Missed Bronchodilator Medication Treatments in Respiratory Therapy: Frequency and Underlying Causes

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BACKGROUND: In the context of increasing attention to medical errors, missed therapies have become a subject of focus both for optimizing clinical care and for assuring appropriate institutional performance during external review by accrediting bodies. Because the issue of missed treatments in respiratory therapy has received little attention to date, we undertook to describe the frequency and causes of missed respiratory therapy bronchodilator medication treatments at the Cleveland Clinic Hospital. METHODS: Between August 2000 and August 2001, using a respiratory therapy management information system, we recorded the number of respiratory therapy bronchodilator medication treatments ordered and delivered (via small-volume nebulizer and metered-dose inhaler) and the reason(s) for each missed treatment. RESULTS: Over the 12-month study interval 113,554 bronchodilator medication treatments (74,921 via small-volume nebulizer and 38,633 via metered-dose inhaler) were ordered. Overall, 4,012 medication treatments were missed (3.5% of the total), with variation by month ranging from 2.0% to 5.0%. The commonest reason for failure to administer the ordered bronchodilator treatment was the patient being out of the room at the time of the therapist's visit, which accounted for nearly one third of missed therapies. Next most common was the patient refusing treatment (24.6%), followed by the patient being unavailable because of ongoing activities or therapy (eg, physical therapy or a medical procedure). The least common reason was the respiratory therapist being called away to administer therapy to another patient (1.4%). CONCLUSIONS: Overall, the frequency of missed bronchodilator treatments was relatively low in this series. The next steps include developing strategies to lower the frequency of missed treatments, so as to optimize the allocation of respiratory therapy services, and studying the clinical consequences of missed therapies. *Key words: medical error, respiratory therapy, bronchodilator, missed treatment, management information system.* [Respir Care 2003;48(2):110–114]

Introduction

Issues regarding patient safety and medical errors, including missed medications, have recently become the focus of attention for organizations such as the Institute of Medicine,[1] the Leapfrog Group,[2,3] and the Joint Commission for Accreditation of Healthcare Organizations.[4–6] Both because of omission and commission, medications errors reportedly account for 2–10% of medical errors,[4,7] and missed medications reportedly occur in 1.4–8.4% of prescribed doses.[8,9]

SEE THE RELATED EDITORIAL ON PAGE 108

In the context of increasing current attention to medical errors and because the issue of missed treatments in respiratory therapy has received little attention to date, our Respiratory Therapy Section at the Cleveland Clinic Foundation undertook a description of the frequency and causes of missed respiratory therapy bronchodilator treatments.

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This descriptive analysis is part of a strategy for ongoing performance improvement, in which follow-up attention will focus on assessing the consequences of missed therapies and on strategies to minimize their occurrence.

Methods

The study was conducted in the Cleveland Clinic Hospital, a 1,000-bed tertiary care institution, where a long-standing protocol-based respiratory therapy consult service has been in use. The bronchodilator protocol encourages patients' use of metered-dose inhalers (MDIs) whenever clinical circumstances and the patient's demonstrated technique competence permit.

Between August 2000 and August 2001, the number of respiratory therapy bronchodilator medication treatments ordered (with both small-volume nebulizers and MDIs) and the number of treatments delivered were recorded using our respiratory therapy management information system (CliniVision, Nellcor/Puritan Bennett, Carlsbad, California). Also, because the treating respiratory therapist (RT) documents the reason for each missed treatment in the CliniVision system, we recorded the reason(s) for each missed treatment, using the following categories:

1. Patient not in room at the time of the RT visit
2. Patient refused treatment
3. Patient discharged
4. Patient in the room but not accessible because of an ongoing procedure (eg, physical therapy or a medical procedure)
5. RT advised by physician or nurse not to give treatment
6. Breath sounds clear at the time of visit
7. Patient deemed unable to tolerate treatment
8. RT called away urgently (eg, to administer emergency therapy to another patient)

Results

Over the 12-month study interval, 74,921 small-volume nebulizer treatments and 38,633 MDI treatments were ordered, for a total of 113,554 bronchodilator medication treatments. MDI treatments that patients self-administered (after appropriate RT assessment and signoff for proper technique) were not included in the study. Overall, 4,012 of these treatments were missed (3.5% of total, Table 1), with variation by month ranging from 2.0% to 5.0%. Excluding therapies that were missed because the patient was discharged ($n = 167$), the physician or nurse advised against giving the treatment ($n = 90$), and because the breath sounds were clear ($n = 462$), the rate of missed medications was 2.9%.

Table 2 presents the reasons the bronchodilator treatments were not given. The most common reason was that the patient was out of the room at the time of the therapist's visit, which accounted for nearly one third of missed therapies. The next most common reason was that the patient refused the treatment (24.6%). The least common reason for failure to administer the ordered bronchodilator treatment was the RT being called away to administer emergency therapy to another patient (1.4%).

Though there was no significant correlation between the number of therapies ordered monthly and the frequency of missed therapies ($p = 0.498$, data not shown), the observation that the highest frequency of missed therapies sometimes occurred when the volume of therapies was low (eg, June 2001) raises a question regarding the impact of staffing on missed bronchodilator therapies. To examine this, we compared the correlation between staffing adequacy (defined as the mean number of work units per therapist) and the percentage of missed treatments; no significant correlation was found (Fig. 1, $r = -0.201$, $p = 0.532$).

Discussion

Though medical errors are a common institutional concern and are the frequent focus of institutional review by external accrediting bodies,[1,4,6] surprisingly little attention has been given to the frequency or consequences of missed medications in hospitalized patients.[10] In this first effort to report errors that may occur during the practice of respiratory therapy,[11] we elected to examine missed bronchodilator medication treatments. Our findings suggest that the frequency of missed bronchodilator treatments at the Cleveland Clinic Hospital is relatively low (3.5% overall, range 2.0–5.0%) and that the most frequent reason for missed treatment was the patient's unavailability because of absence from the floor at the time of the therapist's visit. The patient was scored as *unavailable* if he or she was out of the room or as *not accessible* if another ongoing treatment precluded delivering the bronchodilator treatment, despite repeated RT visits during the shift.

Despite the low percentage of missed treatments, the large volume of bronchodilator medication orders means that the absolute number of missed treatments is large. Indeed, in the context of the millions of medication orders placed for hospitalized patients in the United States, error rates as low as 0.1% would resemble or exceed the standards of other industries.[1] For example, in the context of other industries, an error rate of 0.1% would indicate:[4]

- Two unsafe plane landings per day at O'Hare airport
- 16,000 pieces of lost mail per hour
- 32,000 bank checks deducted from the wrong account per hour

The present study is, to our knowledge, the first to examine the frequency of missed respiratory therapies. Although the broader issue of missed medications for hos-

Table 1. Number of Bronchodilator Treatments Missed

Month	SVN	MDI	Total Treatments	Treatments Missed*	(%) Missed†
Aug 2000	5,264	3,222	8,486	284	3.30
Sep 2000	6,205	2,961	9,166	398	4.30
Oct 2000	5,767	3,608	9,375	308	3.30
Nov 2000	6,425	3,873	10,298	266	2.60
Dec 2000	6,246	3,193	9,439	391	4.00
Jan 2001	7,908	3,530	11,438	403	3.50
Feb 2001	6,985	2,769	9,754	198	2.00
Mar 2001	6,025	2,852	8,877	328	3.70
Apr 2001	6,794	3,557	10,351	426	4.10
May 2001	5,878	3,573	9,451	358	3.80
Jun 2001	5,775	3,001	8,776	441	5.00
Jul 2001	5,649	2,494	8,143	211	2.60
Total	74,921	38,633	113,554	4,012	3.50

SVN = small-volume nebulizer
MDI = metered-dose inhaler
*Reason for not giving the treatment was recorded for all 4,012 missed treatments.
†No significant correlation was observed between the total number of treatments per month and the total number of missed treatments per month ($p = 0.498$).

Table 2. Reported Reasons Bronchodilator Treatments Were Not Given

Month	Total Missed	Patient Not in Room	Patient Refused Treatment	Patient Discharged	Patient Not Accessible	Advised Not to Give	Breath Sounds Clear	Unable to Tolerate	Therapist Emergency Call
Aug 2000	284	45	74	19	71	8	55	9	3
Sep 2000	398	96	68	17	82	19	95	15	6
Oct 2000	308	116	57	9	69	10	22	18	7
Nov 2000	266	73	87	6	64	14	12	6	4
Dec 2000	391	56	94	8	106	17	79	20	11
Jan 2001	403	93	112	18	103	8	51	11	7
Feb 2001	198	87	43	11	48	0	5	4	0
Mar 2001	328	125	89	18	65	3	10	15	3
Apr 2001	426	170	121	8	80	3	20	18	6
May 2001	358	140	93	12	56	5	24	25	3
Jun 2001	441	199	103	20	66	1	37	13	2
Jul 2001	211	68	47	21	12	2	52	6	3
Total	4,012	1,268	988	167	822	90	462	160	55
% Missed	3.5	31.6	24.6	4.2	20.5	2.2	11.5	4.0	1.4

pitalized patients has received considerable attention (available current estimates of missed medications range from 1.4%[9] to 8.4%[8]), available studies have examined neither the rate of missed respiratory therapies nor the clinical consequences of missed medications.[10] In one noteworthy report, McMillan et al[8] reported that the frequency of missed medications among 753 in-patients was 8.4% (ie, 574 missed medications of 6,833 doses ordered) and that 32.1% (242/753) of patients experienced at least one missed dose over the 24-hour study interval. In that series, respiratory drugs accounted for 7% of missed medications, and in 57% of the instances of missed medications the omission was deemed "potentially detrimental."

In another noteworthy study, Nettleman and Bock[9] reported that 1.4% (906/63,031) of medication orders of all types were missed. The risk of missing a medication was related to the number of daily doses, and in this regard shorter-acting medications were more likely to be omitted than long-acting medications. The most frequently prescribed class of short-acting medication (antimicrobials) was the most likely to be missed in that series. In a retrospective nested cohort study of adults with bacterial meningitis, no association was observed between missed doses and mortality risk. Finally, although patients were frequently absent from the floor, only 3% of missed doses were ascribed to patient unavailability. Nurses' assess-

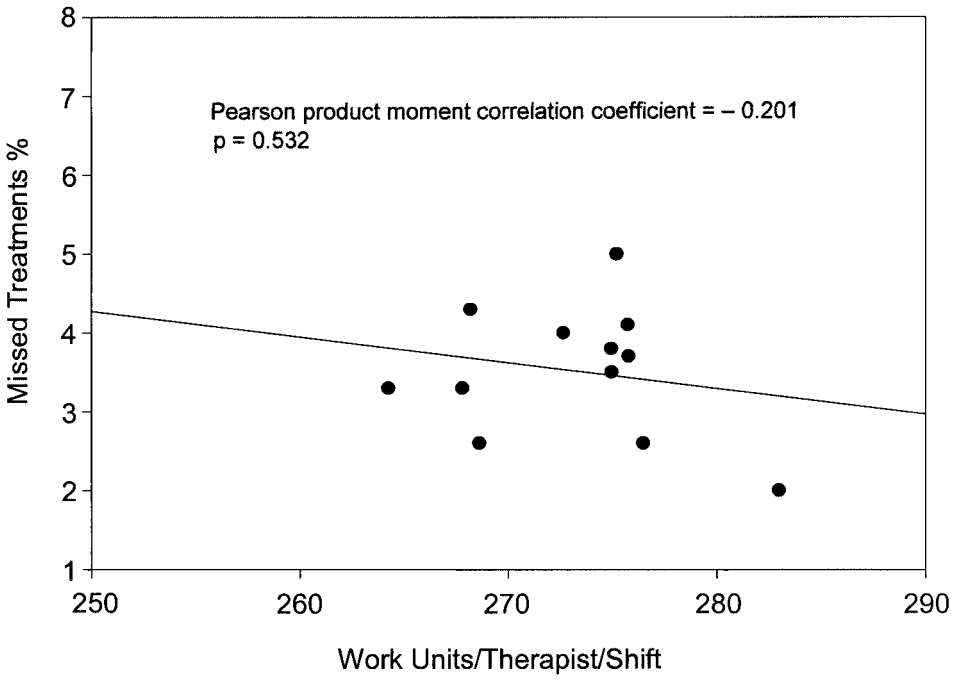

Fig. 1. Monthly mean work units per therapist per shift versus percentage of missed treatments (August 1, 2000, through July 31, 2001).

ments suggested that the procedural complexity of administering medications was the reason that medications were missed.

Several limitations of our study warrant mention. First, given our focus on respiratory therapy, we assessed only missed bronchodilator therapies but did not consider other respiratory treatments (including other bronchodilators such as theophylline or aminophylline) or nonrespiratory medications. Second, in our hospital, respiratory therapy is largely administered under the guidance of a respiratory therapy consult service that uses respiratory care protocols, so the generalizability of our findings to other settings in which protocols are not widely used is uncertain. Third, our study does not assess the clinical impact of missed therapies. In a setting where misallocation of respiratory therapies is common and where over-ordering exceeds under-ordering,[12–14] it is conceivable that missing treatments confers no adverse effects other than medication waste and the expenditure of RT efforts that are unassociated with clinical benefit. On the other hand, direct assessment of clinical impact is needed before the true importance of missed therapies or the benefit of their avoidance can be clearly understood.

Notwithstanding these limitations, our findings do suggest opportunities to enhance care. First, that almost one third of the missed therapies were because the patient was off the floor when the therapist visited suggests an opportunity to better coordinate care between respiratory therapy and nursing, through interdisciplinary planning. For example, a system that apprises the therapist regarding the patient's availability before the floor visit could lessen the risk of missing treatments because of patient absence. Second, the observation that one quarter of missed treatments were ascribed to patients' refusal invites the possibility that providers' explanations of the rationale for therapy may be inadequate. To the extent that inadequate provider communication explains this finding, our results are a reminder that good communication and appropriate patient education are essential for compliance and optimal clinical benefit. In support of this notion, Misson[7] suggested that well-educated patients who understand their medications can serve as a safety check on medication errors, by speaking up if they are unsure of what they are receiving.

Overall, the frequency of missing bronchodilator treatments was relatively low in this series. Future needs include developing strategies to further lower this frequency so as to optimize the allocation of respiratory therapy services, and better understanding of the clinical consequences of such missed therapies.

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