



# What happens to unused, expired and unwanted medications? A survey of a community-based medication disposal practices

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## Abstract

Over half of all medications used are not suitably prescribed, dispensed or sold and only 50% of patients take their medications correctly. Improper disposal of unused, unwanted or expired medication pose a significant risk to the environment, children, relatives and friends. This study was done to determine how residents of Konongo-Odumasi in the Ashanti Region of Ghana dispose of their unused, unwanted and expired medications and to access the possible impact of improper disposal of medications on healthcare and the environment. Through a random sampling technique, 500 residents were accessed by anonymous questionnaires. 98% of respondents reported having medication in the homes which they wished to dispose of via varied disposal methods. Over 98% said they had never received any information about proper medication disposal. Almost all respondents had excess and leftover medication in their homes which could be due to both overprescribing and poor medication adherence. Uniform guidelines for the safe disposal of unused, unwanted or expired medications need to be created and included in routine consumer education programs.

**Keywords:** Konongo-Odumasi; Disposal; Environment; Overprescribing; Adherence

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## **1. Introduction**

Medicines play a vital role in the amelioration, prevention and cure of many diseases or medical conditions (Cranko and Sleggs 1960). Medicines are often regulated by governments into three categories: over-the-counter (OTC) medicines, behind-the-counter (BTC) medicines and prescription only medicines (POM) (Maes et al., 1999; Cridland and Koonin, 2001; Lindenberg et al., 2004).

It has been documented that more than half of all medications are inappropriately prescribed, dispensed or sold (Rodriguez-Gonzalez et al., 2011) and that globally only about 50% of patients take their medication correctly (Brown and Sinsky, 2013; Chummun and Boland, 2013). Medication adherence is even lower in developing and transitional countries (Holloway, 2011). It has also been estimated that, medication errors and medication non-compliance result in about between 44,000 and 98,000 preventable deaths in the United States of America (Charatan, 2000; Nevins and Matas, 2004) and much more in developing countries where up to 50% of all dispensing events are inadequate (Holloway, 2011).

Whiles Rational Use of Medicines (RUM) by health care providers has received high priority in Ghana, public education has received very little attention and adequate human and financial resources have not been allocated for effective public education. As defined by the World Health Organization (WHO), RUM means that appropriate medications are received to meet the clinical needs of patients in terms of dose requirements, over a sufficient treatment length, and at an affordable cost to them and the community (Holloway, 2011).

The disposal of unwanted medication from households is becoming a menace for both global and local health and environmental authorities. Risks such as childhood poisoning and diversion of medicines particularly narcotic drugs to illicit use have been long identified problems (Abahussain and Ball, 2007). In recent times however, environmental concerns because of metabolic excretion, improper disposal and industrial waste are receiving significant prominence (Zuccato et al., 2000).

The use of more sensitive analytical techniques nowadays make it easy to detect the presence of pharmaceutical compounds in the environment particularly in ground-water and potable water even after treatment and purification (Valcarcel et al., 2010; Sanderson, 2011). In view of these findings, burying medication in the ground (garden) or flushing them down the toilet or sink is considered very undesirable as it may lead to the persistence of discarded materials in water supplies (Zuccato et al., 2000).

Current regulations in the United States of America (USA) and the European Union (EU) stipulates that new medicines are accessed for their environmental risks (Bound and Voulvoulis, 2004; Abahussain and Ball, 2007) but there are no such guidelines in developing countries such as Ghana.

Although international guidelines exist on proper methods of healthcare waste disposal (Abahussain and Ball, 2007), these guidelines are usually not properly enforced and very little information which is sometimes contradictory is available to the public.

One approach that has been adopted by some countries is some sort of 'reverse distribution network' (Abahussain and Ball, 2007) which requires that members of the public are requested to return their

unwanted medications to local community pharmacies. The local community pharmacies then arrange for collection and subsequent destruction by pharmaceutical distributors or approved agents.

The 'dump' (Dispose of Unwanted Medicines and Pills) campaigns in the United Kingdom recovered volumes and values of unused medications costing several millions of GBP (Abahussain and Ball, 2007).

The exact extent of the problem of unused, expired and unwanted medication is not fully known in Ghana. Given the environmental, economic and health consequences of unwanted medications, the aim of this study was to evaluate the medication disposal practices of a community in Ghana.

## **2. Methodology**

The study population was randomly selected from among the residents of Konongo-Odumasi in the Ashanti Region of Ghana.

Anonymous questionnaires in English language were designed, pretested on 20 prospective participants and self-administered. The questionnaire was checked for easy readability, easy comprehension, question design and length. As a result of pretesting, some open-ended questions were converted into close-ended questions and vice versa.

The questionnaire informed respondents of the objective of the study, elicited socio-demographic data from respondents including educational background and any medical condition(s) or disease(s) respondents may be suffering from. The questionnaire also sought information on reasons why respondents may not use all the medicines prescribed to them by healthcare personnel as well as their practices with regard to medication disposal. Moreover, the questionnaire elicited information from respondents on the best method of disposal of unused, unwanted and expired medications. Respondents were also given the chance to suggest other disposal methods they thought can be used to ensure proper disposal of unused, expired and unwanted medications.

A total of 500 residents of Konongo-Odumasi in the Ashanti Region of Ghana participated in the study. Literate and semi-literate participants who took part in the study were encouraged to fill the questionnaires themselves while illiterate respondents were taken through structured personal interviews in the local dialect.

The survey was conducted from December 2012 to February 2013. Permission to conduct the survey was obtained from the chiefs and elders of Konongo-Odumasi in the Ashanti Region of Ghana. Residents were at liberty to refuse to participate in the study (the number declining to take part in the survey however was not recorded). The data was analyzed using Microsoft Excel 2010.

## **3. Results**

The total study population was 500 residents of Konongo-Odumasi in the Ashanti region of Ghana comprising 350 females (70%) and 150 males (30%). Respondent's age ranged from 18 to 60 years with a mean age of 39 years.

Most of the respondents were between the ages of 46-55 years (29%), married (67%) and had pre-secondary education (53%) (Table 1).

**Table 1.** Socio-demographic characteristics of respondents (n=500)

| Characteristic | Parameter     | Respondents |    |
|----------------|---------------|-------------|----|
|                |               | n(500)      | %  |
| Gender         | Male          | 150         | 30 |
|                | Female        | 350         | 70 |
| Age (years)    | 18-25         | 95          | 19 |
|                | 26-35         | 75          | 15 |
|                | 36-45         | 125         | 25 |
|                | 46-55         | 145         | 29 |
|                | 56-60         | 60          | 12 |
| Marital Status | Married       | 335         | 67 |
|                | Single        | 135         | 27 |
|                | Widowed       | 5           | 1  |
|                | Divorced      | 25          | 5  |
| Education      | None          | 125         | 25 |
|                | Pre-secondary | 265         | 53 |
|                | Secondary     | 105         | 21 |
|                | Postsecondary | 5           | 1  |

59% of respondents said they had current medical conditions or diseases while 41% of respondents said they did not have any medical condition they knew of. Out of the total number of respondents who had current medical conditions (n=295), 30% had cardiovascular disease, 23% had diabetes mellitus, 8% had asthma, 14% had gastrointestinal disease, 4% had sickle cell anemia and 21% had other diseases (table 2). Other diseases included rheumatic disease, candidiasis and pelvic inflammatory disease, etc.

Almost all respondents (98%) reported having medications in the home which they wished to dispose of. Dosage forms of the medicines they (n=490) wished to dispose of included liquid oral preparations mostly syrups (36%), solid oral dosage forms mostly tablets, caplets and capsules (30%), topical ointments/ creams (15%), ear/eye drops (6%), inhalers (5%), injections (4%) and syringes (2%). No validation was however done to confirm the authenticity or otherwise of these subjective self-reports.

**Table 2.** Current medical complaints of respondents

| Medical condition               | Respondents (%)<br>n=295 |
|---------------------------------|--------------------------|
| <b>Cardiovascular disease</b>   | 30                       |
| <b>Diabetes mellitus</b>        | 23                       |
| <b>Asthma</b>                   | 8                        |
| <b>Gastrointestinal disease</b> | 14                       |
| <b>Sickle cell anemia</b>       | 4                        |
| <b>Other diseases</b>           | 21                       |

38% of the respondents said they do not check the expiry dates of medications when buying them.

The most common method of disposal of unused, unwanted or expired medications according to the respondents was to throw them in the waste bin (29%), dig a hole in the ground and bury the medication (38%), flush the medication down the toilet or sink (4%) while 21% of respondents said they would give it to their relatives and friends (table 3).

88% (n=500) reported having leftover unexpired medication from a previous illness in the last six months.

Reasons cited for why respondents had excess medication in the home and would want to dispose of such medicines included change or discontinuation of the medication by the doctor (16%), self- discontinuation of the medication (30%), buying medications as a result of advertisements by pharmaceutical companies for which respondents did not have need of (26%). (Table 3)

Over 98% of respondents said they had never received any information about proper medication disposal methods. 80% expected to have leftover medications in their homes in the next 6 months.

Respondents were given the chance to make some suggestions on the best possible way for unused, unwanted or expired medication to be collected for safe disposal. 15% said there should be special collection containers provided at vantage points within the town, 40% preferred that medication are collected by a special taskforce charged with the responsibility of collecting unused, expired or unwanted medication, etc (table 3).

Asked the best possible way of minimizing excess medication in the home thereby reducing medication wastage, 30% said that sharing unexpired medication with friends and relatives who had need of them was the best way. 8% felt that if the doctor wanted to discontinue a patients' medication, the doctor should recall all the patients' previous medication(s), 17% felt that patients should be given the exact amount of medication required; 12 % felt that consultation with a pharmacist could help patients to decide whether to

discontinue treatment or not, 23% felt that the public should be educated more on the dangers of self-discontinuation of medications while 10% had no opinion.

**Table 3.** Respondents medication disposal practices, reasons for excess medication in the home and their suggestions on the best medication disposal practices

|  |   | Respondents |    |
|--|---|-------------|----|
|  |   | n           | %  |
| <b>Common medication disposal methods by respondents</b>                     | Waste bin (trash)                                 | 145         | 29 |
|  | Burying in the ground                             | 190         | 38 |
|  | Flushing down toilet/sink                         | 20          | 4  |
|  | Donation to friends/relatives                     | 105         | 21 |
|  | Incineration                                      | 35          | 7  |
|  | Returning them to a pharmacy                      | 5           | 1  |
| <b>Reasons cited by respondents for excess medication in the home</b>        | Discontinuation of medication by doctor           | 80          | 16 |
|  | Self- discontinuation                             | 150         | 30 |
|  | Buying medication because of advertisements       | 130         | 26 |
|  | Possessing expired medication                     | 85          | 17 |
|  | Over prescription/ over dispensing of medication. | 55          | 11 |
|  |   |             |    |
| <b>Suggestions by respondents on the best methods of medication disposal</b> | Special collection containers                     | 75          | 15 |
|  | Returning to a pharmacy                           | 65          | 13 |
|  | Special taskforce collection                      | 200         | 40 |
|  | No opinion  | 160         | 32 |

#### 4. Discussion

The study examined the disposal of unused, expired as well as unwanted medication practices of 500 residents of Konongo-Odumasi in the Ashanti Region of Ghana. Konongo-Odumasi is a gold-mining town, the capital of the Asante Akim North District of Ghana with a settlement population of 41,238 people.

Willing participants below the age of 18 years were excluded from the study because we thought they were quiet young to be able to understand the contents of the questionnaire and to give accurate responses. The large proportion of married respondents probably reflect that single respondents were more likely to be young (18-25 years) and therefore less likely to suffer from many chronic or acute medical conditions.

Indeed more than half of the respondents (59%) suffered from a variety of medical conditions. Notable among these medical conditions were cardiovascular disease (30%), diabetes mellitus (23%) and gastrointestinal disease (14%) which are common medical complaints among Ghanaians.

The oral route of drug administration is the most convenient, usually the safest and the least expensive and therefore one of the most frequently used routes of drug administration (Reisenwitz and Wimbish, 1996; Wiczorkiewicz et al., 2013). It is not surprising therefore that most respondents had a large proportion of oral dosage forms (both solid and liquid) in the home.

Some consumers are sometimes quick to disregard the expiration dates of both their prescription and over-the-counter medications. This could be attributed to the rising cost of medications, negligence or unawareness of the harmful effects of using expired medications. The problems associated with expired medication usage are two-fold: drugs become less potent or less efficacious and can be potentially fatal (Kuspis and Krenzelok, 1996). In this study, 38% of respondents said they did not check the expiration dates of their medication before buying them which is a very bad practice indeed.

Direct risks of unsafe medication disposal such as inappropriate medicine sharing among friends and relatives, childhood poisoning and diversion of medicines to illicit use have been long identified problems (Abahussain and Ball, 2007; Auta et al., 2011).

In recent times however, the impact of inappropriate medicine disposal by patients has become a serious environmental issue worldwide (Garcia Cuadrado et al., 1992; Harhay et al., 2009) and particularly in developing countries (Nkonge Njagi et al., 2012).

Medicine take-back programs for the safe disposal of medicines are a good way of removing unused, expired or unwanted medicines from the home (Gray-Winnett et al., 2010). In many developed countries, occasional "dump" (Dispose of Unwanted Medicines and Pills) campaigns have been successful in collecting substantial volumes and values of unused, expired and unwanted medicines for proper disposal (Abahussain and Ball, 2007). Guidelines on safe disposal of unused, expired and unwanted medicines are urgently needed in Ghana and an organized method of collection needs to be introduced.

Where medicine take-back programs are non-existent or ineffective, it is recommended that unused, unwanted or expired medicines are disposed of in the household trash (Jarvis et al., 2009). It is recommended that medicines are mixed (not crushed) with an unpalatable substance such as coffee grounds, placed in an enclosed container such as a sealed plastic bag and mixed with the normal household trash. Where a medicine container such as a pill box with drug information written on it has to be disposed of, all information written on the container has to be scratched off before disposal. This method of disposal can however put the health and safety of garbage collection workers at risk. Disposed medications can also pollute waterways and drinking water if sent to the normal landfill.



There are some medicines which may be especially harmful and in some cases fatal after accidental ingestion of just one dose by someone other than the person for whom the drug was originally prescribed. Children, pets, relatives and friends may unknowingly ingest these medications and cause serious harm or even death. In view of this, these drugs are recommended and backed by the Food and Drugs Authority (FDA) law to be disposed of by flushing down the sink or toilet (Shader, 2010) when they are no longer needed or expired in the absence of effective medicine take-back programs.

For instance, patients using fentanyl patches for pain relief are requested by law to flush their used, unwanted or expired patches down the toilet. Skin patches usually have sticky sides that hold the patch effectively to the skin. It is therefore recommended that, adhesive skin patches be folded in half so that the sticky sides meet and then flushed down the toilet. Other examples of drugs recommended by the FDA law to be flushed down the sink or toilet include morphine sulfate (immediate release tablets, extended release tablets, oral solution), methadone hydrochloride tablets (tablets, oral solution), diazepam (tablets, rectal gel) etc.

The problem however with flushing medication down the toilet or sink apart from corroding water pipes and blocking water drainage channels is that the medication being disposed of may end up in the lakes, streams and even the community drinking water which can affect public health and aquatic life negatively (Shader, 2010; Tischler et al., 2012). Some surveys conducted worldwide have detected over 100 different pharmaceuticals in the lakes, reservoirs, streams and rivers throughout the world (Zuccato et al., 2000; Valcarcel et al., 2010; Sanderson, 2011). What is most worrying however is the fact that, users of bottled water and home filtration systems do not necessarily avoid exposure to these dangerous chemicals as most bottlers particularly in Africa repackage tap water and do not treat or test pharmaceuticals in the drinking water.

Burying medication in the ground is a bad practice as disposed drugs leach into the soil and affect plants and groundwater adversely. In this study, majority of respondents (38%) said they dispose of drugs by burying them in the ground (garden).

Despite being an attractive excess medication disposal method, incineration has been a subject of intense debate globally (Hornung et al., 1996; Hu and Shy, 2001). The United Nations Environment Program (UNEP) and other environment watchers worldwide have stated incineration as the leading source of dangerous toxins such as dioxin and furan pollution of the air, water and land which may adversely affect human health and the environment (Pesatori et al., 1992; Koninckx, 1999). 7% of respondents cited incineration as their main mode of medication disposal which is indeed very disturbing.

Other methods of effective medication disposal suggested by respondents included the provision of special containers at supermarkets and shops and arranging for special collection by the municipality. Majority of respondents also suggested that, medications should be collected by special taskforce for safe disposal. This will however require special measures to prevent the diversion of expired or unused medicines of abuse potential to illicit use (Tewari, 1992). This will also require some means of separating the medicines and healthcare waste from normal household garbage, for example through the use of special colored collection bags.



Patients' practices in the disposal of unused, expired or unwanted medicines are an important part of the Rational Use of Medicines (RUM) concept, as well as good prescribing habits and effective patient care by health care workers (Garcia et al., 2003). Unfortunately, health policy makers particularly in developing countries generally focus more on the provision and regulation of medicines and efforts to improve health care workers' prescribing skills, rather than efforts aimed at proper disposal of medications.

Public education on the appropriate disposal of unused, expired or unwanted medicines is therefore imperative and of crucial importance. Therefore, well focused educational campaigns could definitely bring about positive results. It is in this regard that, the World Health Organization (WHO) has published various resource materials for educating the public on the rational use of medicines including good storage and disposal practices.

The involvement of the Pharmaceutical Society of Ghana (PSG) and the Pharmacy Council of Ghana would be essential as well as effective public education through the mass media. Collaborating bodies such as the Ministry of Health, the Ministry of Education, the Ministry of Information, Non-Governmental Organizations (NGOs), professional associations, religious groups, and developmental agencies such as the World Health Organization (WHO), United Nations Children's Fund (UNICEF), etc have important roles to play in this regard.

Planning, developing, implementing, monitoring, evaluating and reassessment of effective public education programs or policies on RUM with special emphasis on safe medication disposal practices are therefore urgently needed in developing countries and Ghana in particular.

## **5. Conclusion**

This study indicates that appropriate medication disposal is a problem in Ghana and that the RUM concept is not being adequately enforced. Guidelines on safe medication disposal as well as organized methods of collection need to be introduced urgently.

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