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RESEARCH PAPER

# *What is the matter with crushing pills and opening capsules?*

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**What is the matter with crushing pills and opening capsules?**

This study aims to map out to what degree medication is being crushed and mixed into the patients' food and beverages and how often this practice included medication, which has a statement in the Norwegian pharmaceutical compendium that this should not be done (inappropriately altered medication (IAM)). Data from a total of 2108 patients in 151 wards in 65 nursing homes were collected. The data contained information about the kind of drugs the patient received, in which form it was given and how it was given. Patient characteristics and ward characteristics were also recorded. Twenty-three per cent were given at least one drug mixed into their food or beverages and 10% were given at least one IAM. This study shows a malpractice regarding one aspect of medication in nursing homes. Even though we need more knowledge, we know enough to take action to raise the quality of the administration of medicines in nursing homes.

**Key words:** Norway, nursing, nursing homes.

## INTRODUCTION

Several studies show that it is common to crush, split or open pills or capsules in order to give persons with difficulties in swallowing their medicine.[1–4] It is claimed that this is problematic[2–4] because the dosage might be altered. The effect can also be changed when enteric-coated pills or capsules with depot effect are crushed or opened. It is further suggested that the practice of crushing medication can pollute the environment, allowing the nurses to inhale the dust from the crushed pills. This might be a serious problem with respect to antibiotics and cytotoxics.

In a study dating from 2004 among nursing-home patients, the practice and prevalence of mixing medication in food or beverages were reported.[5] However, there was no detailed information whether all the medicines were given this way, or just some of them. Therefore, a new study about the administration of medication in Norwegian nursing homes was designed. In the present study, we gathered detailed information about each separate medicine, aiming to map out to what degree medication is being crushed and mixed into the patients' food and beverages (in the following called 'altered medication' (AM)) and how often this practice included medication, which has a statement in the Norwegian pharmaceutical compendium ('Felleskatalogen'; http://www.felleskatalogen.no/) that this should not be done (in the following called 'inappropriately altered medication' (IAM)). In addition, we wanted to find out whether particular patient and/or ward characteristics were associated with the practice of crushing tablets or opening capsules.

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## METHODS

(The data and methods have been described in greater detail elsewhere.[6])

Nursing-home care in Norway is provided by the municipalities. The nursing-home wards can broadly be classified into regular units (RUs) and special care units for persons with dementia (SCUs). Some nursing homes have, in addition, respite and rehabilitation wards. RUs are hospital-like wards with ≈ 20 beds. SCUs usually have 6–12 beds and aim to provide homely surroundings where the focus is on the activities of daily living (ADL).

### The study population

All the nursing homes in the South-East Health Region in Norway were eligible for the study, and 103 in small and large municipalities in rural and urban areas were asked to participate. Seventeen declined to participate and 21 nursing homes could not make practical arrangements for data collection within the time frame of the study. Thus, a total of 2108 patients in 151 wards (674 in SCUs and 1434 in RUs) in 65 nursing homes participated. Patients who had been in the ward < 2 weeks were excluded from the study. This accounted for 162 patients. A further three patients (or the patients' next of kin) were not willing to participate. Thus, we collected data from 1943 patients (623 (32%) in SCUs and 1320 (68%) in RUs) in the period from October 2006 to February 2007. In Norway, ≈ 20% of the beds in nursing homes are in SCUs;[7] thus, the number of patients in SCUs is oversampled in the present study.

### Data collection

#### *Registration of medications*

Registered nurses in each ward received oral and written instructions and were trained how to fill in the registration of medications. These nurses were responsible for filling in the registration form for each of the patients in their wards, with the assistance of the nurses who knew the patients best.

The registration form contained information about what kind of drugs the patient received on a daily basis (all the drugs registered in the Anatomical Therapeutic Chemical classification system (ATC code) were eligible for registration), in what form the drug was given (pill, injection, suppositories, etc.), and how it was given (AM or in their ordinary form). Information on each and every medication that the patients received during the 7 days preceding the date of registration was collected and recorded in this way. To find out which medication should not be crushed or opened, the Internet version of the Norwegian pharmaceutical compendium was used. There were orders or recommendations that 68 drugs should not be crushed or opened according to this compendium. For medications with more than one brand name or one version but with the same ATC code, we checked in the compendium whether all versions or brand names carried the same restrictions regarding crushing/splitting and checked which versions or brand names the patient used. If such information was lacking, it was assumed that the patients used the version with no restriction regarding crushing or splitting.

#### *Patient characteristics*

The patients' sex and age, and his/her level of functioning in the ADL, mental capacity and behavioural and psychological symptoms were collected and recorded.

Activity of daily living was classified by the Self Maintenance Scale[8] with a score ranging from 6 to 30; a higher score indicates worse functioning. The ADL scores were fairly normally distributed and thus could be used as a continuous variable.

Mental capacity was rated by means of the Clinical Dementia Rating Scale (CDR), ranging on a scale of 0–3 and scored from an interview with the nurse (0 indicates no dementia and 3 indicates severe dementia).[9] About 41% of the patients had a CDR score equal to 3. CDR was dichotomized with the cut-off point between 2 and 3.

Behavioural and psychological symptoms were rated by means of the Neuropsychiatric Inventory (NPI).[10] The NPI consists of 12 items. Each item scores on a scale from 0 (no symptoms) to 12 (severe symptoms). A higher score indicates more severe symptoms. A factor analysis of the NPI was performed using principal component analysis. The factor analysis suggested that six of the items loaded into one component. The six items were: delusions (0.697), hallucinations (0.555), agitation/aggression (0.767), disinhibition (0.706), irritability (0.764) and aberrant motor behaviour (0.556). This component was treated as one item called 'agitated behaviour', with a score equal to the mean score of the six items in the component. The different items of the NPI scale were not normally distributed. It is suggested that a score ≥ 4 indicates a clinically significant symptom[10] and this value was used as the cut-off point.

### *Ward characteristics*

Ward characteristics were recorded, such as type of ward (SCU or RU), number of beds in the ward and the number of carers on each shift.

## Statistics

The main findings are presented with descriptive statistics generated with the use of SPSS v. 16.0 (SPSS Inc., Chicago, IL, USA). In addition, the associations between the practice of splitting/crushing/opening medications and patients' characteristics and ward characteristics are analysed with logistic regression. Two logistic regression analyses were performed. In the first all the patients were included and AM (1) vs. no AM (0) was used as the dependent variable, whereas in the second analyses only patients with AM ($n = 453$) were included. The dependent variable in this analysis was IAM (1) vs. no IAM (0). As our data have a two-level structure (ward characteristics and patient characteristics), the logistic regression analysis was performed with a multilevel model,[11] using the software package MLwiN v2.10 (Centre for Multilevel Modelling, Bristol, UK).

## Ethical considerations

All the patients and their next of kin were given written information about the study. Information about the patient was identified only by year of birth and gender, and can thus be considered as given anonymously. The study was approved by the Norwegian Social Science Data Services (on behalf of the Norwegian Data Inspectorate), by the Regional Committee for Medical Research Ethics and by the Directorate for Health and Social Affairs.

## RESULTS

Out of 1943 patients, 18 did not receive any medication, 453 (23.3%) were given at least one drug mixed into their food or beverages and 215 of these 453 did not know that the medication was mixed into their foodstuff (covert medication). The practice of covert medication is discussed in detail elsewhere.[6] The mean number of daily medicines with different ATC codes was 6.5 (SD 3.2), and the patients who had at least one AM received fewer medicines on average per day than the other patients (6.0 (SD 2.7) vs. 6.7 (SD 3.3); $P < 0.001$ (Student's $t$-test)).

Ten per cent of the patients (197 patients) were given at least one IAM. This included 23 of the 68 medications that should not be crushed or opened. Most of the patients ($n = 124$) had only one medicine in this category mixed into their food or beverages, and 73 patients had more than one IAM (see Table 1).

**Table 1** Number of patients receiving inappropriately altered medication by number of drugs given this way

| Number of drugs | Number of patients |
|---|---|
| 4 | 2 |
| 3 | 11 |
| 2 | 60 |
| 1 | 124 |
| At least one | 197 |

Of the IAM, the most frequent was enteric-coated acetylsalicylic acid (Table 2), which is usually prescribed as an agent to prevent blood clotting. Next common was an enteric-coated laxative (Bisacodyl), followed next by the antidepressive agent mianserin.

To examine how the patient and ward characteristics were associated with AM and IAM, two multivariate logistic regression analyses were performed. The first showed that severe dementia (adjusted odds ratio 2.3; $P = 0.003$) and low function in ADL (adjusted odds ratio 1.2; $P < 0.001$) were associated with AM. None of the ward characteristics was associated with this practice. In the second analysis, the practice of IAM was analysed. No association between the patients' level of function or ward characteristics and the practice of IAM was found.

## DISCUSSION

This study shows that the practice of crushing pills or opening capsules and blending them into the patients' food or beverages is common in Norwegian nursing homes (23.3%). This result is similar to findings in studies from other countries[1–4] and was not a surprise. It was more astounding that > 10% of the patients were given crushed or opened medication in cases where the Norwegian pharmaceutical compendium warned against such a practice. Of these medicines, the most frequently given this way was enteric-coated acetylsalicylic acid (Albyl-E) in a low dosage. This is probably no big issue regarding the effect of the medication, but acetylsalicylic acid is delivered in several different versions from powder or pills to a mixture in water or suppositories and, thus, it should be easy to find a version that can be administered to patients with difficulties in swallowing that would be less harmful

**Table 2** Number of patients who receive in food or beverages medicine that should not be crushed or opened (inappropriately altered medication), by type of medicine

| ATC code (generic name) | Number of patients |
|---|---|
| A06AB02 (Bisacodyl) | 46 |
| A07EC01 (Sulfasalazin) | 1 |
| A09AA02 (Multienzymes) | 1 |
| A12BA01 (Kaliumklorid) | 5 |
| B01AC06 (acetylsalicylic acid) | 102 |
| B01AC30 (Combinations) | 1 |
| B03AA07 (Ferrous sulfate) | 20 |
| C01DA14 (Isosorbine mononitrate) | 20 |
| J01MA02 (Ciprofloxacin) | 2 |
| M01AB01 (Indometacin) | 1 |
| M01AB05 (Diclofenac) | 3 |
| M01AB55 (Diclofenac, combinations) | 2 |
| M01AC06 (Meloxicam) | 2 |
| M05BA04 (Alendronic acid) | 5 |
| M05BA07 (Risedronic acid) | 1 |
| N02AX02 (Tramadol) | 11 |
| N03AX14 (Levetiracetam) | 1 |
| N04BA02 (Levodopa and decarboxylase inhibitor) | 3 |
| N06AB03 (Fluxetine) | 1 |
| N06AB05 (Paroxetine) | 4 |
| N06AX03 (Mianserin) | 43 |
| N06AX16 (Venlafaxine) | 5 |
| N06DA04 (Galantamine) | 3 |

ATC, the Anatomical Therapeutic Chemical classification system.

for the ventricle than a crushed Albyl-E. The same is true for the second medication most frequently crushed into the patients' food, an enteric-coated laxative (Toilax). It should be easy to find an alternative laxative. For nearly all the medications for which it is stated in the Norwegian pharmaceutical compendium that the medication should not be crushed or opened (see Table 2), there are alternative versions with other forms of administration. We suggest that this practice, and especially the examples with Albyl-E and Toilax, indicates either a lack of basic knowledge in how to administer the medication, severe flaws in the routines or ignorance, or a combination of all three. In a recently published Norwegian study, where nurses in 19 nursing homes were asked about the administration of medicine in their institutions, it was concluded that crushing pills has become a routine where nurses often omit to judge and evaluate their own routines regarding the administration of medicines.[12] This study indicates the same.

As the main reason for crushing medicine and blending it in the patients' foodstuff is a problem with swallowing,[5,6] it was expected that severe dementia and low function in ADL would be associated with this practice. The finding that patients who got IAM do not differ from the rest of the patients who got AM indicates that it is arbitrary which medicines are split/crushed/opened. It depends on what kind of medicines are prescribed and the patients' ability to swallow.

The risk of changing the dosage or pollution from other medications crushed in the same mortar, or pollution of the environment, mentioned in the introduction, are not problems that only occur for the medicine that should not be crushed, but for most of the medications that are crushed. Studies show that even for medications where no restriction on crushing exists, the practice of crushing the pills and blending them in the food might influence the effect of the pill. For instance, furosemide might bind to the food and decrease its absorption.[13] In the pharmacological compendium, it is stated that furosemide tablets might be split, but there is no information about crushing. Thus, it matters how medication is administrated to the patients, even for some drugs that have no clear restriction regarding this in the pharmaceutical compendium.

Even though the medication of the patients is the responsibility of the physician, the routines for administration are mainly handled by nurses. The results of this study show that the administration of medicine presents a challenge to the nursing profession.

## Limitation of the study

The study has some limitations that should be taken into account. First, the data were mainly collected by the nurses who also administered the medicines. This could have led to underestimation of the malpractice seen. Second, drugs prescribed to be given 'as required' are not included. Third, the Norwegian pharmaceutical compendium was checked manually by reading the 'dosage' section for each medicine. There was no standard way of giving recommendations regarding the administration of the medicine; thus, some of the statements might have been missed.

The main focus for the data collection was to study medications that were given covertly. It might be claimed that some of the pills given in food or beverages are not necessarily crushed. This is true, but not likely. A recent study about the crushing of tablets in nursing homes found that similar types of medicine (as in present study) were crushed even when it was stated that it should not be crushed.[12] This study was a survey among nurses and student nurses in 19 nursing homes in the county of Nord-Trøndelag and gave no information about the patients, only about the handling of the medicines. The concurrence of the results of that study and the present study strengthens the validity of both studies.

## Conclusion

This study shows a malpractice regarding one aspect of medication in nursing homes. Even though we need more knowledge about some of the areas focused on in this study, we know enough to take action to raise the quality of the administration of medicines in nursing homes. Further studies should focus on how to change the practice.

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