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Safe storage of methadone in the home. An Irish audit of the effectiveness of information provision in pharmacies.

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Summary

Background: Safe storage of oral methadone at home is an important issue given the risk of accidental paediatric consumption. Pharmacy protocols centre on provision of information to patients relating to general and paediatric dangers of methadone and safe storage of methadone in the home. **Aim:** The study aimed to audit the effectiveness of pharmacy provision of information on safety of methadone consumption and storage in the home. **Methods:** The study involved an audit of five criteria relating to patient awareness of general dangers of methadone use and paediatric risks, patient information recall on safe storage of methadone in the home; take home methadone dispensing in child resistant containers and safe and secured storage of methadone. Audit information was collected using a survey with consecutive adult patients attending a specialist methadone clinic over the course of four weeks (n=94), and telephone interviews with dispensing pharmacists recorded in the specialist clinic register (n=43). **Results:** None of the criteria reached a 100% standard. 51% reported never being provided with safety information. 97% of patients were aware of the dangers of methadone use, with females significantly more aware of dangers of methadone to users. 86% did not place their take-home methadone in a locked place. 90% reported they would seek medical help if a child had accidentally consumed methadone. 58% of pharmacists never questioned patients around storage, but 58% reported counselling patients on safe storage. **Conclusions:** Safe storage of methadone warrants regular and proactive pharmacy provision of information around harms associated with methadone.

Key Words: Methadone; paediatric overdose; accidental consumption

1. Introduction

Addiction to opioids is described as a chronic relapsing disorder with permanent metabolic deficiency [11]. Treatment of opioid addiction and detoxification employing therapeutic agents centre on the oral administration of full or partial opioid agonists (i.e. methadone, buprenorphine, LAAM, codeine or oral morphine) [3]. Methadone replacement therapy is the most frequently prescribed treatment for withdrawal symptoms associated with heroin and other opioids worldwide and with strong evidence for its effectiveness in treating opiate withdrawal and pain [4, 26]. Methadone is a synthetic, narcotic analgesic which has a long duration of action, with plasma half-life ranging from 13 to 58 hours, allowing a once a

day dose regimen [18]. Length of stabilisation varies, and when tapering incremental dose reductions are administered over a course of 7–21 days [33]. Calls to scale up availability of methadone maintenance treatment are evident in recent times [24,26], with low threshold methadone maintenance treatment on the increase [40].

1.1. Risks and Requirements for Safe Patient Storage of Methadone

Methadone is not without risks. The toxic and potentially lethal dose of methadone is 1mg/kg in an opiate naïve patient, with lowest published toxic dose ranging from 0.76 to 2mg/kg, and lowest published lethal dose of 1.3 mg/kg [16]. Methadone is potential-

ly lethal even in smaller doses (0.5mg/kg) [36]. Toxicity can cause fatality resulting from central nervous system (CNS) depression, respiratory depression, miosis and fatal arrhythmias [18, 38, 44]. Iatrogenic methadone toxicity most commonly occurs on commencement of maintenance treatment [9]. Methadone poisoning can also be accidental (overdose due to abuse of narcotics or by children/elderly) or intentional (therapeutic, suicide or homicide purposes) [12, 29]. The majority of methadone related deaths are confounded by the presence of other CNS depressants such as benzodiazepines and opiates [28, 38]. Studies indicate how addiction, gender, age, suicide attempt and presence of psychiatric disorder are closely related to methadone poisonings [6, 27, 41]. Methadone poisoned patients generally fall into the age category of 20-39 years [8, 22, 41].

Safe storage of medicines in the patient home is an important issue, and particularly in the case of oral solutions [5, 30, 42]. Some studies indicate that only half of patients store methadone in a safe place [7], and often in potentially fatal volumes, particularly for children [30]. Of concern is the availability of take home doses to family members and implication of methadone in accidental paediatric deaths where parents administered the drug (for sedating of fretful children or management of neonatal abstinence syndrome); did not store carefully or securely, or where methadone patients were present in the child's environment [2, 14, 23, 39]. There is potential for child abuse among methadone-maintained parents and caregivers [15, 21]. Pharmaceutical companies prepare methadone solutions with fruit taste, making it attractive to children. Shadnia et al. [37] have described how most accidental poisoning cases occur as a result of syrup formulation, particularly by children under 12 years old when mistaken for water or cough mixture. Accidental intoxication appears to occur most commonly with opiate management drugs in children less than 3 years old, and with a predominance of boys [2, 31].

1.2. Dispensing of Take Home Methadone and Information Provision in the Pharmacy

Supervised consumption of methadone in delivery centres (for example pharmacies) has contributed to reduced levels of deaths [30]. However, dispensing errors contributing to contamination of prescription medications such as antibiotics with methadone [20] and in dental cocktails [19] are reported. Despite implementation of supervised consumption, patients

generally take home methadone on Saturday, for unsupervised consumption on Sunday when pharmacies are closed [30]. Requirements to store methadone safely in the home increase when patients are dispensed in quantities of more than daily instalments, and given variations in volume [5]. Given that most patients store methadone for at least one day per week at home the risk for accidental paediatric consumption is compounded [5, 32]. Use of baby's bottles for dose measurement is also reported [17] with residual quantities posing a risk for intoxication [12].

Pharmacy professionals are advised to provide information and guidance to patients around risks associated with methadone and safe secure storage. Pharmacy practice auditing of effective patient information provision relating to safe secure storage, dispensing in child resistant containers, provision of measurement devices and ongoing patient recall and awareness of dangers of methadone and particular risks to children are important [5, 30].

Given the importance of pharmacy advice and dispensing practices with regard to safe storage of methadone, we undertook a pharmacy audit to evaluate effectiveness of pharmacy provision of advice in Ireland relating to awareness of general and paediatric risks, safety of methadone consumption, and storage. At the time of the audit in 2015, 9,615 patients were receiving opiate replacement treatment. The National Poisons Information centre reported on 16 paediatric admissions for methadone toxicity in children under four years old in the period 2005-2014. To date this is the first audit of its kind in Ireland and ultimately conducted in order to provide foundation for the design and implementation of an information leaflet for methadone patients and their carers.

2. Methods

2.1. Audit Criteria and Setting

The audit adhered to a standard audit methodology for assessing the effectiveness of pharmacy information provision on the methadone and safe storage [5, 30], by selection of appropriate criteria and identification of standards to measure success in achieving the criteria and was undertaken in Cork, South Ireland. The audit assessed adequacy of information provision against five criteria.

1. All patients should be aware of the dangers of methadone use.
2. All patients should be aware of the particu-

lar risks to children, especially if they have children at home or visiting the home.

3. All patients prescribed methadone should recall being given information on its safe storage.
4. All methadone should be dispensed in a child resistant container when prescribed for home consumption.
5. All patients with methadone at home should store it in a safe locked location in a container with child resistant caps.

2.2. Standards

The standard setting was agreed by the audit team using the following principles.

1. Given the high risks posed by accidental methadone overdose criteria 1 –5 were given a 100% standard.

2.3. Development of Instruments

The questionnaire for anonymous patient completion was designed by the team based on an extensive consultation with the literature, and the prior audits undertaken in the UK [5,30]. The content of the questionnaire incorporated the following aspects;

- daily volume of methadone prescribed and number of unsupervised consumption days
- prevalence of methadone street diversion
- storage location and security
- recall of health and pharmacy professional information provision around home storage
- perception of personal and non-patient dangers relating to methadone
- child awareness of patient consumption of methadone
- estimations of perceived safe amounts for accidental paediatric (children and teenagers) consumption
- actions to take if accidental paediatric consumption of methadone is suspected.

A telephone-administered questionnaire to dispensing pharmacists containing a checklist was devised to collect data on information provision on methadone safety, dispensing practices and home storage. The content of the questionnaire incorporated the following aspects;

- amount of methadone patients dispensed to in the pharmacy
- provision of take home doses in single large containers or as individual daily containers,

provision of measurement devices and child resistant containers

- pharmacist questioning and counselling of patients around storage of take home methadone
- need for information leaflet outlining risks and precautions regarding take home methadone.

2.4. Sample Description

Consecutive adult patients attending a specialist methadone clinic over the course of four weeks completed the questionnaire which was administered by the prescribing team in the specialist clinic as part of their regular patient consultations. Participants were made aware of the study at one meeting with their prescribing doctor and if willing to participate completed the survey the following week.

Over the four week study period, 96 patients were approached to complete the questionnaire and only two refused. In total, 94 patients completed the questionnaire with a response rate of 98%. Seventy six (81%) patients were males, and 18 (19%) were females. The majority of respondents were in the 25- to 34-age bracket (48 or 51%).

A telephone interview was conducted with the community pharmacists registered as dispensing methadone to patients attending the clinic. Forty three pharmacists recorded in the specialist clinic register as dispensing methadone in the clinic area were contacted. All 43 (100%) pharmacists agreed to complete the telephone survey.

2.4. Ethical Considerations

Ethical approval for the audit was granted by Waterford Institute of Technology, Ireland. In terms of ethical obligations, in addition to a general explanation of the purpose of the audit, each participant was asked to indicate their verbal and written consent prior to access, and was assured of their anonymity in the study. In terms of the methadone patient survey, while the questions asked by the survey administrator could have raised child welfare concerns, they are questions which normally would be asked during the continuing assessment of patients in receipt of methadone replacement by the medical prescriber. The survey was deemed by the team to provide an opportune time to discuss the implications of such patient knowledge and any risks which may be raised. All data collected from participants was anonymised and

Table 1: Location of methadone storage

Location	Number of patients	%
A specific (not locked) high drawer/up high	43	46
A low drawer	21	22
Fridge	15	16
In my jacket/handbag	11	11
Locked place	7	7
Bathroom	2	2

no personally identifiable data was stored.

3. Results

3.1. Analysis of Data

Analysis was conducted using anonymised data. Data analysis involved descriptive statistics, including frequencies and percentages. Statistical tests using SPSS included Chi square tests and p-value were used to assess differences in categorical data. A significance level of 0.05 was set.

3.2. Methadone Patient Perspectives

3.2.1. Volume of Methadone Prescribed and Take Home

Patients were asked to indicate the range of methadone amount they are prescribed per day. The majority of patients were prescribed between 40 ml and 59 ml of methadone per day (30 or 32%). Furthermore, females were prescribed methadone between 20 ml and 99 ml (17 or 100%) with no females prescribed methadone in the 0 to 19 ml bracket or the 100 to 130+ ml bracket.

Methadone was prescribed in instalments, a total of 61 (65%) patients reported that there was only 1 day when they did not attend the chemist, 5 (5%) patients reported not attending the chemist on 2 days. However, 28 (30%) patients received 3 or more doses to take home. Furthermore, no one reported attending the chemist every day and therefore, all of the sam-

ple were potentially storing methadone at home on at least one day.

3.2.2. Street Diversion

A total of 29 (31%) participants admitted buying methadone on the street. Seven (39%) of the female respondents bought methadone on the street while only 22 (29%) of the total male respondents indicated that they purchased extra methadone.

3.2.3. Location and Security of Storage

Patients were asked to indicate where they put the take-home methadone, until needed (Table 1). Forty-three (46%) patients reported storage in a specific high drawer or storage up high. Other areas included in a low drawer (21 or 22%) and in the fridge (15 or 16%). Patients were then asked if they put the methadone in a locked place. Ten (11%) indicated that they placed their methadone in a locked place all of the time. This does not concur with Table 1, where only 7 confirmed that they used a locked place. Out of the 10 above, 1 reported placing the methadone in their jacket or handbag, 1 in the bathroom, 1 in a high place and 2 in a low drawer. Three (3%) stated that they sometimes stored methadone in a locked place with 81 (86%) confirming that they do not place their take-home methadone in a locked place. Interestingly, none of those who purchased extra methadone on the street stored their take-home methadone in a locked cabinet.

Table 2: Advice on safe storage of methadone at home

Professional	Number of patients	%
No-one	48	51
Doctor	38	40
Pharmacist	18	19
Counselor	6	6
Social Worker	1	1
Community Drugs Worker	1	1

3.2.4. Sources of Advice on Methadone Storage

Patients were invited to indicate if they had ever received advice on safe methadone storage at home from different professionals (Table 2). Forty-eight (51%) patients reported never being given information regarding where they should store their methadone. Only 18 (19%) reported that a pharmacist advised them. Social workers and community drug workers were both only indicated once.

3.2.5. Knowledge of General Dangers of Methadone Use

When asked to indicate if methadone is dangerous to themselves as a user, 33 (35%) replied no. However, when subdivided into gender, females (17 or 94%) agreed more strongly than males (44 or 58%) that methadone is dangerous to them as a user. A Chi-square test for independence (with Yates Continuity Correction) indicated a significant association between gender and opinion on the danger of methadone to a user, $\chi^2 (1, n=94) = 7.0, p = 0.008, \phi = -0.30$. A similar question was asked in regard to dangers of methadone to non-users. Ninety one (97%) replied yes and only 3 (3%) replied no.

3.2.6. Presence of Methadone in the Home Environment and Risks to Children

Thirty (32%) patients reported that they have children currently staying in the same accommodation as them. Seven (23%) of these patients are currently linked in with child social services, 6 (20%) have been linked in to services in the past and 17 (57%) have never been linked in with social services. The subgroup that were linked in with social services in the past, reported never placing their take-home methadone in a locked place.

Patients were asked if children had ever seen them taking methadone in their house. Twelve (13%) reported that children had witnessed them taking methadone and 11 (92%) of this subgroup never

placed their methadone in a locked cabinet with 1 (8%) specifying that they sometimes placed it in a secure location. In addition, nine (66%) of this subgroup indicated that they had been either currently or in the past linked with child social services.

Patients were asked to indicate what they felt would be a safe amount of methadone for a child under 12 to take by accident. Eighteen (19%) indicated that it would be safe for a child to take between 5 ml to 20 ml of methadone accidentally. When asked to indicate what would be a safe amount for a teenager to take accidentally, 30 (32%) patients reported a teenager could consume between 5 ml to 30 ml, with 14 (15%) indicating 20 ml or higher. In response to a question relating to what to do first, if you thought a child had taken methadone, 85 (90%) indicated that they would seek urgent medical help. However, 7 (8%) reported that they would try to make them sick.

3.3. Methadone Patient Perspectives

Pharmacists were dispensing for a mean of 7 methadone patients (Range 0 to 48, SD 10.4). Thirty (70%) pharmacists reported providing multiple take-home days in individual daily containers.

3.3.1. Methadone Patient Counselling and Information Provision

Twenty five (58%) pharmacists reported never questioning methadone patients regarding their storage arrangements for take-home methadone, however, 25 (58%) stated that they would counsel patients on the safe storage of methadone at home and around children. Forty one (95%) pharmacists also agreed that a standard information leaflet outlining the risks and precautions regarding take-home methadone would be of benefit.

Table 3: Performance on Audit Criteria

Criteria	Standards	Results
All patients should be aware of the dangers of methadone use.	100%	97%
All patients should be aware of the particular risks to children, especially if they have children at home or visiting the home.	100%	53%
All patients prescribed methadone should recall being given information on its safe storage.	100%	49%
All methadone should be dispensed in a child resistant container when prescribed for home consumption.	100%	95%
All patients with methadone at home should store it in a safe locked location in a container with child resistant caps.	100%	7%

3.3.2. Provision of Containers and Measurement Devices

Of the thirty pharmacists that provided multiple take-home days in individual daily containers, twenty (67%) of this subgroup did not usually provide a measuring device, however, 9 (30%) would provide it on request. In contrast, of the 13 pharmacists that provided single large containers, 11 (85%) would provide a measuring device on request. In a question relating to provision of containers with a child-resistant cap, 41 (95%) of the pharmacists indicated that they always provide these containers for take-home methadone. None of the 43 pharmacists reported reimbursement for provision of these containers, however, all 43 pharmacists agreed that it would be a good idea to provide all take-home methadone in a child-resistant container as standard practice.

3.3.3. Audit Criteria

Performance on criteria 1 to 5 measured against the defined standards are shown in table 3. None of the criteria reached a 100% standard. However, 97% of patients were aware of the dangers of methadone use. The patients (53%) that reported storing their methadone in a locked place or a specific place such as a high drawer or up high were classed as safe locations and therefore they were said to be aware of the risks of methadone to children.

4. Discussion

In this Irish audit, none of the audit criteria measuring standards of effective information provision on safe storage of methadone reached a 100% standard. The audit illustrated that whilst dispensing practices in child resistant container when prescribed for home consumption are adequate, patient recall of information on methadone's safe storage needs to be provided regularly both in the pharmacy on dispensing but also at other contact points. The majority of patients were prescribed between 40 ml and 59 ml of methadone per day, generally reporting one take home dose per week.

4.1. Patient Knowledge of Risk

Nearly all patients were aware of harm to non-users, with females reporting greater awareness of harm of methadone to the user. Similar levels of patient knowledge are reported in the UK [5, 30].

A third of patients reported having children in the home environment, with a small number engaging with child social services. Of note was that this group

never placed their take home methadone in locked storage. In contrast, Mullin et al. [30], reported that a majority of their methadone patients with children in the home reporting that children were not able to access their methadone. Bloor et al. [5] found that a minority of patients accepted that children in the home would be aware of the storage location. A small number of patients in our audit also felt it would be safe for a child to consume between 5 and 20 ml methadone accidentally. However if accidental consumption was suspected, nearly all would seek urgent medical help. Dupuy et al. [12] have underscored how parents may not realise dangers for children in the event of accidental intoxication and potential for death, emergency medical treatment advised, and may be fearful of potential social service intervention for poor parenting.

4.2. Patient Safe Storage of Methadone

Acceptable medication storage is defined as out of sight and out of reach of children, with optimal medication storage when also kept in a secure container, and is reportedly more common in patients taking higher doses of methadone [42]. Half of patients reported storage in a specific high drawer or storage up high, with other areas including low drawers and fridges, and with a minority placing their take-home methadone in a locked place. Methadone is most commonly stored at home in cupboards and fridges, generally unlocked and dispensed and stored in the original, child resistant container [5, 30, 43]. Of note, is that none of the patient group (roughly a third) who reported street methadone sourcing in this Irish audit stored their take-home methadone in a locked place. Bloor et al. [5], have reported in their audit that patients who did not store their methadone at home generally consumed on the street or stored on their person or gave to a parent for safekeeping.

4.3. Pharmacy Provision of Information and Patient Recall

Recall of patient information around safety of methadone is generally poor in the referred UK audits [30]. Over half of these Irish patients reported never being given information regarding where they should store their methadone, with a minority referring to the pharmacist as source. Other audits reveal that the majority of methadone patients receive information from the Methadone Clinic or local drugs agency [5]. Over half of the Irish pharmacists in this

audit never questioned their methadone patients regarding their storage arrangements for take-home methadone, however, they did report counselling patients on the safe storage of methadone at home and around children. There was agreement that a standard information leaflet outlining the risks and precautions regarding take-home methadone is warranted. However, according to Mullin et al. [30], it is unlikely a long term methadone patient would recall receiving information around safe storage.

4.4. Dispensing Practices of Storage Containers and Measurement Devices

The majority of pharmacists provided multiple take-home days in individual daily containers, with a majority only providing a measurement device on request. Of the minority providing single large containers, a majority of this group would provide a measuring device on request. Nearly all always provided containers with child resistant caps. In the UK all pharmacists in the Mullin et al. [30] audit dispensed methadone in a child resistant container, and nearly all provided a measuring device on request.

Limitations

Limitations of the audit centre on its localised nature pertaining to the specialist clinic catchment of methadone patients in the Cork area, and the convenience sampling of a diverse range of methadone patients pertaining to length of treatment regime.

5. Conclusions

The audit highlighted adequate dispensing practices in terms of child resistant containers, but underscored the need for enhanced pharmacy professionals' vigilance in the advice and counselling role in improving patient recall of information, given the low reporting of safe and secure home storage, and patient awareness of paediatric risk. Studies show that safe storage of oral methadone can be improved by consistent provision of safe storage containers with child resistance caps, measurement devices to deter use of inappropriate devices such as baby bottles, and labelling, information around dangers of methadone, risk for children and contracting around safety, particularly in the transition period from supervised consumption to unsupervised home consumption regimes [1, 12, 13, 17, 21, 30]. We emphasize how important repeated exposure to safety information must occur at

several points of contact namely, the addiction clinics, and in the day to day transacting with methadone patients in the pharmacy. Strategies focusing on information provision may be effective in enhancing informed decision-making of patients [35] around safe storage. Risk management plans for further development in Ireland centre on information campaigns using printed information material such as leaflets and posters for safe storage of methadone containers and disposal of used containers after thorough rinsing and secure closure. Verbal advice relating to methadone is viewed by pharmacists as 'risky' compared with non-confrontational provision of printed safety material supported by verbal provision [25, 30]. The issue therefore may present unique potential for extrapolation for novel innovations relating to mobile phone based health technology (mHealth) to support the stabilised methadone patient in self-management, with safe storage reminders via mobile phone messaging [10]. Desire for training and education for pharmacists in the delivery of the expanded public health role, and substance abuse is also generally warranted and desired [34].

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Conflict of interest

All authors declare no conflict of interest.

Ethics

Authors confirm that the submitted study was conducted according to the WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects. The study have IRB review/approval.