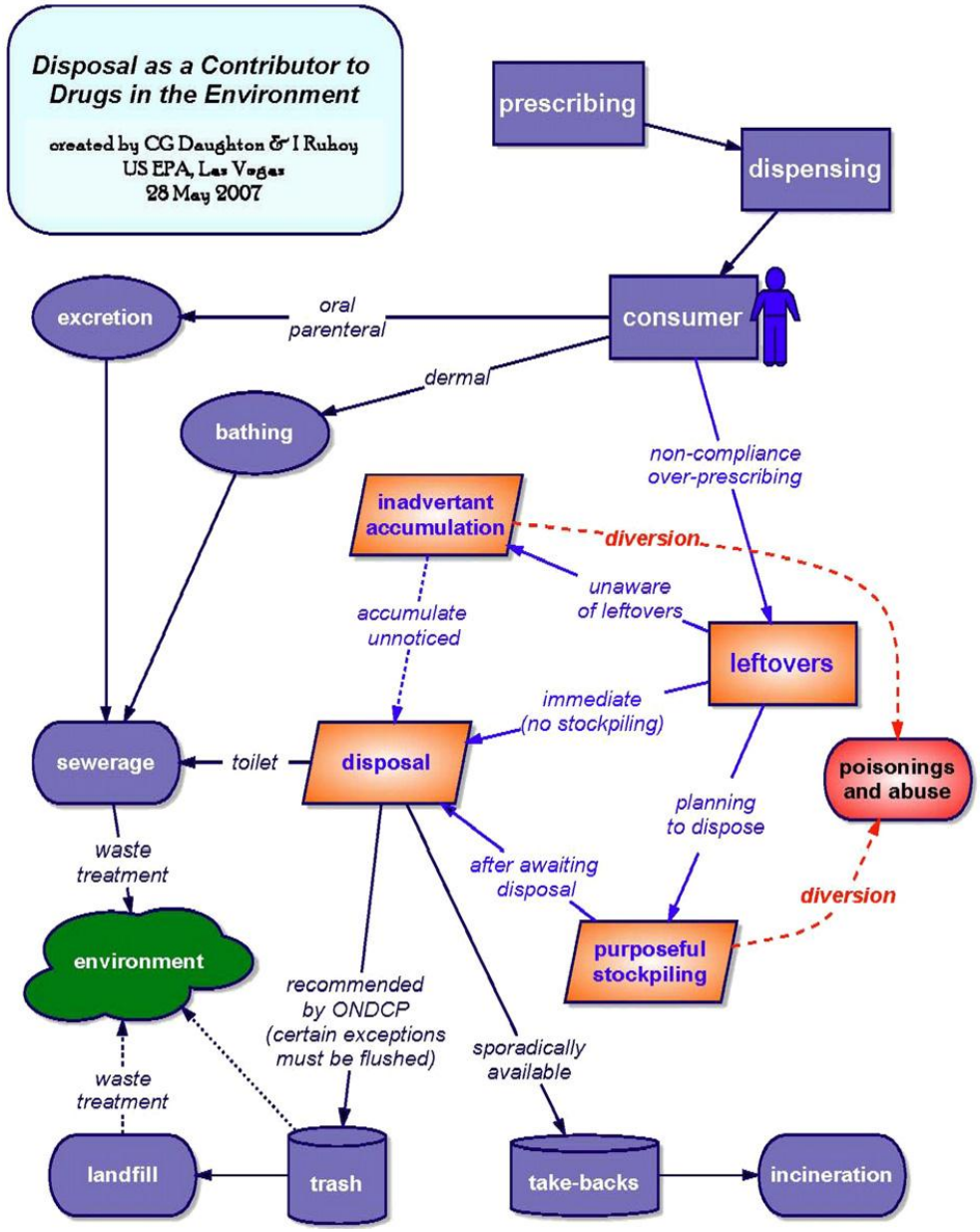
2. Effect of leftover drugs on human health and the ecosystem

The storage of leftover drugs at home or the inappropriate disposal of unwanted or expired medications by flushing in the toilet or tossing in garbage poses hazardous effects on human health as well as on the ecosystem.[5]

Approximately 50 new drugs enter the U.S. market every year. With the introduction of each new medication, a potential new waste for disposal is also introduced. Past regulation of pharmaceuticals has focused on their efficacy and safety for use. Awareness of their environmental impacts has been realized later on. In the United States, the Federal Interagency Task Group on Pharmaceuticals and Personal Care Products was formed in September 2004. In Canada, the Environmental Impact Initiative was formed in 2001.[21]

The European Medicines Agency (EMEA) is the body of the European Union responsible for the protection and promotion of public and animal health through the evaluation and supervision of medicines. In 1999, in response to rising evidence of pharmaceuticals in the environment and their impacts, the EMEA began drafting environmental risk assessment procedures to accompany new pharmaceutical applications in Europe. The proposed European guidance is the first to include long-term ecotoxicity testing, as well as to consider the environmental effects from extremely low concentrations of bioactive substances, such as endocrine disruptors. [21]

The effect of leftover drugs in the exposures of humans and the environment is shown in (Figure 1)



Figure(1):The effect of leftover drugs in the exposures of humans and the environment.[22]

2.1. Impact of leftover drugs on human health

2.1.1. Drug poisoning and diversion

Keeping expired medications in the home or giving them to family or friends may increase the risk of accidental poisoning or inappropriate ingestion.[23]

Concerns about medication disposal were previously limited to preventing the accidental poisoning of children or animals when the medication was discarded. This resulted in the common practice of flushing pharmaceuticals into the sewage system and throwing them into the trash.

In 2007, there were 255,732 cases of improper medicine use reported to Poison Control Centers in the United States. Approximately 9% of these cases (23,783) were exposed accidentally to stored medicine at home which was prescribed for others. Approximately 5,000 of these accidental exposure cases are children of 6 years and below.[7]

Reports have developed new terminology for the emerging pollution waste stream. Daughton and Ternes[24] have created the most widely encompassing term, "Pharmaceutical and Personal Care Products" (PPCPs). Sedlak et al.[25]created the term "pharmaceutically active compounds," and Fisher and Borland[26]recently described pharmaceutical pollutants as "feral pharmaceuticals."

Daughton *et al* found that adverse health effects in humans have not been established. Hypothesized effects from continuous exposure include reproductive organ tissue cancers.[24]

2.1.2 Antibiotic resistance

Potential antibiotic resistance of bacteria may arise from repeated exposure of bacteria to low level antibiotics found in water. Several studies have shown a decrease in the effectiveness of antibiotics because of their ever-present nature in the environment.[8, 9]

A study at Pantacheru (India) in 2010, reported the presence of ciprofloxacin in water.[27]Further in India, bacteria resistant to ciprofloxacin have been found downstream pharmaceutical plants, genes for multi resistance were found in drinking water and multi resistant Salmonella in water sprayed on vegetables.[28]

Large amounts of veterinary drugs and active metabolites end up in sediments in the vicinity of aquacultural areas. The presence of these substances in sediments, where many of them are known to be stable, favors the development of bacterial resistance, which gives rise to infections that are difficult to treat; also, the sediments act as a reservoir for both the compounds and the resistant bacteria.[29, 30]

There is also evidence that the presence of antibiotics in waterways has an impact on the bacteria present and may lead to antibiotic resistance.[31]

All the samples taken from the Ohio River in a study made in 2002, contained Escherichia Coli with some resistance to penicillin, tetracycline and vancomycin.[32]