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Variation in medication use in cancer patients at the end of life: a cross-sectional analysis

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ABSTRACT

Purpose Despite advances in cancer treatment, patients still die with unnecessary suffering. Therefore, high-quality end-of-life care is needed. Variations in medication use at the end of life may suggest areas for improvement. This study aims to describe the use of medications during the last days of life of cancer patients and to explore the possibility of using it as a quality measure.

Methods We conducted an international survey on experts' opinions regarding potentially inappropriate medications for dying patients. Subsequently, a chart review of deceased cancer patients was conducted, which assessed the current medication use in different settings.

Results The mean number of medications used in the last 3 days of life was 4.8 (SD 2.1). Hospital patients were less likely than hospice patients to receive opioids, midazolam, haloperidol, and drugs for pulmonary secretions or nausea/vomiting. Over 90% of experts rated 12 medications as unlikely to be appropriate. Hospital patients were more likely than hospice patients to receive these potentially inappropriate medications. Before the implementation of an end-of-life care pathway, hospital patients had a higher probability, than after, to receive potentially inappropriate medication. Moreover, after implementation of such pathway, patients for whom a pathway was not used were more likely to receive potentially inappropriate medications than patients for whom it was used.

Conclusion Medication use at the end of life varies widely by setting, both for potentially appropriate and inappropriate medications.

Combining experts' opinion and current medication use resulted in the identification of 16 medications that might be used to assess the quality of cancer care at the end of life.

INTRODUCTION

Despite advances in early detection, treatment, and survival of cancer, a large proportion of cancer patients still dies with unmet needs [1, 2]. Therefore, high-quality care in the last days of life is important. Recognition of the dying phase is important for high-quality care, and it has been shown to be feasible in a large

proportion of patients dying from cancer [3]. Hospital care frequently involves burdensome interventions, with patients experiencing unremitting pain and suffering in the final week of life [4]. Over the last decade, attention to end-of-life care in hospitals has increased, as reflected in the growth of palliative care services in hospitals, such as palliative care consultation teams, and the increasing use of care pathways for dying patients, such as the Liverpool Care Pathway for the Dying Patient [5]. Palliative care consultation teams in hospitals have been shown to have beneficial effects, such as better quality of life of patients [6–9] and less aggressive care, which is concordant with the patients' preferences at the end of life [7]. Furthermore, the use of the Liverpool Care Pathway for the Dying Patient (LCP) has been shown to lead to better symptom control, better bereavement outcomes, and a more comprehensive documentation of care [10], and has previously been considered as a measure of quality [11].

Quality indicators are essential in assessing, evaluating, and improving the quality of care, but finding appropriate quality indicators for end-of-life cancer care is challenging [12]. Measurement of quality indicators should be quick and efficient, so feedback can be provided on a regular basis. Data from medical records have been suggested as quality indicators before [13–15]. This includes medication prescription and use, which are already used as quality indicators in other fields [16–18] and have also been suggested as indicator in the field of palliative care [19]. Medication use should be in concordance with the goals of care and applicable guidelines. In the dying phase, medication use should be evaluated, non-essential medications should be withdrawn [20], and inappropriate medications should be avoided. Little is known about the current use of medications in the last days of life of cancer patients, although there are indications of unnecessary medication use among advanced cancer patients [21] and of variation in pain medication use at the end of life [19]. Assessing patterns of medication use is the first step towards understanding medication use as a potential quality measure for end-of-life care. The aim of our study was to describe the use of potentially inappropriate and appropriate medications during the last days of life in cancer care and to explore whether medication use might be a potential quality indicator in end-of-life care.

MATERIALS AND METHODS

Survey of international experts

We conducted an explorative survey among international experts in palliative care to generate a list of potentially inappropriate medications in the care for dying cancer patients. Purposive sampling was used to construct an international expert panel; 20 palliative care physicians from ten different countries were contacted. The selection criteria used included being a physician and having expertise in the field of palliative care. The sample included palliative care physicians from Argentina (two), Germany (two), Italy (two), the Netherlands (two), New Zealand (two), Slovenia (two), Spain (two), Sweden (two), Switzerland (two), and the UK (two). After one reminder, 16 experts responded (response rate 80 %). Non-responders originated from Slovenia (two), Switzerland (one), and the UK (one).

Questionnaire

To formulate the questionnaire of our survey, we conducted a literature search in the database PubMed to identify potentially inappropriate medications, using the search terms “inappropriate medication”, “futile medication”, “unnecessary medication”, “palliative care”, “end-of-life care”, and “terminally ill”. The final questionnaire assessed the experts’ opinions on 20 potentially inappropriate medications in the last 3 days of life. The experts were asked to rate the medication’s probability of being useful in cancer patients’ last days of life.

A four-point Likert scale was used, with 1 for “low”, 4 for “high”, and a “don’t know” option. The questionnaire focused on the last days of life because it is known that in the vast majority of cases, physicians are able to recognize when cancer patients are imminently dying [22]. Furthermore, the respondents were asked to add other potentially inappropriate medications. The experts’ responses directed the medical chart review by guiding the selection of potentially inappropriate medications.

Chart review

This retrospective study was conducted to assess medication use during the last 3 days of life of cancer patients in a hospital or hospice. In total, we included 135 cancer patients (ICD-IX 140-239) who consecutively died in the General Medicine wards or the Respiratory Disease ward of the Villa Scassi Hospital of Genoa (Italy) between December 2006 and July 2009. Halfway through this period, the LCP was implemented in these departments. In addition, 60 consecutive deceased cancer patients who died between February and May 2011 in the Hospice Maria Chighine of Genoa were included. For each patient, demographics and information regarding medication use in the last 3 days of life were collected using a standard care assessment tool. This tool was developed for the assessment of the Italian version of the LCP [23, 24], and in this study, it was used to assess potentially inappropriate and appropriate medications. Potentially inappropriate medications included all medications rated by the experts as being “unlikely to be appropriate” (Appendix). All supplements were merged into one category, and two additional medications were added: vasodilator drugs and dopamine. The appropriate medications were derived from the textbook *Care for the Dying* [5]. Furthermore, data about routes of administration, except creams, eye drops, and topical mouth drugs (e.g. antimicrobics), were collected.

Double assessment (MC and PP) of a random subsample was performed to guarantee the quality of the data collection.

Discrepancies were discussed and verified in the medical charts. These assessments suggested good reliability of the data; the maximal number of discrepancies per item was 7 %, and 97 % of all items had a kappa of >0.6.

Statistical analyses

The medications that were scored by at least 90 % of the experts as having a low likelihood of being useful (score 1 or 2) were classified as being “unlikely to be appropriate”.

This classification was used to indicate variances in medication use in cancer patients who died in different settings.

These settings had an expected difference in the quality of care. We conducted three analyses. First, we compared medication use of patients in the hospital (before LCP

implementation) with patients in the hospice, under the assumption that hospice care is of better quality [25, 26].

Second, patients dying before and after implementation of the LCP program in the hospital were compared [10, 24].

We assumed that this program improved the quality of end-of-life care. Third, after the implementation of the LCP in the hospital, patients for whom the LCP was used were compared with patients for whom the LCP was not used.

We assumed that dying when on the LCP involves better quality of end-of-life care [10].

To compare groups, bivariate crude odds ratios with 95 % confidence interval (CI) were calculated. Medication classes with at least two odds ratios (ORs) in the expected direction were classified as potential quality indicators. For statistical analyses, we used SPSS (SPSS PASW 17 17.0.2 ENG, Win Wrap Basic, Polar Engineering and Consulting).

Ethical consideration

The project protocol was approved by the Ethical Committee of the National Cancer Institute of Genoa and of the Villa Scassi Hospital.

RESULTS

The survey of international experts

All experts rated supplements (iron, vitamin, and other), bisphosphonates, replacement hormones, hyperuricemia drugs, and anticoagulants as being unlikely to be appropriate in the last days of life of cancer patients (Appendix).

Medications rated as being unlikely to be appropriate by 94 % of all experts were antihypertensives, antiarrhythmics, antiulcer drugs, antibiotics, and steroids. Overall, 12 classes of medication were classified as being potentially inappropriate by the experts.

The medical chart review

Of the 195 patients included in the medical chart review, 38 % were female (Table 1). The mean age was 74 and 72 years for hospital and hospice patients, respectively. The most common primary tumors were respiratory, digestive, and genital/urinary tumors. The median length of admission was 9 days in the hospital and 10 days in the hospice. No significant differences in patient characteristics and length of admission were found. In the hospital, patients died significantly more often from respiratory cancers ($p < 0.001$).

Characteristics of medication use

Patients received, on average, 4.8 ± 2.1 classes of medication in the last 3 days of life: 5.1 in the hospital and 4.7 in the hospice (Table 2). For patients in the hospice, medication was administered subcutaneously in 56 % of all admission days. In the hospital, medication was administered subcutaneously only in 13 % of all admission days, and in 80 % of all admission days, other routes were used for administering medication.

Variation in use of potentially inappropriate medication

The proportion of patients in the hospital receiving medications that are likely to be inappropriate during the last 3 days of life was compared with the proportion of

patients in the hospice (Table 3). In both settings, steroids and antiulcer drugs were the most often used potentially inappropriate medication types. Hospital patients had a significantly higher probability of receiving antiulcer drugs (OR 3.5; CI 1.7–7.1), antibiotics (OR 3.1; CI 1.4–6.9), vasodilator drugs (OR 4.9; CI 1.3–17.9), and dopamine (OR >8.4) compared to hospice patients. In the hospital, before and after the implementation of the LCP (Table 4), steroids and antiulcer drugs were the most often used potentially inappropriate types of medication. Patients who died before the implementation of LCP had a significantly higher probability of receiving vasodilator drugs (OR 3.8; CI 1.2–12.0) and a lower probability of receiving replacement hormones (OR 0.3; CI 0.1–0.8) than patients who died after LCP implementation. When comparing post-implementation hospital patients for whom LCP was actually used to those for whom the LCP was not used, patients dying without being on the LCP had a significantly higher probability of receiving antiulcer drugs (OR 5.8; CI 1.9–17.9), anticoagulants (OR 4.2; CI 1.1–16.4), replacement hormones (OR 7.3; CI 1.5–35.7), and dopamine (OR >2.6) (Table 5).

[TABLE 1] [TABLE 2] [TABLE 3]

Variation in the use of appropriate medication Table 3 shows the proportion of patients who received medications that are likely to be appropriate in the last 3 days of life in the hospital and hospice settings. In both settings, opioids and morphine were most often used. Hospital patients had a significantly lower probability of receiving appropriate medications than hospice patients; odds ratios ranged from 0.01 to 0.24. Comparing hospital care before and after LCP implementation (Table 4), we found a significantly lower probability of receiving haloperidol (OR 0.5; CI 0.2–0.9), midazolam (OR 0.02; CI 0.003–0.2), medication for pulmonary secretions (OR 0.1; CI 0.04–0.3), and medication for nausea/vomiting (OR 0.2; CI 0.1–0.9) for patients before LCP implementation. Furthermore, we found a significantly lower probability of receiving appropriate medications, except medication for nausea or vomiting, for patients dying without being on the LCP compared to patients for whom LCP was used (Table 5).

Medications as potential quality indicators

Ten potentially inappropriate medications had at least two odds ratios in the expected direction: antiulcer drugs, antibiotics, anticoagulants, replacement hormones, antiarrhythmics, antihypertensives, vasodilator drugs, steroids, dopamine, and bisphosphonates. All six potentially appropriate medications had at least two odds ratios in the expected direction.

DISCUSSION

Medication use in the last days of cancer patients varies per setting for potentially appropriate and inappropriate classes of medication. Combining experts' opinions on the appropriateness of medications in the last days of life with current medication use in 195 patients in three different care settings resulted in 16 potential quality indicators for end-of-life care of the dying patient; ten medication types are potentially inappropriate, and six are likely to be appropriate drugs. These 16 potential quality measures need further exploration and validation.

Data on inappropriate medication use have already been used as quality indicator in other fields of medicine. For example, the Beers criteria are well known and widely used to evaluate care for elderly patients [27, 28]. These criteria aim to identify inappropriate medication use in older adults, and the criteria enable care providers to plan interventions for minimizing drug-related problems, such as unnecessary polypharmacy or adverse drug events. In end-of-life care, there is also a growing interest in potential indicators for inappropriate care like aggressive end-of-life care, e.g., chemotherapy close to death [29, 30] and futile medication use among people with limited life expectancy [20, 31, 32].

Recently, variation in pain medication use at the end of life has been identified as potential quality measures [19]. One fifth of ambulatory advanced cancer patients use futile medications, and the prevalence of inappropriate medication use among patients with a limited life expectancy varies from 25 to 44 % [20]. Subsequently, Maddison et al. [20] emphasize in their systematic review the need to develop a framework to assess inappropriate medication at the end of life.

[TABLE 4]

There are some concerns regarding using standard medical file data on medication use for quality assessment.

Especially, the lack of completeness and accuracy of such data are mentioned [14]. However, electronic patient records and electronic prescribing systems are increasingly present, which contribute to a higher quality of administrative data on medication use [33]. An increasing interest in medication safety and mandatory reporting of medication use will further improve the quality and reliability of medication data.

In this study, we used a well-developed and evaluated care assessment tool to ensure standardization of the data collection, and a double assessment of a random subsample was performed, which confirmed the reliability of this assessment tool. Furthermore, restricting the data collection period, i.e., the last 3 days of life, improved the feasibility, which is also an important feature of quality indicators. When using medication use as a quality indicator, it is important to realize that it aims at assessing the quality of care at an aggregate population level. Population-based indicators for quality of end-of-life care are not designed to measure quality of care on the individual level. Individual patients may sometimes experience better quality of care due to the use of medications such as supplements, although these supplements are, in general, inappropriate in the last days of life.

We used an international expert panel to assess the appropriateness of medications. For constructing this panel, we used purposive sampling to ensure a panel with sufficient expertise in care for the dying. This may have led to selection bias because it is not a random sample. Therefore, the panel might not represent palliative care experts in general, which, however, does not significantly compromise the explorative aim of this research. Furthermore, we used consecutive samples of deceased cancer patients, which include all patients in the given time periods. Although it is a non-probability sampling method, for which it may not be assumed that the sample fully represents the target, consecutive sampling is a good choice within the non-probability sampling methods. However, some subgroups were small, e.g., deceased hospital patients for whom the LCP was used (n023). These small

subgroups might endanger the comparability of patients who were on LCP and those who were not through possible imbalances in primary cancer sites. Patients for whom the LCP was used were relatively often diagnosed with respiratory cancer, which might explain the frequent use of medication for pulmonary secretions in this group.

[TABLE 5]

This study is a first step towards using data on medication use as a quality indicator in end-of-life care. Future studies are needed to validate these potentially inappropriate and appropriate medications as quality indicators. The association between the prevalence of their use and quality of cancer care should be assessed to verify construct validity. Finally, it is important to evaluate these potential quality indicators further to assess their feasibility, validity, and sensitivity.

Our list of 16 medications may not be comprehensive.

Lipid-lowering drugs, such as statins, are often mentioned as being inappropriate at the end of life. However, recognition of a life-limiting condition is not associated with less use of statins [31], and this lack of sensitivity implies statins to be a less useful quality indicator.

Although an increasing awareness of potentially inappropriate medical care in the last days of life is present, critical assessment of the appropriateness of care and medication during the last days of life still needs to disseminate further among professionals. End-of-life pathways, such as the LCP, urge professionals to evaluate potentially inappropriate medications; a prerequisite is recognition of the dying phase. Using end-of-life pathways may support professionals in recognizing the dying phase, increase awareness among professionals, and create an opportunity to discuss the situation with the patient and family. By these means, it might contribute to the improvement of end-of-life care.

In conclusion, medication use in the last days of life of cancer patients varies per setting. In total, 16 classes of medication with the potential to assess the quality of end-of-life cancer care were identified by combining experts' opinions on appropriateness of medications in the last days of life with a medical chart review of current medication use.

The use of these medications, single or combined, as quality indicators may contribute to better end-of-life cancer care and needs further exploration.

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[TABLE 6]

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TABLES AND FIGURES

Table 1 Characteristics of deceased cancer patients

	Hospice	Hospital			
	All N=60	Pre-LCP ^a N=73	Post-LCP ^a N=62	No LCP ^b N=39	On LCP ^b N=23
Female	23 (38)	23 (32)	28 (45)	19 (49)	9 (39)
Age (mean(SD))	72(14)	76(10)	73(11)	74(11)	72(10)
Primary cancer site					
Digestive	26 (43)	16 (22)	8 (13)	7 (18)	1 (4)
Respiratory	12 (20)	33 (45)	30 (48)	15 (39)	15 (65)
Genital urinary	14 (23)	10 (14)	4 (7)	3 (8)	1 (4)
Hematological	2 (3)	8 (11)	6 (10)	4 (10)	2 (9)
Other	6 (10)	6 (8)	14 (23)	10 (26)	4 (17)
Days in the ward (median, (lower–upper quartiles))	10 (3–19)	8 (3–15)	11 (4–20)	9 (4–20)	14 (3–22)

All figures represent numbers and percentages unless otherwise specified

^aLCP is the Liverpool Care Pathway for the Dying Patient. Pre- and post-LCP include all cancer deaths that occurred in the participating wards in the 4 months before and after the implementation of LCP, respectively

^bNo LCP includes all cancer deaths that occurred in the hospital for which the LCP was not used after the implementation of LCP. On LCP includes all cancer deaths that occurred in the wards for which the LCP was used

Table 2 Other characteristics of medication use in patients in their last 3 days of life

	Hospice	Hospital			
	All N=60	Pre-LCP ^a N=73	Post-LCP ^a N=62	No LCP ^b N=39	On LCP ^b N=23
Poly-medication use (mean (SD))					
Number of medications	4.7 (1.8)	5.3 (2.4)	4.9 (2.0)	5.2 (2.1)	4.5 (1.7)
Route of administration (%)	N=165 days	N=202 days	N=180 days	N=112 days	N=68 days
Days with no medication	2 (3)	6 (12)	9 (16)	14 (16)	0 (0)
Days with only subcutaneous	56 (92)	4 (9)	22 (39)	6 (7)	47 (32)
Days with other routes	42 (70)	90 (181)	69 (125)	79 (89)	53 (36)

All are numbers and percentages unless indicated otherwise

^aLCP is the Liverpool Care Pathway for the Dying Patient. Pre- and post-LCP include all cancer deaths that occurred in the participating wards in the 4 months before and after the implementation of LCP, respectively

^bNo LCP includes all cancer deaths that occurred in the hospital for which the LCP was not used after the implementation of LCP. On LCP includes all cancer deaths that occurred in the wards for which the LCP was used

Table 3 Patients receiving potentially inappropriate and appropriate medication in last 3 days of life; hospital vs. hospice

	Hospital pre-LCP ^a N=73 % (N)	Hospice N=60 % (N)	Hospital vs. hospice (ref)	
			OR	95 % CI
Potentially inappropriate medication^b				
Supplements	16 (12)	–	>11.8 ^c	–
Replacements hormones	11 (8)	3 (2)	3.6	0.7–17.5
Bisphosphonates	3 (2)	–	>1.7 ^c	–
Hyperuricemia drugs	–	–	–	–
Anticoagulants	26 (19)	23 (14)	1.2	0.5–2.6
Antihypertensive	15 (11)	5 (3)	3.4	0.9–12.7
Antiarrhythmics	21 (15)	8 (5)	2.8	1.0–8.4
Antiulcer drugs	70 (51)	40 (24)	3.5	1.7–7.1
Antibiotics	41 (30)	18 (11)	3.1	1.4–6.9
Steroids	69 (50)	72 (43)	0.9	0.4–1.8
Vasodilator drugs	21 (15)	5 (3)	4.9	1.3–17.9
Dopamine	12 (9)	–	>8.4 ^c	–
Appropriate medication				
Opioids	81 (59)	95 (57)	0.22	0.06–0.8
Morphine	64 (47)	93 (56)	0.13	0.04–0.4
Midazolam	1 (1)	50 (30)	0.01	0.002–0.1
Haloperidol	25 (18)	75 (45)	0.11	0.05–0.2
For pulmonary secretions	7 (5)	68 (41)	0.03	0.01–0.1
For nausea/vomiting ^d	4 (3)	15 (9)	0.24	0.06–0.9

Italic OR indicate significant values, $p < 0.05$

^a LCP is the Liverpool Care Pathway for the Dying Patient. Pre-LCP includes all cancer deaths that occurred in the participating wards in the 4 months before the implementation of LCP

^b Classes of inappropriate medications are ordered by the likelihood of being inappropriate in the last 3 days of life, as rated by the palliative care experts

^c Computation of OR was not possible due to zero cases in one of the cells of the reference category. Zero was replaced by 1 to compute for the OR

^d Medication for nausea and vomiting includes metoclopramide and levomepromazine

Table 4 Patients receiving potentially inappropriate and appropriate medication in the last 3 days of life; hospital pre-LCP vs. hospital post-LCP

	Hospital pre-LCP ^a N=73 % (N)	Hospital post-LCP ^a N=62 % (N)	Pre-LCP vs. post-LCP (ref)	
			OR	95 % CI
Potentially inappropriate medication^b				
Supplements	16 (12)	16 (10)	1.0	0.4–2.6
Replacements hormones	11 (8)	29 (18)	<i>0.3</i>	0.1–0.8
Bisphosphonates	3 (2)	–	1.8	–
Hyperuricemia drugs	–	7 (4)	<0.2 ^c	–
Anticoagulants	26 (19)	29 (18)	0.9	0.4–1.8
Antihypertensive	15 (11)	19 (12)	0.7	0.3–1.8
Antiarrhythmics	21 (15)	16 (10)	1.3	0.6–3.3
Antiulcer drugs	70 (51)	57 (35)	1.8	0.9–3.6
Antibiotics	41 (30)	32 (20)	1.5	0.7–3.0
Steroids	69 (50)	53 (33)	1.9	0.9–3.9
Vasodilator drugs	21 (15)	7 (4)	<i>3.8</i>	1.2–12.0
Dopamine	12 (9)	7 (4)	2.0	0.6–7.0
Appropriate medication				
Opioids	81 (59)	86 (53)	0.72	0.3–1.8
Morphine	64 (47)	73(45)	0.68	0.3–1.4
Midazolam	1 (1)	37 (23)	<i>0.02</i>	0.003–0.2
Haloperidol	25 (18)	42 (26)	<i>0.5</i>	0.2–0.9
For pulmonary secretions	7 (5)	40 (25)	<i>0.1</i>	0.04–0.3
For nausea/vomiting ^d	4 (3)	16 (10)	<i>0.2</i>	0.1–0.9

Italic OR indicate significant values, $p < 0.05$

^a LCP is the Liverpool Care Pathway for the Dying Patient. Pre- and post-LCP include all cancer deaths that occurred in the participating wards in the 4 months before and after the implementation of LCP, respectively

^b Classes of inappropriate medications are ordered by the likelihood of being inappropriate in the last 3 days of life, as rated by the palliative care experts

^c Computation of OR was not possible due to zero cases in one of the cells of the reference category. Zero was replaced by 1 to compute for the OR

^d Medication for nausea and vomiting includes metoclopramide and levomepromazine

Table 5 Patients receiving potentially inappropriate and appropriate medication in last 3 days of life; hospital no LCP vs. hospital on LCP

	Hospital no LCP ^a N=39 % (N)	Hospital on LCP ^a N=23 % (N)	No LCP vs. on LCP (ref)	
			OR	95 % CI
Potentially inappropriate medication^b				
Supplements	23 (9)	4 (1)	6.6 ^c	0.8–55.6
Replacements hormones	41 (16)	9 (2)	7.3	1.5–35.7
Bisphosphonates	–	–	–	–
Hyperuricemia drugs	8 (3)	4 (1)	1.8	0.2–18.9
Anticoagulants	39 (15)	13 (3)	4.2	1.1–16.4
Antihypertensive	28 (11)	4 (1)	8.6	1.0–71.4
Antiarrhythmics	13 (5)	22 (5)	0.5	0.1–12.2
Antiulcer drugs	72 (28)	30 (7)	5.8	1.9–17.9
Antibiotics	41 (16)	17 (4)	3.3	0.9–11.6
Steroids	56 (22)	48 (11)	1.4	0.5–4.0
Vasodilator drugs	8 (3)	4 (1)	1.8	0.2–18.9
Dopamine	10 (4)	–	>2.6 ^c	–
Appropriate medication				
Opioids	77 (30)	100 (23)	<0.14 ^c	–
Morphine	62 (24)	91 (21)	0.15	0.03–0.7
Midazolam	13 (5)	78 (18)	0.04	0.01–0.2
Haloperidol	28 (11)	65 (15)	0.2	0.07–0.6
For pulmonary secretions	15 (6)	83 (19)	0.04	0.01–0.2
For nausea/vomiting ^d	21 (8)	9 (2)	2.7	0.5–14.1

Italic OR indicate significant values, $p < 0.05$

^a LCP is the Liverpool Care Pathway for the Dying Patient. No LCP includes all cancer deaths that occurred in the hospital for which the LCP was not used after the implementation of LCP. On LCP includes all cancer deaths that occurred in the wards for which the LCP was used

^b Classes of inappropriate medications are ordered by the likelihood of being inappropriate in the last 3 days of life, as rated by the palliative care experts

^c Computation of OR was not possible due to zero cases in one of the cells of the reference category. Zero was replaced by 1 to compute for the OR

^d Medication for nausea and vomiting includes metoclopramide and levomepromazine

Table 6 Percentage of experts (*N*=16) indicating potential inappropriateness of medication in last three days of life

Potentially inappropriate medication	Low likelihood of being appropriate ^a (%)
Likely inappropriate medication	
Iron supplements	100
Vitamin supplements	100
Replacements hormones	100
Bisphosphonates	100
Other supplements	100
Hyperuricemia drugs	100
Anticoagulants	100
Antihypertensive	94
Antiarrhythmics	94
Antiulcer drugs	94
Antibiotics	94
Steroids	94
Appropriateness unclear	
Laxatives	81
Antidepressants	81
Pulmonary drugs	81
Hypoglycemics	81
Diuretics	56
NSAIDs	56
Anticonvulsants	38
Benzodiazepines	20

^a Scored as 1 or 2 on a 4-point Likert scale from low (1) to high(4) likelihood of being appropriate in the last three days of life