



Public practice regarding disposal of unused medicines in Ireland



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HIGHLIGHTS

- Despite EU directives many countries lack appropriate unused medicines disposal systems.
- No information has been published on disposal of unused medicines in Ireland.
- Nearly 90% of respondents to a survey have unused medicines at home.
- Seventy five percent of respondents dispose of unused medicines appropriately if information is provided.
- Effective communication is likely to improve appropriate disposal.

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ABSTRACT

Background: Over recent years, a global increase in the use of pharmaceutical products has been observed. EU directives state that “Member states shall ensure that appropriate collection systems are in place for medicinal products that are unused or have expired” (Directive 2001/83/EC and Directive 2004/27/EC).

Objectives: There is no published data on how people in Ireland dispose of unused medicines; therefore the purpose of this study is to establish baseline information on storage and disposal of medicines.

Design: Data was collected over two 2-week periods a year apart. People in the streets of Galway and Cork were approached randomly and invited to participate by filling out a questionnaire.

Results: The questionnaire was completed by 398 individuals (207 in Galway and 191 in Cork). Unused medicines were kept in the home by 88% of the respondents. The most cited reason for keeping unused medicines was “in case they are needed later” (68%). Of the respondents who had disposed of medicine in the past, 72% had done so inappropriately. Environmentally inappropriate disposal methods were through general waste disposal and via the sewage system. Interestingly, of the people who had received advice on disposal practices from a healthcare professional, 75% disposed of their medicine appropriately.

Conclusions: There is little awareness among members of the public regarding appropriate ways to dispose of unused medicines. Our findings suggest that effective communication and established protocols will promote appropriate disposal practices.

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1. Introduction

Over recent years, a global increase in the use of pharmaceutical products has been observed (Kaiser Family Foundation, 2010). This increase is related in part to an ageing population and significant burden of chronic disease, resulting in a higher proportion of the population taking medicines for longer periods of their lives (Moynihan et al., 2013). Increased use of pharmaceuticals in both human and animals may have effects beyond the immediate consumer as they may enter

the environment (Daughton and Ruhoy, 2013). Much confusion exists about the proper way in which medicines should be disposed as many countries do not have standard medicines disposal protocols (Tong et al., 2011).

The processes of absorption, metabolism and excretion of pharmaceuticals are variable; however for many agents significant quantities are excreted in urine and/or in faeces without alteration or in altered but biologically active form. In addition to excretion of administered pharmaceutical agents into the sewage system, pharmaceuticals may also enter the environment in unaltered form as a result of environmentally inappropriate disposal (Bound et al., 2006). Sewage treatment systems were not generally designed specifically to remove pharmaceuticals from effluent before discharge into receiving waters (Daughton and Ternes, 1999). Disposal of unused medicines into domestic waste may also lead to

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landfill leachate and create environmental problems (Bound and Voulvoulis, 2005). Similar issues may arise with a variety of personal care products which frequently contain biologically active compounds. The situation is further complicated by substantial use of pharmaceuticals in agriculture through animal urine and faeces including land spreading of animal slurry. When pharmaceuticals enter the environment, complex biological and physical processes may result in degradation of compounds at variable rates, depending on environmental conditions (Fent et al., 2006). In some cases it is possible that pharmaceutical metabolites are reactivated by conventional sewage treatment processes before environmental discharge (Daughton and Ternes, 1999; Ruhoy and Daughton, 2008).

Through sorption and biodegradation in the environment, pharmaceutical products may diffuse and transformed into by-products. These contaminant reservoirs may pose a higher or lower environmental risk (Crane et al., 2006; Fent et al., 2006). However, such risk assessment is difficult as it is generally assessed based on single compounds (Kümmerer, 2010). The human health and broader environmental impact of pharmaceutical agents in the environment are uncertain. Concentrations of individual compounds are generally well below the levels thought to cause acute harm to humans or readily detectable impacts on the wider environment (Bound et al., 2006). There is considerable uncertainty however regarding potential harm from chronic exposure to low levels of pharmaceuticals and the potential for health and environmental interactions from traces of multiple agents (Crane et al., 2006; Johnson et al., 2008). The latter issue arises because there are generally traces of multiple different pharmaceuticals agents in the environment (Carlsson et al., 2006). Environmental problems possibly associated with the use and disposal of pharmaceuticals have already been observed. Jobling reported the feminisation of fish and Oaks documented on the near extinction of the Asian vulture (*Gyps bengalensis*) from diclofenac (Jobling et al., 1998) (Oaks et al., 2004). In addition to the direct environmental effects of pharmaceuticals, the presence of antibiotics in wastewater has the potential to create antibiotic resistant organisms and disrupt sewage treatment processes (Bound et al., 2006).

Removing excreted pharmaceuticals from urine and faeces poses substantial technical challenges and there is debate as to the extent to which the evidence of harm justifies investment in upgrading treatment systems. The issue of appropriate medicines disposal should in principle be much easier to address. In fact there is an existing directive that places an obligation on EU member states to ensure that appropriate collection systems are in place for medicinal products that are unused or have expired (Directive 2001/83/EC and Directive 2004/27/EC). However this law is inconsistently applied and appears to be unenforced.

Studies done in countries such as the UK, Sweden and New Zealand in recent years have shown that people frequently dispose of medicines inappropriately via routes which may be detrimental to the environment (Braund et al., 2009; Persson et al., 2009; Tong et al., 2011). These studies have also shown that if patients are aware of the impact of pharmaceuticals on the environment, they are more likely to return medicines for proper disposal and destruction (Tong et al., 2011). In Sweden, a national and frequently publicised system for disposal of unused medicine through pharmacies resulted in the participation of more than 50% of the population (Persson et al., 2009). This is consistent with a review regarding disposal methods around the world which stated that information is the key to appropriate disposal of unused medicines (Tong et al., 2011). A formal system and guidelines for disposal are particularly important in countries that offer free or subsidised medicines as there can be greater accumulation and hoarding of medicines (Braund et al., 2009). In Ireland where free and subsidised medicines are available to a section of the population either through the medical card or drugs payment scheme and where public expenditure on drugs in the community increased over six fold from 300 million euro in 1998 to 1.9 billion euro in 2008 (Barry et al., 2010), there is a clear need for a formalised system of disposal.

The environmentally appropriate method to dispose of unused medicines is by returning them to the pharmacy. Currently, an *ad hoc* system

is in place in Ireland whereby some pharmacies accept unused medicines for return and some do not (Health Service Executive Ireland (HSE), 2007–2012). The pharmacy regulator (Pharmaceutical Society of Ireland) advises its members to advise the public to return medicines to the pharmacy for safe disposal (Pharmaceutical Society of Ireland, 2011). There are however no obligations on the pharmacies to accept returns and the costs of disposal rest with the pharmacies.

In two Irish counties, Cork and Kerry, efforts have been made to put a structured system in place for the safe disposal of unwanted and unused medicines. DUMP (Dispose of Unused Medications Properly) was organised by the Health Services Executive (HSE) in conjunction with community pharmacists in the region (Health Service Executive Ireland (HSE), 2007–2012). DUMP aimed to encourage members of the public to return unwanted or out of date medicines to pharmacies which would then be disposed of safely and properly and reduce the chance of accidental poisonings, overdose, inappropriate sharing of medicines and damage to the environment (Environmental Awareness Research Unit of Cork City Council, 2011). The scheme included both prescription and over the counter medicines. The campaign ran for 6-week periods at the start of each year from January 2007 to 2010. In a special report highlighting the outcomes of the DUMP campaign, the conclusion argued for more campaigns across the country and greater publicity but this has not happened (Kim and Aga, 2007; O'Driscoll et al., 2009). Against this background we conducted a study to assess knowledge and practice of Irish people regarding the disposal of unwanted pharmaceuticals.

2. Objectives

The objective of this study was to establish baseline information on storage and disposal of medicines. The results combine two surveys in Ireland in Galway in 2010 and Cork in 2011.

3. Methods

Interviews were held over 2-week periods, a year apart. People in the streets of the cities of Galway and Cork were approached randomly and invited to participate. People were approached at different times during the day, on weekdays as well as during the weekends. Participants could either complete the survey themselves or have their responses marked by the researchers. Participants had to be Irish residents, over 18 years of age with fluency in English. The questionnaire requested responses regarding medicine use, storage and disposal as well as socio-economic indicators (Table 1). A medical card provides free access to the general practitioner and other medical services and to medicine (subject to a small contribution). Medical card status is based on income thresholds and at the time of the survey in Ireland about 30% of the population were eligible for a medical card.

People approached in Cork were asked two additional questions, namely, whether they had heard of the DUMP campaign, and if so, whether they had used the bins provided by the campaign to dispose of unused medicines.

Data entry was done in Epidata (DK) and statistical analysis was performed using SPSS for windows (version 18.0). Dichotomous and ordered variables were analysed using the chi square test (for trend) and for continuous data, samples were compared with a *t*-test. A *p*-value of 0.05 was considered to be significant; however, due to the high number of comparisons, caution was observed in interpreting their practical significance. An overview of the questionnaire and possible answers is presented in Table 1. For questions where multiple responses were allowed, the percentages are based on the total number of answers provided.

4. Results

A total sample size of 398 was obtained with 207 responders in Galway and 191 in Cork. Overall, 68% were female and 32% male. Most respondents were in the age group 26–65 years, 37% in the 26–45 years,

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