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Original Article

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Medication errors in residential facilities based on Danish Poison Information Center inquiries

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ABSTRACT

INTRODUCTION: This study describes the types and health consequences of medication errors in residential facilities for which the Danish Poison Information Center (DPIC) was contacted.

METHODS: This study is based on all inquiries made by residential facilities to the DPIC during a 13-month period. Information about inquirers and residents, data related to the medication error, symptoms, risk assessments and recommendations was collected, and a follow-up phone call was made to evaluate the clinical outcomes, preferably within one week.

RESULTS: During the study period, the DPIC received 146 inquiries concerning medication errors in residential facilities. Nearly all inquiries concerned excess administration of medication (96%) and often involved medications targeting the nervous system (65%). In 9% of cases, the DPIC recommended hospitalisation. Most medication errors (92%) were considered of “no or minor risk”. Administration of medication to the wrong resident is a frequent reason for consulting the DPIC (45%) in cases with medication errors.

CONCLUSIONS: In this study, we inventoried the inquiries made to the DPIC about medication errors in residential facilities in Denmark. Most medication errors did not carry a risk of serious health consequences, but continued monitoring is warranted to minimise risk in this vulnerable population.

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TRIAL REGISTRATION: not relevant.

The majority of people living in residential facilities suffer from mental disability and have schizophrenia, anxiety, autism, Down syndrome, cerebral palsy or acquired brain injury, among other diagnoses [1]. Residential facilities are not necessarily equipped as treatment facilities [1-3], but their residents often take several medications [4] and approximately two-thirds need help with medication administration [1]. Both factors generate a risk of medication errors [5], which can be defined as “an unintended failure in the drug treatment process that leads to, or has the potential to lead to, harm to the patient” [6]. If a medication error has occurred, cognitive impairment or psychiatric disease might limit the patient’s cooperation to treatment or hospitalisation.

In Denmark, all unintended medication events should be reported to the Danish Patient Safety Authority (DPSA) [3]. According to DPSA oversight data from 2017, residential facilities had many problems with medication, and 36% of residential facilities did not meet the national requirements for medication lists to be clear and systematic [2]. Data from the DPSA also show that the number of medication errors in Denmark at residential facilities increased from 15,000 per year in 2015 to 22,000 per year in 2019 [7]. The severity of these errors is unknown, and it remains unclear if the upsurge is due to an increased focus and/or also reflects a true increase in the incidence of medication errors.

The Danish Poison Information Center (DPIC) was opened in 2006 to phone calls from the public and receives inquiries about actual and potential intoxications. Data from the DPIC may be used to explore if an increase has occurred in the number of inquiries concerning medication errors in residential facilities and to evaluate the nature and outcome of these errors. Thus, the aim of our study was to describe types and consequences of medication errors occurring in Danish residential facilities over a 13-month period based on prospectively registered data from the DPIC. Additionally, we investigated the number of inquiries to the DPIC concerning residential facilities from 2006 to 2019 and explored any differences in the number of inquiries within this period.

METHODS

We collected data on the total number of inquiries and the number of inquiries from residential facilities from the DPIC database for the period from the DPIC database was established to the end of the study period (from 15 August 2006 to 31 December 2019).

In addition, we prospectively collected data on inquiries to the DPIC regarding medication errors in residential facilities from 1 March 2018 to 31 March 2019. Nurses with toxicological training collected the following data: educational background of the inquirer, resident characteristics (sex, age, diagnosis) and data related to the medication error (the medicine(s) involved, time and date, time between error and inquiry), symptoms, risk assessment (risk of developing: 1) “no/minor”, 2) “manifest” (i.e. moderate or severe), 3) “life-threatening” poisoning or 4) “non-evaluable risk” based on the anamnesticly reported clinical presentation/symptomatology, type of medication(s) involved, significant comorbidity and/or relevant laboratory abnormalities) and recommendation for treatment/observation (“observation at home”, i.e. in the residential facility or “admission to hospital”). To evaluate clinical outcomes, follow-up phone calls to the residential facility were attempted within one week.

Descriptive analyses were performed and a graphical presentation was prepared. The study was approved by the Danish Data Protection Agency (2012-58-0004). Data collection was performed as part of a quality project, and data were anonymised prior to analyses. No ethical approval was necessary. Reporting was in accordance with the STROBE guideline [8].

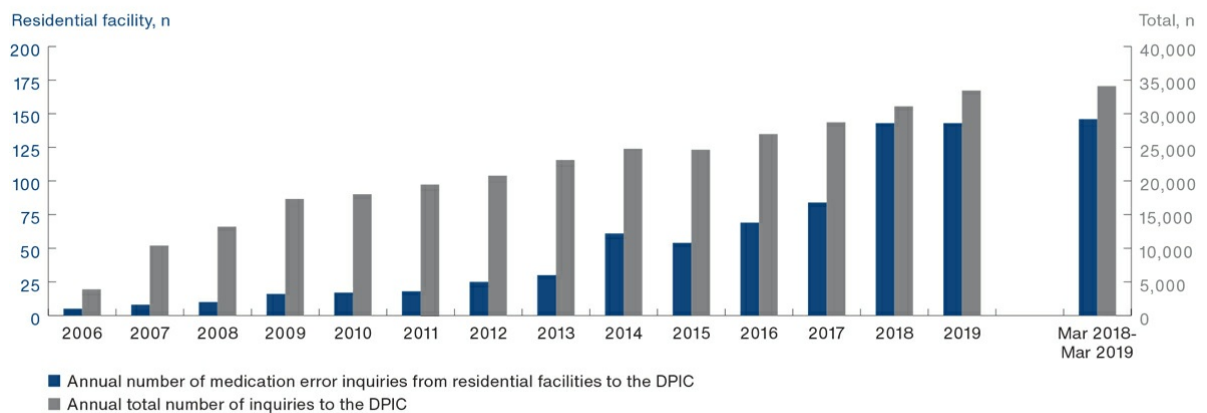
Trial registration: not relevant.

RESULTS

Development in inquiries 2006-2019

As shown in **Figure 1**, a total of 683 inquiries concerning medication errors in residential facilities were made to the DPIC in the period from 2006 to 2019. The annual number of inquiries from residential facilities increased over time and was particularly high in 2018-2019. In the primary risk assessment of these inquiries, the medication errors were evaluated as having or constituting a risk of either “no or minor” (74%, 507/683), “manifest” (19%, 129/683) or “life-threatening” (0.4%, 3/683) poisoning, whereas 4% (44/683) were non-evaluable. The total annual number of inquiries from the whole community also increased over this time period (Figure 1).

FIGURE 1 Number of inquiries to the Danish Poison Information Center (DPIC).



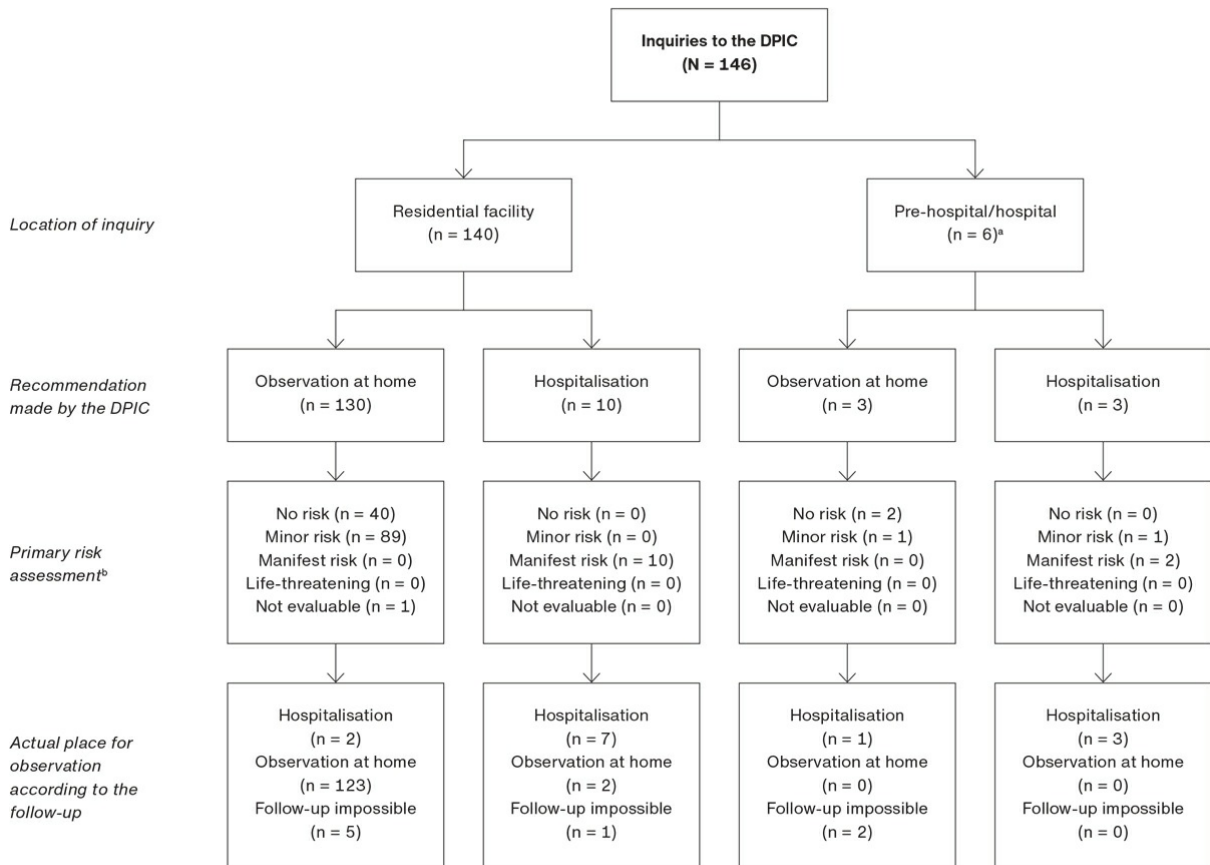
Prospective study period 2018- 2019

During the 13-month prospective registration period, the DPIC received a total of 34,103 inquiries. Of these, 146 (0.43%, 146/34,103) concerned medication errors in residential facilities.

Demographics

In 63% (92/146) of the cases, the medication error concerned male residents. The median age of the residents was 49 (range: 12-84) years. Overall, 18% (27/146) had a psychiatric diagnosis, 44% (64/146) had a neurological diagnosis and for 38% (55/146) a diagnosis was not reported. The majority of inquiries were made by personnel at residential facilities (96%, 140/146) (**Figure 2**). Most often, healthcare professionals (45%, 65/146) or pedagogical staff (33%, 48/146) made the inquiry. In 23% (33/146), the educational background was unknown. Inquiries were made primarily during daytime (47%, 68/146) or evening (51%, 74/146) shifts. In 46% (67/146) of cases, the inquiry was made within 30 minutes after the medication error.

FIGURE 2 Distribution of location for inquiries, recommendation, risk assessments and actual place for observation.



DPIC = Danish Poison Information Center.

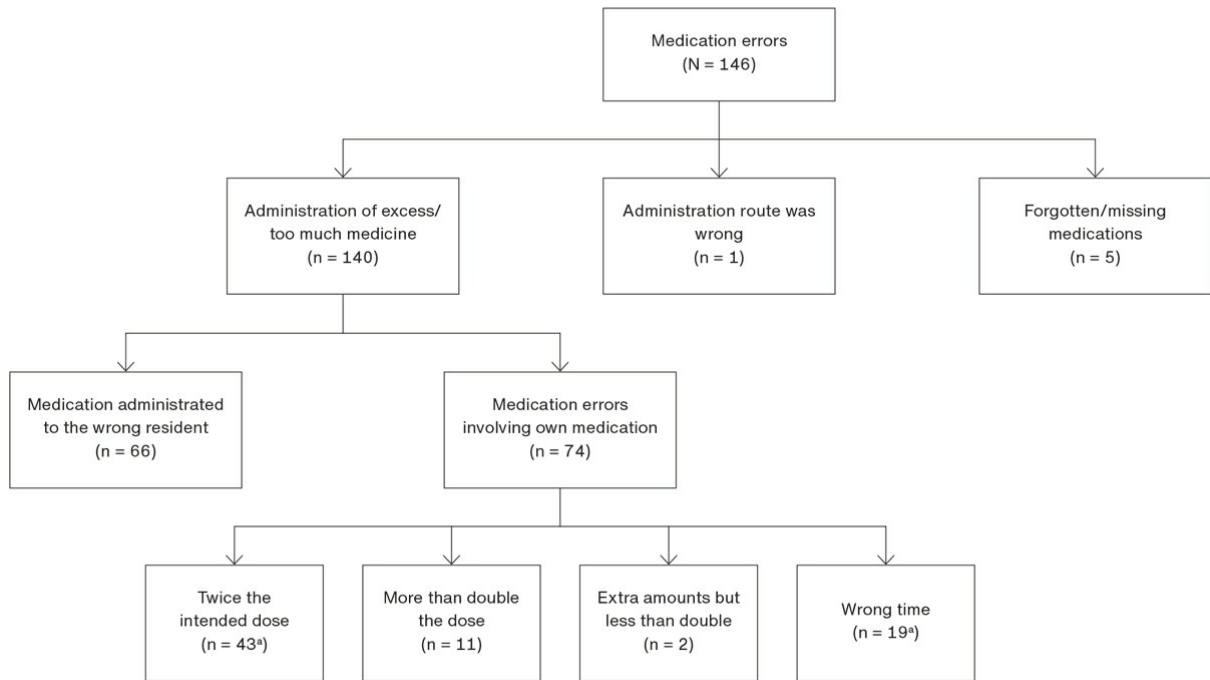
a) The resident was on his/her way to or already in hospital for assessment, or the inquiry came from an emergency control centre.

b) The risk assessment evaluates the risk of toxicity that the medication error potentially can cause.

Types of medication errors

Most errors involved “administration of excess/too much medicine” (96%, 140/146) (**Figure 3**). Administration to the wrong resident constituted 45% (66/146) of the cases. Regarding the errors involving the residents’ own medication, 26% (19/74) were due to administration at an incorrect time (i.e. evening medication given in the morning), whereas 73% (54/74) concerned administration of twice the prescribed dose or more. In cases involving administration of excess medication, the medication error involved one drug in 51% (71/140) of cases, whereas in 49% (69/140) of the cases, two or more medications were involved.

FIGURE 3 Types of medication errors.



a) For one resident the medication error involved both "Twice the intended dose" and "Wrong time".

In total, 313 over-the-counter and prescription medications were involved in the errors, mostly medication affecting the nervous system (65%, 202/313) (Table 1). Within this group, most errors concerned anti-epileptics (28%, 88/313) and psycholeptics (25%, 79/313).

TABLE 1 Substances involved in the medication errors – categorised by the Anatomical Therapeutic Chemical Classification System (ATC) group and listed in descending order by frequency.

	n
<i>ATC N – Nervous system</i>	
N03 Antiepileptics	88
N05 Psycholeptics ^a	79
N06 Psychoanaleptics ^b	17
N02 Analgesics	11
N04 Anti-Parkinson drugs	5
Other ^c	2
Subtotal	202
<i>ATC A – Alimentary tract and metabolism</i>	
A02 Drugs for acid related disorders	13
A12 Mineral supplements	11
A10 Drugs used in diabetes	5
A11 Vitamins	5
Other ^c	6
Subtotal	40
<i>ATC C – Cardiovascular system</i>	
C 09 Agents acting on the renin-angiotensin system	7
C03 Diuretics	6
C07 Beta blocking agents	5
Other ^c	8
Subtotal	26
<i>ATC B – Blood and blood forming agents</i>	
Bx Omega-3, iron, essential amino acids	12
B01 Antithrombotic agents	5
Other ^c	1
Subtotal	18
<i>ATC M – Musculoskeletal system</i>	
M03 Muscle relaxants	9
Other ^c	3
Subtotal	12
<i>ATC R – Respiratory system</i>	
R06 Antihistamines for systemic use	6
Other ^c	2
Subtotal	8
<i>Other</i>	
ATC group G, H, J, L, P, V ^c	7
Total	313

ATC = Anatomical Therapeutic Chemical Classification System.

a) Includes antipsychotics, anxiolytics, hypnotics and sedatives.

b) Includes antidepressants, psychostimulants and anti-dementia medications.

c) Number in each group ≤ 3.

Adherence to recommendations

Figure 2 presents the distribution of inquiries from residential facilities or a (pre-)hospital setting, as well as the recommendation, risk assessment and place for observation. The DPIC recommended observation at home (in accustomed surroundings at the residential facility) in 91% (133/146) of cases and hospitalisation in 9% (13/146) of cases.

In the 140 cases in which the call was made by the residential facility, the DPIC recommended observation at home in 93% (130/140) of cases and hospitalisation in 7% (10/140). Among the inquiries from the residential

facilities, the recommendation from the DPIC for observation at home was followed in 95% (123/130) and a recommendation for hospitalisation was followed in 70% (7/10) of cases.

Risk assessment

The DPIC categorised most residents as having “no or a minor risk” of poisoning (92%, 133/146). Only 11% (16/146) of residents had developed symptoms at the time of inquiry. None of the medication errors were assessed as “life-threatening”, but 8% (12/146) were considered to carry a risk of developing or had already developed into a “manifest” poisoning. Most of these residents (67%, 8/12) had taken/received the medication intended for another resident, and in all these cases the DPIC recommended hospitalisation.

Development of symptoms

Among cases with available follow-up data, 34% (47/138) of residents developed symptoms between the inquiry and follow-up, whereas 60% (83/138) were asymptomatic. For 6% (8/138), data on symptoms between the inquiry and follow-up were not registered. One resident (0.7%, 1/138) had a chronic poisoning and symptoms had not resolved at follow-up, whereas the remaining residents (99%, 137/138) seemed to be in recovery or had recovered from symptoms by the time of follow-up.

DISCUSSION

From 2006 to 2019, an increasing number of inquiries were reported from residential facilities concerning medication errors. During the 13-month prospective registration in 2018-2019, the DPIC was consulted about 146 medication errors in residential facilities. Nearly all (96%) of the errors involved excess administration of medications, whereas skipped doses/medications and incorrect administration routes were rarely consulted with the DPIC. In 45% of inquiries, medication was administered to a wrong resident. Medications affecting the nervous system were most often involved, especially anti-epileptics and psycholeptics. The DPIC recommended hospitalisation in 9% of cases. Follow-up was obtained for 95% of inquiries, and all residents with acute overdoses had recovered or seemed to be in recovery from any symptoms at this time.

Limitations and strengths

This study has a limited sample size and likely represents a highly selected population as the inquirer needs to be familiar with the DPIC. Hence, the findings may not necessarily be representative of the medication errors taking place at residential facilities. Furthermore, some errors may have been handled internally or conferred elsewhere. It is also possible that the errors for which the DPIC was contacted were considered to have a high potential for toxicity as opposed to, for instance, errors involving forgotten (or too low) doses. Some residents may have difficulties expressing symptoms, and therefore the reported number of residents experiencing milder/moderate symptoms may have been underestimated.

This study has several strengths, including the prospective design and follow-up. The Poison Information Center can gather detailed information that is otherwise hard to obtain about errors in a nationwide non-hospital setting. Medication administration in Danish residential facilities is often handled by pedagogical staff [1, 3], who represented 33% of the inquirers in our study. Sufficient knowledge about medications is important to diminish the occurrence of medication errors [5] and it seems possible that improved knowledge may prevent some errors [4]. Thus, the findings from this study may be used to establish educational interventions aiming to improve medication knowledge and prevent future errors.

Previous studies

Several reports have investigated medication errors in residential facilities [1-4], but, to our knowledge, this is

the first study to investigate medication errors in this setting based on inquiries made to a national poison centre.

An increase was observed in inquiries during the 2006-2019 period, both overall and from residential facilities. The number of inquiries from residential facilities in 2018-2019 is particularly high, which may be due to an increased awareness as detailed information was collected by the DPIC staff concerning these inquiries. However, this is probably not the only explanation as an increase was also present before. Increased focus on medication errors at the residential facilities due to oversight by the health authorities and media attention likely also contributed [2-4]. However, there is also a risk that the increase may be explained by increased bustle, personnel without a healthcare background, stress when handling medications, etc. [5].

Medication errors have almost exclusively been studied in in-patient settings [9, 10]. A Japanese study argues that patients in long-term psychiatric hospitals share similarities with the residents of a variety of community settings in the US, UK and Europe [11]. In our study, 45% of errors involved administration to wrong residents, whereas the corresponding percentage in the Japanese study was 36% [11]. Other studies report much lower frequencies for this type of error, i.e. 4% in a psychiatric hospital, where nurses exclusively administer medications [12] and 2.6-3.1% of all inadvertent medication events in Danish residential facilities [3]. A possible explanation for our higher percentage of errors involving administration to a wrong resident may be that inquirers have a lower threshold for consulting the DPIC with this type of error. Administration of an incorrect drug potentially leads to more serious adverse events than an incorrect administration time or dose [11].

An overall admission rate of 9% in our data seems comparable to US studies based on data from the US Poison Control Centers concerning medication errors in the community with antidepressants and antipsychotics [13] and anticonvulsives [14], where 8.3% and 15%, respectively, resulted in hospitalisation. In line with our study, the US Poison Control Center reported that few inquiries resulted in major medical outcomes or death, but some had a potential for severe toxicity [13, 14]. Drug errors typically do not have serious adverse health consequences, but they all deserve attention as we might provide insight into how we may diminish their risk [15].

CONCLUSIONS

Overall, an increase was observed in the number of inquiries made from residential facilities to the DPIC from 2006 to 2019. During 13 months in 2018-2019, the DPIC was consulted about 146 medication errors occurring in residential facilities. Nearly all inquiries concerned the administration of excessive amounts of medications – most often administration of medications targeting the nervous system to an incorrect resident. In 9% of cases, the DPIC recommended hospitalisation, but most medication errors were considered as carrying “no or minor” risk of poisoning. At follow-up, all residents with acute overdoses seemed to be in recovery or had recovered from any symptoms experienced due to the medication overdose.

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Conflicts of interest Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

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