

Air Travel for Subjects Receiving Long-Term Oxygen Therapy

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BACKGROUND: Ambulatory oxygen (O_2) is the recommended treatment for hypoxemia at rest or induced by exercise. Commercial aircraft often fly at altitudes of 30,000 feet; their cabins are pressurized to altitudes of 6,000–8,000 feet, with an equivalent F_{IO_2} of 0.15. O_2 supplementation, for those receiving baseline ambulatory O_2 , is paramount. **METHODS:** We gathered information on subjects' experience traveling with supplementary oxygen and reasons individuals receiving O_2 do not travel. Subjects were identified using a home oxygen database. Data were gathered by postal questionnaire. The objective of this study was to gather information relevant to subjects' experience organizing travel with supplementary oxygen and their experience of traveling itself. **RESULTS:** Between 2013 and 2015, 512 patients were entered into the database: 277 were excluded (269 had died, 8 had incomplete records). We sent 235 questionnaires, and 50 responses were received (21% response rate). Of these, 11 (22%) were returned as the patient had died, 20 (40%) had not traveled by air, 11 (22%) had flown with O_2 , 4 (8%) no longer used O_2 , and 4 (8%) forms were incomplete. Of those who traveled with O_2 , 54% found it complicated to organize their trip, 72% found it complicated to access information, and 81% would fly again. Regarding those who had never flown with O_2 , 35% were unaware that O_2 was available on commercial aircraft, 30% had no wish to travel, and 30% had worries regarding their health. **CONCLUSIONS:** Air travel is challenging; however, those who did travel reported a mainly positive experience. Increasing available information on options for travel should help individuals. *Key words:* air travel; oxygen; COPD. [Respir Care 2018;63(3):326–331. © 2018 Daedalus Enterprises]

Introduction

The numbers of individuals traveling by plane are increasing, with an estimated 3.4 billion flying in 2015, and this is expected to rise to 7.4 billion/y by 2034, as quoted by the International Air Transport Association (<http://www.iata.org/pressroom/pr/Pages/2015-11-26-01.aspx>, Accessed January 21, 2017). With an aging population and esti-

mated 384 million people living with COPD worldwide,¹ a significant proportion of the traveling population will have underlying lung disease. Ambulatory oxygen (O_2) is a well-established treatment for hypoxemia at rest or induced by exercise, and use of in-flight oxygen is increasing by 10–12%/y.² Commercial aircraft often fly at altitudes of 30,000 feet; their cabins are pressurized to altitudes of 6,000–8,000 feet, with an equivalent F_{IO_2} of 0.15.³ O_2 supplementation, for those receiving baseline ambulatory O_2 , is paramount. On a practical level, traveling with ambulatory oxygen provides many physical and financial obstacles for patients; mobility difficulties have been shown to be associated with COPD⁴ and pulmonary fibrosis.⁵

Many studies have investigated the role of pre-assessment of patients with lung disease, not requiring ambulatory oxygen at baseline, before air travel.⁶ It is well established that individuals requiring supplemental oxygen therapy will require supplemental oxygen when flying; however, to date, no studies have examined the individuals' attitudes to and perceptions of air travel.

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The objective of this study was to gather information relevant to subjects' experience organizing travel with supplementary oxygen and their experience of traveling itself. For this purpose, patients in a supplementary oxygen database were invited to answer a questionnaire regarding their experience of air travel to include limitations, obstacles to air travel, personal experiences, and reasons why they would not travel.

Methods

Subjects

This observational, cross-sectional study was carried out in St Vincent's University Hospital in Dublin, Ireland. Subjects were identified using the hospital database of users of long-term oxygen therapy. Subjects had previously undergone a long-term oxygen assessment, and hypoxemia at baseline was established. Excluded were patients who were using ambulatory oxygen for palliation, patients who had died, and any patients with incomplete records. Five hundred twelve patients were identified, with 277 excluded and 235 invited to participate.

Questionnaire

Data were gathered using an air-travel questionnaire, which was designed for the study and tested on age-matched controls. Information related to the organization of ambulatory oxygen during travel, previous knowledge of flying with long-term oxygen, availability and source of information, interactions with the airport and airline staff, the experience of flying with oxygen, any barriers to travel, and in-flight respiratory symptoms was collected. Quantitative and qualitative data were gathered; open- and closed-ended questions were used, with a rating scale (from very good to poor) and "tick all that apply" styles used, with additional space for free text and comments. The questionnaires were delivered by mail, with a prestamped envelope for return.

Ethics

St Vincent's University Hospital Ethics Board granted ethics approval. An information and consent form was included with the postal questionnaire. Contact information for any further queries was included.

Statistical Analysis

We used descriptive statistics for analysis of variables (means and proportions) for each cohort. Analysis was carried out using SPSS (Version 20 SPSS, Chicago, Illinois). For qualitative information, free text feedback was categorized into groups.

QUICK LOOK

Current knowledge

Ambulatory oxygen is the recommended treatment for hypoxemia induced by exercise or at rest. When traveling by plane, commercial aircraft cabins are pressurized to altitudes of 6,000-8,000 feet with an equalization F_{IO_2} of 0.15. Oxygen supplementation, for those requiring long-term oxygen, is crucial.

What this paper contributes to our knowledge

Individuals requiring long-term oxygen therapy face many barriers to air travel, related to information availability, logistical pressures, and health concerns. Many subjects who required ambulatory oxygen were unaware that plane travel was an option for them; however, when traveling, the majority of subjects who did travel reported a positive experience.

Results

Response

Five hundred twelve patients were initially identified on the database, 235 once exclusion criteria were applied (Fig. 1). Of the 235 questionnaires sent, we received 50 responses (21% response rate); of those 50 subjects, 11 had flown with oxygen (22%), 20 had not (40%), 11 subjects died (22%), 4 sent blank replies (8%), and 4 were no longer using ambulatory oxygen (8%).

Demographics

The average age of the subjects who had flown with long-term oxygen was 70 y; in the group who had not, it was 68 y. The predominant diagnoses across the groups were COPD (9 subjects [82%] of those who had traveled, 9 subjects [45%] of those who had not) and interstitial lung disease (1 subject [9%] of those who had flown, 6 subjects [30%] of those who had not), and other diagnoses included chronic respiratory failure secondary to kyphoscoliosis, post-cardiac arrest, and lung cancer (Table 1).

Flight Experience, Quantitative Data

Of those who had flown with ambulatory oxygen, 6 (54%) found it complicated or very complicated to organize travel (Fig. 2A). To access the required information, 8 (73%) found it complicated or very complicated (Fig. 2B). The majority of the information was accessed from non-medical sources, 3 (27%) phoning the airline com-

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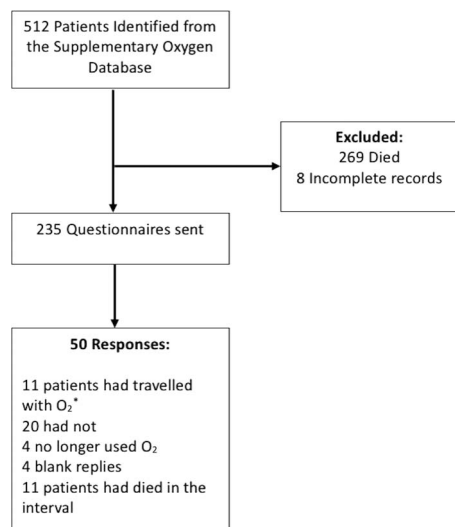


Fig. 1. Flow chart.

Table 1. Demographics of Respondents

Characteristics	Had Flown With Supplementary Oxygen (n = 11)	Had Not Flown (n = 20)
Age, average (range) y	70 (60–86)	68 (47–89)
Diagnosis, n (%)		
COPD	9 (82)	9 (45)
ILD	1 (9)	6 (30)
Other*	1 (9)	5 (25)
Time receiving LTOT, average y	2	1.5

* Chronic respiratory failure secondary to kyphoscoliosis, post-cardiac arrest, and lung cancer.
ILD = interstitial lung disease
LTOT = long-term oxygen therapy

pany and 3 (45%) accessing the airline website, with only 2 (18%) using their physician or hospital doctor. Eight subjects (72%) canvassed multiple airline providers, all using 2 or 3 different providers.

During the journey, the majority of subjects felt the airlines were very competent or somewhat competent at dealing with ambulatory oxygen (63%) compared with not at all (27%). Six subjects (54%) felt well supported by airport staff (Fig. 2C).

During the flight, 6 subjects felt unwell. Symptoms they described were shortness of breath at rest (3 subjects [50%]), shortness of breath on exertion (6 subjects [100%]), wheeze (4 subjects [66%]), and cough (2 subjects [33%]) (Fig. 3). Some subjects reported multiple symptoms, expressed in Figure 3.

Regarding the individuals who had never flown with ambulatory oxygen, the most common reason stated was that they were unaware oxygen was available on commercial airplanes (7 [20%]). Six subjects had no wish to travel

by plane (17%). This was closely followed by worries regarding health: “worried about my breathing problems” (4 subjects [20%]) and “worries about other health problems” (2 subjects [10%]). Many subjects reported more than one reason for not traveling by airplane; reasons expressed as percentage of total responses given displayed in Figure 2.

The vast majority of individuals who have flown would fly again (9 subjects [81%]). Those who would not fly again (2 subjects [18%]) felt that it was too much work to organize, and 2 subjects (18%) felt too unwell on the flight.

When asked how these barriers could be overcome, the most common need identified by those subjects who had not traveled by airplane (n = 20) was written information from a respiratory physician or nurse (10 subjects [50%]), followed by written information from the airline (6 subjects [30%]).

Of those subjects who had never flown with ambulatory oxygen (20 subjects), 7 subjects were unaware that ambulatory oxygen was available on commercial air travel or that airlines would provide supplementary oxygen, 6 had no wish to fly, 4 subjects were worried about their breathing on a plane, 2 had concerns about other medical conditions, 4 had limited mobility, and 1 found it too difficult to organize. No subject cited cost as a reason for not traveling on a plane. Three subjects chose multiple reasons for not traveling by plane (Fig. 4).

Qualitative Feedback

The majority of subjects had a positive travel experience, with statements such as “People in the airport could not be more helpful,” “Very enjoyable,” “I have no problem flying and wish I could do more of it,” and “I was well looked after from the staff. One telephone call it took me, and I was very happy” (Table 2).

Some subjects did encounter difficulties, such as “I flew to Glasgow and the oxygen cylinder did not work. I was at the point of being disembarked when the captain then decided to use the emergency oxygen. I managed to delay the flight taking off 15–20 min,” and “Had to use overhead oxygen on the flight as the batteries for portable oxygen ran out, cylinders not allowed.” Other subjects found it difficult to coordinate their ambulatory oxygen, stating, “It was very arduous having to bring my own portable oxygen and luggage; this should be free and on board every flight so that travelers needing oxygen can travel easier.” Finally, some subjects felt increased symptoms during the flight, leading to a negative experience: “Terrible, never again! I felt very ill” (Table 2).

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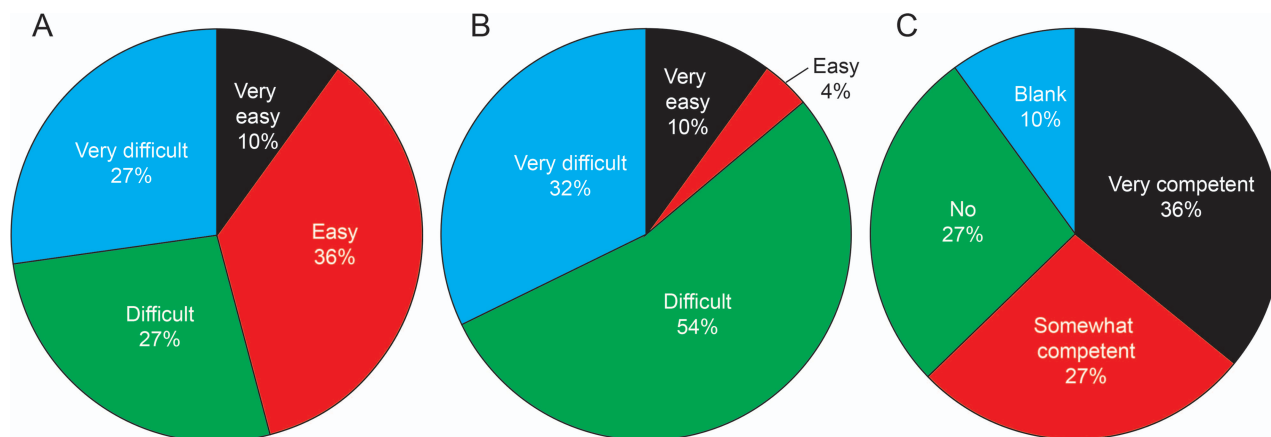


Fig. 2. Experiences of subjects who flew with supplemental oxygen. A: Was traveling with O₂ easy to organize? B: Was information regarding air travel with supplemental O₂ easy to find? C: Was the airline able to manage your supplemental O₂?

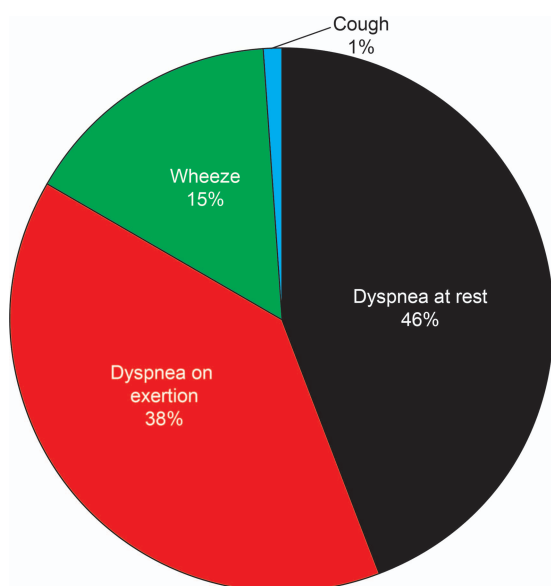


Fig. 3. Symptoms of subjects flying with supplemental oxygen who felt unwell during the flight.

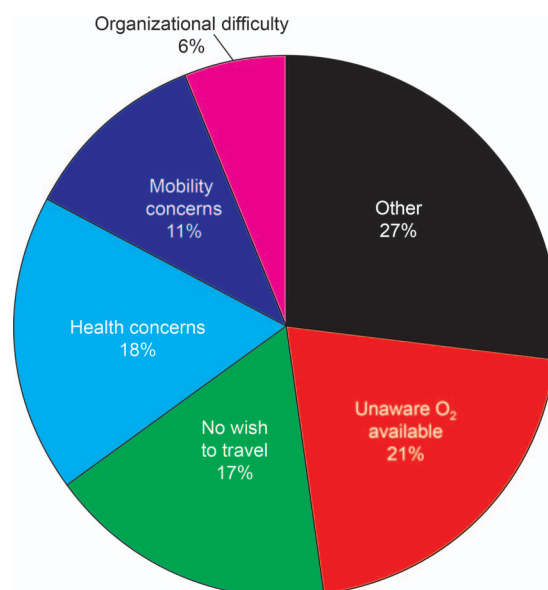


Fig. 4. Reasons given by subjects on supplemental oxygen who did not fly.

Discussion

Our investigation of patient experience flying with ambulatory oxygen shows that a minority of users of ambulatory oxygen travel by plane. Of the individuals surveyed, only 22% had traveled by air. This is clearly a low rate and could not be used as a reliable frequency of air travel rates by patients with severe pulmonary disease; however, it does indicate that some proportion of these patients do travel by plane and should be accommodated. Health concerns are the major barrier to travel, followed by limited mobility. The major difficulty faced by those who did fly with ambulatory oxygen was organizing oxygen provision during travel, followed by accessing information. The majority of information

accessed was from the airline company, predominantly online, with one individual organizing oxygen by telephone.

The population investigated in this study reflects the patient cohort that is prescribed long-term oxygen therapy and confirms that this population represents individuals with multiple comorbidities and a high mortality rate. Although we do not have specific data for this patient cohort, co-morbidities such as cardiac disease, hypertension, diabetes mellitus, osteoporosis, obstructive sleep apnea, metabolic syndrome, and psychological disorders are reported in COPD.^{7,8} Previous studies reflect the high morbidity and mortality in this cohort of subjects, with a median survival of <2 y after oxygen therapy is started.⁹ We know that most patients starting long-term oxygen therapy for therapeutic indications are elderly women with multiple comorbidities.¹⁰⁻¹⁴ Our response rate

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Table 2. Qualitative Feedback: Negative and Positive

Negative Feedback	Positive Feedback
I flew to Glasgow and the oxygen cylinder did not work. I was at the point of being disembarked when the captain then decided to use the emergency oxygen. I managed to delay the flight taking off 15–20 min.	People in the airport could not be more helpful. Every time I used to fly, in a week I would end up in hospital. I love flying; I nearly had to stop because I was so unwell after my trips. I looked at the problems and sorted it. It took awhile to find the right mask; now it is great. Happy days again.
It was very arduous having to bring my own portable oxygen and luggage; this should be free and on board every flight so that travelers needing oxygen can travel easier.	Very enjoyable.
Had to use overhead oxygen on the flight as the batteries for portable oxygen ran out, cylinders not allowed.	I have no problem flying and wish I could do more of it.
Terrible, never again! I felt very ill.	I was well looked after from the staff. One phone call it took me, and I was very happy.
Experience was very bad; staff were very unhelpful and made me feel like I was being an uncooperative passenger despite having paid extra for them to provide assistance.	Bit of work involved in getting access to relevant person in airline to organize paperwork; cannot download from website. They then e-mail the forms for printing and completing. Cabin crew very helpful, even moving a passenger so that my wife and I had the use of 3 seats, one for the machine.
Airport not very knowledgeable of customers that required oxygen. Didn't seem to be happy with me taking it on in the first place; seen it as a problem.	
The worst part was getting my consultant doctor to write the proper description of the oxygen the airline wanted me to take.	

for this study was 21%, which is low. Response rates to postal surveys have been falling since the 1970s.¹⁵ Similar questionnaire-based studies eliciting respiratory symptoms have shown low response rates: 33% in a Swedish study¹⁵ and 36% in a study of subjects with refractory breathlessness.¹⁶ The latter study would have a similar patient population in terms of disease severity. The high morbidity and mortality rate of this population is likely to have been a contributing factor in this response rate. Some subjects who had died were mailed questionnaires, and this was an understandable source of distress to families. Although the database is regularly updated, the high mortality rate meant that the questionnaire was mailed during the short interval before database update. It was for this reason that the planned repeat delivery of the questionnaire was cancelled.

In treating individuals in a holistic manor, travel may be of great importance to quality of life. For many individuals, their physician may be their first port of call and should be able to provide information. In our study, 50% of individuals surveyed expressed the need for information from respiratory physicians or respiratory nurse specialists, ranking higher than information from an airline (30%). There are many resources available at local and international levels to guide patients and their caring physicians with regard to traveling with oxygen.^{3,17,18} Interestingly, only 5% of subjects who had never flown with ambulatory oxygen felt that organization was a barrier to travel, showing that this may be a hidden barrier that only presents when organizing travel plans.

While traveling, it is encouraging to note that individuals did not feel that their ambulatory oxygen was a burden, and the majority of travelers (64%) felt that the airlines were able to manage their oxygen requirements and felt well supported by the staff. One recipient stated, “I

have no problems flying and only wish I could have more of it,” and another individual found it “very enjoyable.”

While on the flight, some subjects did feel unwell, 55%, as would be expected, given that this cohort are at the severe end of the spectrum of respiratory disease. Symptoms expressed included shortness of breath and wheeze. However, it is encouraging to note that despite the apparent predominance of respiratory symptoms, only a third of these subjects felt that they were too unwell to attempt another plane journey. The increased incidence of symptoms during flying is consistent with previous studies.^{19,20} Respiratory symptoms of dyspnea and air hunger during air travel were reported by 21% of subjects with COPD, compared with 4% of healthy subjects, but these were not subjects with oxygen supplementation.

Regarding the health concerns expressed by subjects who had never attempted to travel, 20% of subjects cited this as a reason to avoid travel, and 10% had concerns regarding other health problems. However, this did not appear to be a major concern of those who had traveled. Eighty-one percent of those who flew would fly again, and of those who would not, only 18% felt that their health would prevent them from flying again. Physicians and health-care providers can inform potential travelers regarding their options and reassure them that the majority of patients travel with minimal difficulties.

Concerning the subjects who had never flown with ambulatory oxygen, again information availability was the biggest barrier; 35% of recipients were unaware that ambulatory oxygen was available during plane travel. To our knowledge, this is the first study to establish this lack of patient knowledge in relation to their travel options. When assessing health-related quality of life, the World Health Organization Health-Related Quality of Life Scale examines difficulties with

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transport and access to transport.²¹ Patient education in COPD has been shown to improve patient outcomes,²² and this should be expanded to include travel options. This is reflected in the qualitative feedback, with one subject stating, “Many thanks for giving me something to look forward to!” Conversely, 30% of subjects had no wish to fly; reasons given were not having a passport or never having flown previously. Interestingly, no subject felt that cost was a barrier, although this has been previously stated in the literature,^{3,23} suggesting that the benefits of travel outweigh the costs involved.

Limitations for this study include the relatively small sample size, in a single center. The prospective design of the questionnaire, asking subjects about their experience, may lead to over- or underreporting of negative or positive experiences. Postal questionnaire surveys traditionally have a low return rate.²⁴ Second, in this patient population, other factors, independent of their oxygen dependence, will affect their ability to travel, including mobility,^{4,5} other medical co-morbidities,¹⁰⁻¹⁴ and a simple lack of interest in traveling. Further studies are required to ascertain the influence of these other barriers to travel.

Conclusions

This study has shown that, for subjects requiring supplementary oxygen therapy, travel by airplane was a generally positive experience. This is particularly relevant with an increasing patient population with chronic lung disease¹ combined with a growing traveling population²⁵ and increasing use of long-term oxygen therapy.² The main barriers to travel found were lack of patient education, lack of information available, and difficulty accessing information. Patient and health-care worker education is paramount to improve patient quality of life. More studies are required to further examine patient experience and barriers to travel and how to address these barriers to improve individual experience for our subjects.

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