Incentive Spirometry Adherence: A National Survey of Provider Perspectives

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BACKGROUND: Patient adherence is a critical factor for success of patient-administered therapies, including incentive spirometry (IS). Patient adherence with IS is not known, so we sought to evaluate providers' perspectives on the current state of IS adherence and elucidate possible factors hindering patient adherence. **METHODS:** Respiratory therapists (RTs) and nurses across the United States were surveyed via social media and online newsletters. Surveys were distributed to the relevant national RT and nursing societies: the American Association for Respiratory Care, the Academy of Medical-Surgical Nurses, the American Society of Peri-Anesthesia Nurses, and the American Association of Critical-Care Nurses. **RESULTS:** Responses from 1,681 (83.8% completion rate) RTs and nurses were received. The clear majority of all providers agreed that patient adherence is poor (86.0%; 1,416 of 1,647 respondents) and should be improved (95.4%; 1,551 of 1,626 respondents). Providers believe that IS adherence is hindered by various factors. The most common reasons cited were that patients forget to use their ISs (83.5%; 1,404 of 1,681 respondents), do not use them effectively (74.4%; 1,251 of 1,681 respondents), and do not use them frequently enough (70.7%; 1,188 of 1,681 respondents). **CONCLUSIONS:** These findings from a large national survey of health care providers highlight the need for improved IS adherence and indicate that patient forgetfulness may be a large contributor to nonadherence. Efforts aimed at improving IS adherence are warranted. *Key words:* incentive spirometry; nurse; respiratory therapy; adherence; adherence. [Respir Care 2018;63(5):532–537. © 2018 Daedalus Enterprises]

Introduction

Successful incentive spirometry (IS) implementation is dependent on patient adherence with provider instructions; such instructions include target inspiratory volumes and

frequency of use.¹ Patients are told to use IS regardless of the provider's presence or absence. Multiple investigations have highlighted patient adherence as a major factor limiting the efficacy of IS.^{2–4} Poor adherence and suboptimal utilization can preclude the potential benefits of IS.⁵

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Previous studies have demonstrated that IS adherence is not known.⁵ In a 2016 systematic review of the literature, Narayanan et al⁵ demonstrated that a major confounder in IS trials is the scarcity of data on patient adherence. The authors found that only 16.6% of IS studies included mention of adherence rates, and even these adherence data were uninterpretable due to omitted data,^{6,7} averaged population values over the whole intervention period,⁸ arbitrary classifications of good adherence,⁸ and poorly kept subject-recorded adherence logs.⁹ Of the various adherence-monitoring methods that have been tested, direct in-person or electronic observation could be a reliable approach.¹⁰ Due to resource limitations, however, these approaches are likely not feasible on a broader scale.

Without a better understanding of the reasons or perceptions of adherence problems, efforts aimed at improving or monitoring adherence may fall short. Accurate adherence data are a prerequisite for valid assessment of IS efficacy and optimization. Previous studies have repeatedly shown that effectiveness of IS has not been demonstrated,^{2,4,11-14} largely due to unknown patient adherence.⁵ Multiple IS investigations have called for greater attention to adherence data.^{2,3,6,7,9,15-24} Because the costs of postoperative pulmonary complications are substantial,²⁵⁻²⁸ optimizing therapeutic strategies, such as IS, is critical.

In an effort to better understand IS adherence, the goal of this study was to evaluate providers' perspectives on the current state of IS adherence in practice and elucidate possible perceived factors hindering patient adherence.

Methods

A cross-sectional study of nurses and respiratory therapists (RTs) on the reported application and adherence of IS in clinical practice was completed. For sampling technique, a secure online survey was distributed via email newsletters and social media by way of listserv to members of the American Association of Critical-Care Nurses, the Academy of Medical-Surgical Nurses, the American Association for Respiratory Care, and the American Society of Peri-Anesthesia Nurses, between September and December 2016. These national professional organizations were selected for representing fields that directly implement, manage, and assess IS adherence in daily clinical practice. All members of the professional organizations who receive email newsletters from the organizations were eligible for responding to the survey. Those who responded to the survey were included; members who did not receive the emailed survey and those who did not respond to the survey were excluded. To assess the views of all providers, no minimum years of practice was required for eligibility. This investigation aimed to estimate attitudes of providers, so no specific hypotheses were being tested. Without hypothesized comparisons, anticipated effect sizes

QUICK LOOK

Current knowledge

Patient adherence is a critical factor for success of patient-administered therapies, including incentive spirometry (IS). IS adherence is not known.

What this paper contributes to our knowledge

These findings comprise a large national survey of provider perspectives on IS. The results highlight the need for improved IS adherence and indicate that patient forgetfulness may be a large contributor to nonadherence. Efforts aimed at improving IS adherence are warranted.

do not exist. In turn, sample size from power analysis could not be calculated. The goal, therefore, was to receive responses from as many individuals as possible from each organization. The survey was created using REDCap²⁹ and was approved by an institutional review board. No incentives were provided for completing the survey. Survey responses were anonymous.

Respondents were asked their perspectives on IS adherence and factors hindering IS usage. Given the lack of standardized protocols for IS use and, therefore, the lack of adherence to such protocols, adherence was deliberately left undefined in the survey to assess providers' real-life perspectives in their own practices.³⁰ In so doing, the meaning of adherence is standardized to what is actually practiced by providers. An operational definition of adherence is that of a patient acting in accordance with provider advice. Respondents indicated as many or as few factors that they believed hinder IS usage. The percentage of respondents who marked each factor was calculated.

The reported statistical analyses were conducted using SAS Software 9.4 (SAS, Cary, North Carolina). Counts and percentages were calculated using PROC FREQ, and medians were calculated using PROC MEANS. With Likert-scale responses between 1 and 6, means were estimated using the generalized linear model, assuming a binomial distribution, thus allowing for 95% CIs to be asymmetrical using PROC GLIMMIX.

Results

Responses were received from 1,681 unique nurses and RTs from the 4 national organizations with various educational backgrounds, years of experience, and primary practice locations. Respondent characteristics and survey completion rates are fully detailed in Eltorai et al.³⁰

The clear majority of providers agreed that patient adherence with IS is poor (86.0%; 1,416 of 1,647 respon-

dents) and should be improved (95.4%; 1,551 of 1,626 respondents) (Table 1). Interestingly, the American Association of Critical-Care Nurses and American Association for Respiratory Care respondents showed strongest agreement with poor IS adherence, which may relate to the patient populations under their care. Nurses from the American Association of Critical-Care Nurses also had the strongest agreement with a need to improve IS use adherence (54.8%).

Providers reported that IS adherence is hindered by various factors. The most commonly cited reasons were that patients forget to use their IS device (83.5%; 1,404 of 1,681 respondents), do not use them effectively (74.4%; 1,251 of 1,681 respondents), and do not use them frequently enough (70.7%; 1,188 of 1,681 respondents) (Table 2).

Discussion

A nationwide study of RT and nurse views on IS adherence and potential barriers to IS use was completed. Most RTs and nurses agreed that adherence should be improved and patient forgetfulness is a primary factor hindering IS adherence.

Previous studies have highlighted how little is known about IS adherence⁵⁻¹⁰ and that there is an urgent need for attention to the topic.^{2,3,6,7,9,15-24} The findings from this study suggest adherence is not only poor but in need of improvement. Furthermore, by surveying providers who best understand IS, hindrances to adherence are revealed. Understanding such barriers to successful IS adherence offers insight into how best to address such challenges and optimize IS implementation.

Given the high costs of postoperative pulmonary complications for patients, providers, and healthcare expenditures,²⁵⁻²⁸ optimizing therapeutic strategies such as IS is critical. However, the therapeutic value of IS remains unknown^{2,4,11-14} and cannot be determined without reliable IS-use data. Only with well-designed clinical trials and reproducible methods of collecting and reporting IS utilization can the efficacy of IS truly be evaluated. Such an investigation may reveal that the issue with IS is that good adherence is not achievable in a realistic, cost-efficient manner. A procedure that patients cannot complete cannot be effective. However, if IS adherence yields improved clinical outcomes, additional investigations will be required to evaluate the cost effectiveness of such interventions and how adherence can be further augmented.

Early IS technology possessed use-recording capabilities for provider review. In 1973, the Bartlett-Edward IS device was developed to incentivize patient usage by providing visual light feedback when patients achieved his or her inspiratory target volume.³¹ In 1975, Marion Laboratories (Kansas City, Missouri) further enhanced the electronic IS device's visual feedback by putting the display lights on a scale indicating increasingly larger achieved in-

Table 1. Provider Perspectives on IS Adherence

	Agreement	Response Options (Score)	AARC n (%)	ASPAN n (%)	AMSN n (%)	AACN n (%)	Aggregated n (%)
In general, patient IS adherence is poor.	Agree	Strongly agree (1)	93 (22.9)	148 (17.8)	63 (20.9)	38 (35.5)	342 (20.8)
		Agree (2)	125 (30.8)	284 (34.1)	112 (37.2)	37 (34.6)	558 (33.9)
		Somewhat agree (3)	127 (31.3)	284 (34.1)	81 (26.9)	24 (22.4)	516 (31.3)
	Disagree	Somewhat disagree (4)	42 (10.3)	95 (11.4)	34 (11.3)	5 (4.7)	176 (10.7)
		Disagree (5)	16 (3.9)	20 (2.4)	10 (3.3)	3 (2.8)	49 (3.0)
In general, patient IS adherence should be improved.	Mean (95%CI), median	Strongly disagree (6)	3 (0.7)	2 (0.2)	1 (0.3)	0 (0)	6 (0.4)
	Agree		2.3-2.5 (2.4, 2)	2.4-2.5 (2.5, 2)	2.3-2.5 (2.4, 2)	1.9-2.2 (2.0, 2)	2.4-2.5 (2.4, 2)
		Strongly agree (1)	133 (33.3)	365 (44.0)	136 (46.6)	57 (54.8)	691 (42.5)
		Agree (2)	139 (34.8)	338 (40.7)	123 (42.1)	39 (37.5)	639 (39.3)
	Disagree	Somewhat agree (3)	93 (23.3)	99 (11.9)	24 (8.2)	5 (4.8)	221 (13.6)
Mean (95%CI), median		Somewhat disagree (4)	19 (4.8)	22 (2.7)	5 (1.7)	2 (1.9)	48 (3.0)
		Disagree (5)	11 (2.8)	6 (0.7)	4 (1.4)	1 (1.0)	22 (1.4)
		Strongly disagree (6)	5 (1.3)	0 (0)	0 (0)	0 (0)	5 (0.3)
			2.0-2.2 (2.1, 2)	1.7-1.8 (1.8, 2)	1.6-1.8 (1.7, 2)	1.4-1.7 (1.6, 1)	1.8-1.9 (1.8, 2)

For statement 1: for AARC, N = 406; for ASPAN, N = 833; for AMSN, N = 301; for AACN, N = 107. Aggregated N = 1,647.
For statement 2: for AARC, N = 400; for ASPAN, N = 830; for AMSN, N = 292; for AACN, N = 104. Aggregated N = 1,626.

PROVIDER PERSPECTIVES ON IS ADHERENCE

Table 2. Factors Hindering IS Usage

	Response Options	AARC <i>n</i> (%)	ASPAN <i>n</i> (%)	AMSN <i>n</i> (%)	AACN <i>n</i> (%)	Aggregated <i>n</i> (%)
Patient IS adherence is hindered by (mark all that apply):	Forgetting to use IS	332 (79.8)*	697 (81.6)*	278 (92.1)*	97 (89.0)*	1,404 (83.5)*
	Not knowing when to use IS	194 (46.6)	426 (49.9)	146 (48.3)	62 (56.9)	828 (49.3)
	Not understanding how to use IS	238 (57.2)	565 (66.2)†	197 (65.2)	77 (70.6)‡	1,077 (64.1)
	Not receiving the IS device	148 (35.6)	509 (59.6)	177 (58.6)	68 (62.4)	902 (53.7)
	Not using IS frequently enough	300 (72.1)‡	565 (66.2)‡	245 (81.1)†	78 (71.6)	1,188 (70.7)‡
	Not using IS effectively	301 (72.4)†	631 (73.9)†	238 (78.8)‡	81 (74.3)†	1,251 (74.4)†
	Not using IS long enough	145 (34.9)	347 (40.6)	120 (39.7)	45 (41.3)	657 (39.1)
	Not being able to reach the IS device	242 (58.2)	325 (38.1)	140 (46.4)	44 (40.4)	751 (44.7)
	Having too much pain	259 (62.3)	497 (58.2)	167 (55.3)	71 (65.1)	994 (59.1)
	Sleep interference	127 (30.5)	288 (33.7)	79 (26.2)	35 (32.1)	529 (31.5)
	Providers not having enough time to work with the patient on IS use	191 (45.9)	425 (49.8)	144 (47.7)	62 (56.9)	822 (48.9)
	Providers having inadequate resources to work with the patient on IS use	107 (25.7)	238 (27.9)	66 (21.9)	27 (24.8)	438 (26.1)
	Facility having too few staff to work with the patient on IS use	163 (39.2)	308 (36.1)	106 (35.1)	46 (42.2)	623 (37.1)
	Patient cognitive status	246 (59.1)	394 (46.1)	165 (54.6)	68 (62.4)	873 (51.9)
	Patient language barrier	109 (26.2)	246 (28.8)	78 (25.8)	23 (21.1)	456 (27.1)

For AARC, *N* = 416; for ASPAN, *N* = 845; for AMSN, *N* = 302; for AACN, *N* = 109. Aggregated *N* = 1,681.
Rank of response for each organization: * = first; † = second; ‡ = third.

spiratory volumes.³² The electronic IS devices were in use for many years, but they have been replaced by less expensive single-use devices.² Current disposable IS devices do not have integrated use-counting capabilities. Previous attempts of recording IS usage via patient reporting, questionnaires, or electronic counters have yielded unreliable results due to inconsistent data collection and inconclusive analyses.⁵⁻⁹

Patient adherence is a major challenge in the implementation of other self-administered therapies as well (eg, medication adherence).³³⁻³⁷ The difficulty in monitoring adherence relates to the variability and fluctuations in individual patient behavior.³⁸⁻⁴¹ Nevertheless, the findings of this investigation further delineate specific factors that likely hinder patient adherence. In particular, the data suggest that patients forgetting to use their IS could be a principle focus for future work on improving adherence. Future research should collect actual patient data for true adherence rates and reasons for non-adherence. Case-study analysis within a specific health network could be useful for this. If the major factor is patients forgetting to use their IS device, reminder systems (eg, emails, automated telephone calls, smartphone reminders) may be of value. A valuable case study would be to collect patient data on adherence before versus after the implementation of such a reminder system. Alternatively, a randomized controlled study comparing patient IS utilization with versus without the reminder system may be helpful.

This study is not without limitations. Sampling was only drawn from nurses and RTs from 4 professional societies,

and thus the sample is not all-inclusive. Furthermore, although our completion rates were high, the precise response rate is not known due to the manner in which the survey was distributed. All members of the professional organizations who receive newsletters were eligible. The group includes both those who are currently practicing (any number of years) and those who may no longer be practicing. Such responses reflect both the current state of IS adherence along with the recent past, which helped shape the present. How providers' years of experience and current practice status affect their perspectives on IS warrants further investigation. Survey responses would ideally be collected from all practicing providers to reduce the potential IS bias due to receiving responses only from members of one or more professional societies. Patient adherence with IS in this survey was determined from assessments of nurses and RTs, rather than from measurements of patients. Although the list of factors hindering IS usage is thorough, other unknown hindrances for specific patients may be involved. Additional assessment of IS adherence among specific patient subpopulations (including pediatrics) could provide further granularity and useful patient-specific insights on adherence.

Conclusions

Nearly all providers in this study believe that patient adherence is hindered, at least in part, by patients forgetting to use their IS. Further investigations should include

a more detailed assessment of factors influencing patient adherence. Until adherence is well-established, the full potential impact of IS upon patient outcomes cannot be determined.

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