Assessment of the association between drug disposal practices and drug use and storage behaviors

Ahmet Akici a,⇑, Volkan Aydin a, Arzu Kiroglu b

a Department of Medical Pharmacology, Marmara University Faculty of Medicine, Istanbul, Turkey
b Turkcell Global Bilgi Inc., Istanbul, Turkey

A R T I C L E   I N F O

Article history:
Received 6 April 2017
Accepted 14 November 2017
Available online 14 November 2017

Keywords:
Rational use of medicine
Drug handling
Drug storage
Drug disposal
Self-medication

A B S T R A C T

Objective: Keeping unnecessary drugs at home is a situation showing both causes and consequences of irrational use of medicine. This study aimed to evaluate the approaches of a company’s employees regarding drug storage, use, and disposal.

Method: This online-based descriptive study was held in a multi-centered private-sector company in a voluntary basis. The survey assessing participants’ drug handling and storage behaviors was answered by 1121 employees from across eight provinces of Turkey in 2016. Main outcome measures were storage and disposal of unused/unwanted drugs at home in a rational way.

Results: The percentage of participants who declared that they keep unused/unwanted drugs at home was 28.0%. About one-third of participants disposed their unused/unwanted drugs via the “garbage, sink, toilet, etc.”. Participants ≥30 years old and living with <4 household members significantly tended to bring their unused/unwanted drugs to the company’s drug-box. Nearly half of all participants (46.5%) started a recent change in their disposal behavior. The vast majority of participants (94.6%) who previously took drugs back to the company’s drug-box stated that they either had, or would, help their contacts adopt such behaviors. These participants were also significantly less likely to dispose of drugs inappropriately, practice self-medication, be unaware of expired drugs at home, or fail to store drugs according to the labelling.

Conclusion: While our findings showed that a substantial number of participants still had unused drugs at home and disposed of them inappropriately, it is understood that they started to exhibit more favorable behaviors in recent years.

1. Introduction

The World Health Organization defines rational use of medicine (RUM) as “patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community” (WHO, 2002). In fact, this applies to all phases of drug handling from manufacturing to disposal, hence any non-compliance during these processes could be regarded as irrational use of medicine (IUM). Keeping unnecessary drugs at home is a situation showing both causes and consequences of IUM. This unfavorable behavior predisposes to many IUM practices such as drug wastage, inappropriate treatment, resistance to antibiotics, medication errors, intoxication, drug use of insufficient duration and dose, and unnecessary self-medication (Akici and Oktay 2007; CDC, 2006; Daughton and Ruhoy, 2008; de Bolle et al., 2008; Hazell and Robson, 2015). Besides, inappropriate disposal of used drugs constitutes an additional threat for human health and ecosystems (Daughton and Ruhoy, 2008; Kusturica et al., 2017).

It is well-recognized that people often fail to exhibit proper behavior in keeping medicines at home, which should be confined

Abbreviations: CDC, Center for Disease Control; DTB, drug take-back; IUM, irrational use of medicine; RUM, rational use of medicine; TC, Republic of Turkey; TGB, Turkcell Global Bilgi, Inc.; US, United States; WHO, World Health Organization.

⇑ Corresponding author at: Department of Medical Pharmacology, Marmara University, Faculty of Medicine, Maltepe, Istanbul, Turkey.

E-mail address: aakici@marmara.edu.tr (A. Akici).

Peer review under responsibility of King Saud University.
to drugs for ongoing therapies and some over-the-counter drugs (Gracia-Vásquez et al., 2015; Jassin 2010; Kusturica et al., 2012). This confers great responsibilities to many individuals and institutions, where drug-users stay at the top. Meanwhile, several obstacles exist to overcome for proper disposal of unused/unwanted drugs. For instance, many countries including Turkey lack regulations and programs concerning appropriate management of drug waste (Kusturica et al., 2017; TC, 2005; Saygi et al., 2012; Tong et al., 2011). Despite representing the last chance for informing patients just before drug usage and handling, pharmacies in Turkey currently do not accept unused or leftover drugs, possibly due to absence of any obligatory regulation (Toklu, 2015; Saygi et al., 2012). Therefore, any pioneering activities of those companies or institutions that feel responsible, either governmental, non-governmental, or private, may help to reduce this problem. Recently, one such example was run by a private communication company, Turkcell Global Bilgi (TGB), to raise RUM awareness among its employees. This consisted of activities such as RUM training (a symposium, a distant learning course, and informative materials provided to employees), a survey about drug use behaviors, and the “take-back” of unused drugs into the drug-box within the company, where useful ones (regarded as useable by experts) were delivered to animal shelters and others were disposed with least harm to the environment. With collection of more than 14,000 packs and appropriate disposal of 560 kg of drugs, achievements of this RUM awareness-raising campaign were both presented through scientific and public meetings, attracting great attention (Kiroglu et al., 2016).

This study aimed to evaluate the approaches of the company employees regarding drug storage, use, and disposal and to compare these by their “participation to drug waste management activities” status.

2. Method

This cross-sectional study consisted of a 14-item questionnaire, which was implemented with voluntary completion of web-based online forms by TGB company employees in late February 2016. TGB is one of Turkey’s leading call center companies, serving in 14 locations in Turkey with over 12,000 employees. Representing almost each geographic region, the survey was carried out in eight locations (five of which were from five different metropolises) of Turkey, where the relevant number of employees in each local office was taken into account.

The questionnaire, delivered to 5200 employees in these 8 locations and completed by 1121 participants (response rate: 21.6%), comprised demographic characteristics followed by questions regarding attitudes and habits of drug use and storage at home, self-medication, and unused drug handling. Survey data was compared by one of the unused drug handling approaches, namely “prior action of drug taking-back to company’s drug-box ever [DTB(+) ] or never [DTB(−) ]”, and by their demographic characteristics.

Participants were included in the survey on a voluntary basis. Due to the web-based nature of the study and ease of participation, verbal consent was obtained from employers during various sessions of RUM activities. Participants were informed that an online survey was issued as part of RUM activities and its main findings might be published in scientific media. Among all participants, those who replied to the survey were accepted and documented as those who gave consent to the study.

Data were analyzed through Microsoft Excel and SPSS 11.5 Statistics Pack software. Chi-square test was used for detection of any association between demographic or other relevant approaches. Statistical significance was set at a p value of <.05.

3. Results

There were a total of 1121 participants with a mean age of 28.5 ± 5.1 (range: 18–49), 781 of whom were women (69.7%). Almost half of the participants (49.4%) were living with <4 household members.

Participants declaring “not to keep unused drugs at home” were 31.0%, while those “keeping such drugs” and “failing to remember present condition” were 41.0% and 28.0%, respectively. Handling of unused drugs showed a balanced distribution among participants such that 32.1% declared “to bring them to drug-box of the company”, 34.0% “to give them to a health facility such as pharmacy, family health center, hospital, etc.”, and 33.9% “to dispose them to garbage, sink, toilet, etc.” Nearly half of participants (46.5%) stated a behavioral change in this manner in recent years. While 45.9% of participants stated that they did not keep expired drugs, the rest either had such drugs or failed to remember whether they had or not. Participants who stated a recent change in their self-medication behaviors constituted 39.6%, of which 79.1% declared that they gave up purchasing drugs without prescription.

A total of 320 participants (28.6%) declared that they previously took drugs back to the company's drug-box during the 2 years of RUM awareness campaign. The vast majority of these participants (94.6%) claimed either to have helped people to develop such attitudes or to affirm to help them when possible (Fig. 1). Comparison of drug take-back status by demographic characteristics showed significantly higher rates of DTB(+) behavior among participants of ≥30 years old and living with <4 household members, compared to those <30 years old and living with ≥4 household members. No gender difference was found in this behavior (Table 1).

When keeping unused drugs at home was compared by drug take-back status, more participants among DTB(+) group had this attitude than that in DTB(−) group. Handling of unused drugs also differed significantly according to drug take-back status (p < .001). While only 7.3% of DTB(+) participants declared that they disposed unused drugs to garbage, sink, toilet, etc., this was 44.8% for the DTB(−) group. Additionally, significantly more DTB(−) participants (40.2%) did not know whether or not they had expired drugs at home, compared to 24.1% in the DTB(+) group (Table 2).

The presence of a recent change in self-medication behavior was also significantly influenced by drug take-back status, where more participants in DTB(+) group reported a change in last 2 years compared to that of DTB(−) group (47.2% vs 36.6%, respectively; p = .001). Among those claiming such behavioral change, 88.7% of DTB(+) participants gave up purchasing drugs without prescription, compared with 74.1% of DTB(−) participants (p < .001), (Fig. 2).

Drug take-back status also affected the recent change of participants' attitudes regarding unused drug handling, where more DTB(−) participants (79.7%) declared the presence of such change compared to those in the DTB(+) group (33.2%). Behavior-changers in these two groups also demonstrated a statistically significant difference (p < .001), which was led by more participants in the DTB(+) group who started to bring unused drugs to the company's drug-box. Similarly, the percentage of those who started to store drugs according to its instructions for use were found to be higher in the DTB(+) group than in the DTB(−) group (40.0% vs 28.0%, respectively, p < .001), (Table 3).

Participants' drug usage habits were also compared by their demographic characteristics. Gender stratification showed that more women kept unused drugs at home compared to men (44.6% vs 32.7%, p < .001). In addition, a higher percentage of women declared to change their unused drug handling practice (49.9%) than that among men (38.5%, p < .001). Other variables reviewed in the survey showed no gender difference.

When keeping unused drugs at home was compared by age groups, it was found that more participants in <30 years old group...
did not know presence of any unused drugs at home" than that among ≥30 years old group (34.5% vs 16.9%, p < .001). These groups also differed in their unused drug handling behavior such that participants ≥30 years old were significantly more likely to bring unused drugs to the company’s drug-box, compared to those <30 years old (46.2% vs 27.0%, p < .001), (Table 4). Age groups examined in the study had no influence on self-medication habits or presence of expired drugs at home.

The number of household members was shown to affect several aspects of the participants’ attitudes. Significantly less people living with <4 members were found to be unaware of the presence of any unused drugs at home compared with those living with ≥4 members (16.9% vs 34.5%, p < .001). The percentage of those giving unused drugs to the company’s drug-box were significantly higher among participants living with <4 members compared to those living with ≥4 members (37.3% vs 27.1%, p < .001). Similarly,

| Table 1 | Comparison of participants’ drug taking-back behaviors by their demographic characteristics. |
|---------|------------------------------------------------------------------------------------------------------------------|
| Parameter | Total Drug take-back (+) | Drug take-back (−) | Statistics |
| n | % | n | % | n | % |
| Sex | | | | | | |
| Male | 340 | 30.3 | 289 | 27.8 | 251 | 31.3 | χ²: 1.3, P > .05 |
| Female | 781 | 69.7 | 491 | 72.2 | 550 | 68.7 |  |
| Total | 1121 | 100.0 | 780 | 100.0 | 801 | 100.0 |  |
| Age group | | | | | | | |
| <30 years | 706 | 63.0 | 141 | 44.1 | 565 | 70.5 | χ²: 68.7, P < .001 |
| ≥30 years | 415 | 37.0 | 179 | 55.9 | 236 | 29.5 |  |
| Total | 1121 | 100.0 | 320 | 100.0 | 801 | 100.0 |  |
| Household members | | | | | | | |
| <4 people | 554 | 49.4 | 186 | 58.1 | 368 | 45.9 | χ²: 13.6, P < .001 |
| ≥4 people | 567 | 50.6 | 134 | 41.9 | 433 | 54.1 |  |
| Total | 1121 | 100.0 | 320 | 100.0 | 801 | 100.0 |  |

| Table 2 | Comparison of participants’ drug taking-back behaviors by their drug keeping attitudes at home. |
|---------|------------------------------------------------------------------------------------------------------------------|
| Parameter | Total Drug take-back (+) | Drug take-back (−) | Statistics |
| n | % | n | % | n | % |
| Do you have unused or unwanted drugs at home? | | | | | | |
| Yes | 459 | 41.0 | 174 | 54.4 | 285 | 35.5 | χ²: 40.3, P < .001 |
| No | 348 | 31.0 | 92 | 28.8 | 256 | 32.0 |  |
| Do not know | 314 | 28.0 | 54 | 16.8 | 260 | 32.5 |  |
| Total | 1112 | 100.0 | 320 | 100.0 | 801 | 100.0 |  |
| How do you handle unused or unwanted drugs?* | | | | | | |
| Return to health facility | 398 | 34.9 | 42 | 12.3 | 356 | 42.9 | χ²: 516.8, P < .001 |
| Throw into garbage, sink, toilet, etc. | 397 | 33.9 | 25 | 7.3 | 372 | 44.8 |  |
| Bring to company’s drug-box | 377 | 32.1 | 275 | 80.4 | 102 | 12.3 |  |
| Total | 1172 | 100.0 | 342 | 100.0 | 830 | 100.0 |  |
| Do you have expired drugs at home? | | | | | | |
| Yes | 208 | 18.5 | 75 | 23.4 | 133 | 16.6 | χ²: 26.8, P < .001 |
| No | 514 | 45.9 | 168 | 52.5 | 346 | 43.2 |  |
| Do not know | 399 | 35.6 | 77 | 24.1 | 322 | 40.2 |  |
| Total | 1121 | 100.0 | 320 | 100.0 | 801 | 100.0 |  |

* Multiple choices allowed.
people living with <4 members were significantly less likely to be unaware of the presence of any expired drugs at home than those living with ≥ 4 members (42.5% vs 28.5, p < .001), (Table 4). Household member strata did not reveal any statistically significant difference in terms of self-medication, unused drug handling, or drug storage.

### 4. Discussion

One of the common practices of IUM is use of drugs by any individual other than the prescribed person. Keeping unused and/or expired drugs at home precipitates many IUM practices in this respect. While unused drugs may mainly increase self-medication tendency and the risk for pediatric toxicity due to storing in inappropriate places, expired drugs pose toxicity risk and threaten human and environmental health due to inappropriate drug waste and disposal practices (CDC, 2006; Daughton and Ruhoy, 2008; de Bolle et al., 2008; Hazell and Robson, 2015; Kusturica et al., 2017). National or local drug take-back programs run in different countries in order to tackle these unfavorable outcomes gained acceptance by the public with important achievements (Coma et al., 2008; Ekedahl, 2006; Lauer et al., 2010; Perry et al., 2014; Persson et al., 2009; Thach et al., 2013). In our study, although a substantial number of participants were seen to keep unused/unwanted drugs at home and dispose them inappropriately, some of them started to exhibit and spread favorable changes in their behaviors.

Presence of unused drugs at home is a widespread entity throughout the world, varying between 15 and 98% (Abruquah et al., 2014; Dias-Ferreira et al., 2016; Jassim, 2010; Kusturica et al., 2012; Persson et al., 2009; Seeheusen and Edwards, 2006; Vellinga et al., 2014). While 41.0% of participants in our study declared to keep unused drugs at home, 28.0% of participants was not aware of unused drug status at home. A nationwide study performed by Turkish Social Security Institution in 2013 reported that participants did not consider using 42.7% of the drugs they were keeping (Dogukan et al., 2015). Another study performed in...
the same year reported 72.0% of participants keeping drugs at home (Ozdinc et al., 2015). An earlier study showed that 61.3% of participants had leftover drugs at home (Gocgeldi et al., 2009). Keeping unused drug was also analyzed in terms of demographic characteristics. Since this behavior has been mainly analyzed at household level so far, there’s a scarce amount of data focusing on gender differences. Among them, while an Irish study showed no gender differences, another in Uganda reported that women were more likely to keep unused drug at home (Ocan et al., 2014; Vellinga et al., 2014). Our finding that women more commonly exhibited this attitude may contribute to the literature by identifying scope for new research focusing on gender-specific features.

Apart from keeping too many and unnecessary drugs at home, being unaware of the presence of drugs at home could be regarded as an unfavorable attitude due to its potential risks. In our study, 28.0% of participants exhibited such an attitude, being significantly more common in those <30 years old and those living with >4 members. This may be explained by a lesser need of young individuals for drug treatment and the reduced probability of an individual’s awareness on drugs used by other people in crowded households, with a consequent difficulty of recalling this during the survey.

About one-third of our participants appeared to practice inappropriate drug disposal behavior according to their statement of throwing unused drugs to the garbage waste, sink, toilet, etc. A study in the United States (US) reported that 85.0% of participants threw their drugs to trash, sink, or toilet (Law et al., 2015). A Serbian study in 2010 revealed that 87.9% of participants disposed their unused drugs to garbage or toilet (Kusturica et al., 2012). Another study performed in Ireland reported that 72.0% of participants disposed their unused drugs through inappropriate ways, mainly household waste, sink, or toilet (Vellinga et al., 2014). On the other hand, disposal of unused drugs into waste bin was reduced to 3% after disposal awareness campaigns in Sweden, where a drug take-back policy already existed (Persson et al., 2009). The probability that some participants in our study were affected by the RUM awareness campaign within last two years might explain the lower rates observed in our study compared to mostly published literature. Indeed, those who received information about safe disposal of medications were reported to be four-fold more likely to return unused drugs or expired drugs to a pharmacy compared to those who never received such information (Owens and Anand, 2009).

Handling of unused drugs was influenced by some demographic characteristics, where the attitude of drug take-back to company’s drug-box was exhibited significantly more in >30 age group and those living with <4 members, albeit with no apparent gender difference. A US study reported a higher percentage of women disposing of unused drugs or expired drugs into toilet or sink and a lower tendency to throw such drugs into the garbage with increasing age (Owens and Anand, 2009). A Saudi study in 2015 showed that men exhibited a lower responsibility to find the proper way of disposing drugs and willingness to return these to collection facilities, and that these two habits were significantly more likely to seen with increasing age (Al-Shareef et al., 2016). While these findings partially imply an association between drug disposal management and age, no such association could be established in terms of gender. In fact, an Irish study reported no gender difference with respect to inappropriate disposal of unused drugs (Vellinga et al., 2014). Besides, this was observed to be more commonly adopted by young people, consistent with our findings.

In order to possess appropriate drug waste management behavior, people are expected to be motivated by considering benefits over costs, from receiving relevant information, and developing and maintaining new habits (Pieters, 1991). Particularly, information about hazardous household material and introduction of appropriate occasions for waste collection help people to take action (Cassel, 2008). For instance, drug collection events supported by national awareness campaigns in Sweden were reported to reduce the percentage of people who stated to throw their unused drugs to a waste bin (Persson et al., 2009). In our study, 28.6% of participants declared that they previously took drugs back to the company’s drug-box. When drug take-back status was analyzed by demographic characteristics, while gender was not a distinctive factor, this attitude was found to be more common among >30 age group and those living with <4 members. Consistently, when current handling of unused drugs was questioned, taking back of unused drugs to a company’s drug-box were more commonly adopted by these two groups. In this context, it could be suggested that participants start to convert their previous positive drug take-back experience into a habit. This is further supported by the finding that DTB(+) participants were six-fold less likely to throw their drugs into waste bin, sink, or toilet, compared to DTB

### Table 4
Comparison of participants’ drug keeping and handling attitudes by their age group and number of household members.

| Parameter                                      | Total          | Age Group       | Household Members |
|-----------------------------------------------|----------------|-----------------|-------------------|
|                                               | n   | %  | <30 years | ≥30 years | n   | %  | <4 people | ≥4 people |
| Do you have unused or unwanted drugs at home? | Yes | 459 | 41.0    | 251 | 35.6 | 208 | 50.1 | 258 | 46.6 | 201 | 35.5 |
| No                                           | 348 | 31.0 | 211 | 29.9 | 137 | 33.0 | 188 | 33.9 | 160 | 28.2 |
| Do not know                                   | 314 | 28.0 | 244 | 34.5 | 70   | 16.9 | 108 | 19.5 | 206 | 36.3 |
| Total                                         | 1121 | 100.0 | 706 | 100.0 | 415 | 100.0 | 554 | 100.0 | 567 | 100.0 |
| Statistics                                    | χ²: 43.6, P < .001 | χ²: 39.8, P < .001 |
| How do you handle unused or unwanted drugs?   | Return to health facility | 398 | 34.0 | 283 | 36.6 | 115 | 26.9 | 167 | 29.0 | 231 | 38.8 |
|                                              | Throw into garbage, sink, toilet, etc. | 397 | 33.9 | 282 | 36.4 | 115 | 26.9 | 194 | 33.7 | 203 | 34.1 |
|                                              | Bring to company’s drug-box | 377 | 32.1 | 179 | 27.0 | 198 | 46.2 | 215 | 37.3 | 162 | 27.1 |
| Total                                         | 1121 | 100.0 | 774 | 100.0 | 428 | 100.0 | 576 | 100.0 | 596 | 100.0 |
| Statistics                                    | χ²: 61.4, P < .001 | χ²: 17.6, P < .001 |
| Do you have expired drugs at home?            | Yes | 208 | 18.5 | 112 | 16.0 | 96  | 23.1 | 112 | 20.2 | 96  | 16.9 |
| No                                            | 514 | 45.9 | 316 | 44.8 | 198 | 47.7 | 284 | 51.3 | 230 | 40.6 |
| Do not know                                   | 399 | 35.6 | 178 | 25.2 | 121 | 29.2 | 158 | 28.5 | 241 | 42.5 |
| Total                                         | 1121 | 100.0 | 706 | 100.0 | 415 | 100.0 | 554 | 100.0 | 567 | 100.0 |
| Statistics                                    | χ²: 3.6, P > .05 | χ²: 24.0, P < .001 |

* Multiple choices allowed.
at home were reported to be unused, of which 8% had expired (Wievzorkiewicz et al., 2013). In a Portugal study, 72% of drugs, 23% of them having expired prescription medicines, are dentists as having leftover unexpired drugs at home and further estimates the prevalence of expired drugs in our study compared to the literature. Besides, in a simulated study in Turkey, none of the pharmacists counselled their patients about drug storage conditions (Toklu et al., 2010). Therefore, practices encouraging adoption of appropriate drug collection methods may help to raise such awareness. In fact, those unaware of expired drug status at home were less among DTB(+) participants than that in DTB(−) group.

Our study has some limitations. First, since the survey was completed online and based on participants’ statements, status of keeping unused drug at home was not confirmed by observation. Apart from that, other household members’ approaches about unused drug handling and storage were not examined. Responses to survey, particularly drug take-back status may be influenced by behaviors and attitudes of other individuals at home. Despite being a limitation, this may be investigated in future studies focusing on other household members’ attitudes. In addition, there is no regulation regarding over-the-counter drug definition in Turkey. Therefore, we regarded all the medicines that were kept at home and self-medicated as prescribed medicines. However, people could buy most of the drugs from pharmacies without a prescription. This was another limitation of the study. Finally, data was collected in 10 days on late winter, and might therefore have been subject to seasonal variations to keeping drugs at home, which in turn may change recall of individuals’ responses regarding drug storage and handling.

In conclusion, our findings show that a substantial number of participants still keep unused drugs at home and dispose of them inappropriately. Nevertheless, it is understood that they started to present more favorable changes in their behaviors in recent years. This may be attributed to the internal campaign within the company, featuring rational management of drug handling, storage, and disposal. In addition, it is remarkable that those exhibiting positive behaviors have a high tendency to extend such behaviors to their contacts. These model behaviors need to be taken as an example and spread across countries, which display less rational behaviors regarding the management of drug disposal.

Acknowledgements

The authors thank Ulku Sur Unal, M.D. from Medical Pharmacology Department of Marmara University and Kemal Eryar from Turkcell Global Biği, Inc. for their assistance in data collection and preparation of the previous project, which contributes to the basis of this article. The authors also thank Tony Spencer for proofreading of the article.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors declare no competing or conflict of interest.

Ethical approval

Ethical approval was not obtained since the data were fully anonymized to the authors and the items were asked to gather limited data about questioned behaviors and attitudes without violat-
ing volunteers’ privacy. In addition, local regulations in the country did not require the approval by ethics committee for this type of study.

References

Abuqah, A.A., Drewry, J.A., Ampratwum, F.T., 2014. What happens to unused, expired and unwanted medications? A survey of a community-based medication disposal practices. Int. J. Dev. Sustain. 3 (12), 2175–2185.

Akcı, A., Oktay, S., 2007. Rational pharmacotherapy and pharmacovigilance. Curr. Drug Saf. 2 (1), 65–69.

Al-Shareef, F., El-Assar, S.A., Al-Bakr, L., Al-Amro, M., Alqahtani, F., Alemany, F., Al-Rashood, S., 2016. Investigating the disposal of expired and unused medication in Riyadh, Saudi Arabia: a cross-sectional study. Int. J. Clin. Pharm. 38 (4), 822–828.

Ali, S.E., Ibrahim, M.I., Palaian, S., 2010. Medication storage and self-medication behaviour amongst female students in Malaysia. Pharm. Pract. (Granada) 8 (4), 226–232.

Asenser, N., Ballereau, F., Trombet-Paviot, B., Bouget, J., Foucher, N., Renaud, B., et al., 2013. Frequency and severity of adverse drug reactions due to self-medication: a cross-sectional multicentre survey in emergency departments. Drug Saf. 36 (12), 1159–1168.

Asti, L., Jones, R., Bridge, J.A., 2012. Acetaminophen and expired medication storage in homes with young children. J. Clin. Toxicol. 2, 130.

Aubel, J., Touré, L., Diagne, M., Lazard, K., Siné, E.H.A., Faye, Y., Tandia, M., 2001. Strengthening grandmother networks to improve community nutrition: experiences from Senegal. Gend. Dev. 9 (2), 62–73.

Cassel, S., 2008. Product stewardship: shared responsibility for managing HFW. In: Handbook on Household Hazardous Waste. The Scarecrow Press, Maryland, pp. 182–185.

Centers for Disease Control and Prevention (CDC), 2006. Nonfatal, unintentional medication exposures among young children–United States, 2001–2003. MMWR Morb. Mortal Wkly. Rep. 55 (1), 1–5.

Coma, A., Modamio, P., Lastra, C.F., Bouvy, M.L., Mariño, E.L., 2008. Returned medicines in community pharmacies of Barcelona, Spain. Pharm. World Sci. 30 (3), 272–277.

Daughton, C.G., Ruboy, I.S., 2008. The afterlife of drugs and the role of pharmecoigvigion. Drug Saf. 31 (12), 1069–1082.

De Bolle, L., Mehuys, E., Adriaens, E., Remon, J.P., Van Bortel, L., Christiaens, T., 2008. Consumer perceptions about a community-based medication take-back program. J. Am. Pharm. Assoc. (2003). 54 (3), 280–284.

Persson, M., Battal, D., Sahan, O.N., 2012. Çevre ve insan sağlığı yönelik ilaç atıklarının önemi. Importance of drug wastes in terms of environment and human health. Marmara Pharm. J. 16, 29–37.

Seehusen, D.A., Edwards, J., 2006. Patient practices and beliefs concerning disposal of medications. J. Am. Board. Fam. Med. 19 (6), 542–547.

Torg, A.Y.C., Peake, B.M., Braund, R., 2011. Disposal practices for unused, expired and unwanted medications? A survey of a community-based medication take-back program. J. Am. Pharm. Assoc. 54, 275–279.

Ozdicin, S., Sensoy, N., Kurt, R., Altilan, S., Altun, R., 2015. Are we using drugs rationally? A survey study from Turkey. Pak. J. Med. Sci. 31 (5), 1156–1161.

Perry, L.A., Shinn, B.W., Stanovich, J., 2014. Quantification of ongoing community-based medication take-back program. J. Am. Pharm. Assoc. 54, 275–279.

Livlins, A., Alland, S., 2009. Medication Disposal Survey: Final Report. SRI Study 1060, pp. 99.

Ozdinc, S., Sensoy, N., Kurt, R., Altilan, S., Altun, R., 2015. Are we using drugs rationally? A survey study from Turkey. Pak. J. Med. Sci. 31 (5), 1156–1161.

Seehusen, D.A., Edwards, J., 2006. Patient practices and beliefs concerning disposal of medications. J. Am. Board. Fam. Med. 19 (6), 542–547.

Sklíros, E., Merkouris, P., Papazafropoulou, A., Gikas, A., Matzouranis, G., Papafrogs, C., et al., 2010. Self-medication with antibiotics in rural population in Greece: a cross-sectional multicenter study. BMC Fam. Pract. 11, 58.

T.C. Çevre ve Şehirlik Bakınlığı/ Tıbbi Atıkların Kontrolü Yönetmelği [Turkish Ministry of Environment and Urbanization. Regulation for Control of Pharmaceutical Waste]. Resmi Gazete Tarihi: 22.07.2005 Resmi Gazete Sayısı: 25883.

Thach, A.V., Brown, C.M., Pope, N., 2013. Consumer perceptions about a community pharmacy-based medication take back program. J. Environ. Manage. 127, 23–27.

Toklu, H.Z., 2015. Rational use of medicine in pharmacy practice. Türkvey Klinikeri J Pharmacosp-Spl. Topics 3 (1), 74–83.

Toklu, H.Z., Akici, A., Oktay, S., Coli, S., Sezen, S.F., Kerey-Uysal, M., 2010. The pharmacy practice of community pharmacists in Turkey. Marmara Pharm. J. 14, 53–60.

Tor, A.Y.C., Peake, B.M., Braund, R., 2011. Disposal practices for unused medicines around the world. Environ. Int. 37 (1), 292–298.

Vellinga, A., Cormican, S., Driscoll, J., Furey, M., O’Sullivan, M., Cormican, M., 2014. Public practice regarding disposal of unused medicines in Ireland. Sci. Total Environ. 478, 98–102.

WHO Regional Office for South-East Asia, 2010. Regional Strategy on Prevention and Containment of Antimicrobial Resistance 2010–2015. WHO New Delhi, India, p. 16.

World Health Organization (WHO) [Internet], 2002. Promoting rational use of medicines: core components. WHO Policy Perspectives on Medicines, Geneva. [cited 2017 April 6]. Available from: http://apps.who.int/medicinedocs/pdf/h3011e/h3011e.pdf.