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Lung transplantation in Turkey: lessons from surgeons and pulmonologists

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Background/aim: In order to actualize an efficient lung transplantation program, it is necessary to determine priorities and set up strategies. This study aimed to estimate the present situation in Turkey by determining the level of interest and knowledge of pulmonologists and thoracic surgeons regarding lung transplantation.

Materials and methods: A questionnaire was prepared to establish the level of interest and knowledge of physicians on lung transplantation. It was sent to 2131 pulmonologists and thoracic surgeons, and 130 physicians completed the questionnaire.

Results: Of the 130 physicians who responded, 42 were thoracic surgeons and 88 were pulmonologists. There was no significant difference between the two groups regarding the availability of lung transplantation at their hospitals. The rates of correct answers to the questions and responses supporting the transplant initiative were higher in the thoracic surgeon group than in the pulmonologist group.

Conclusion: The establishment of a successful system for lung transplantation in Turkey requires an increase in interest, knowledge, and dedication of physicians, coupled with adequate and continuous training. There also needs to be sufficient equipment and financing in addition to disciplined multidisciplinary teams and cooperation. This survey shows there is still much work to be done to achieve success in lung transplantation in Turkey.

Key words: Lung transplantation, physicians, questionnaire, knowledge

1. Introduction

Lung transplantation is a treatment option used for selected patients with end-stage respiratory insufficiency to prolong survival and improve quality of life (1). Since the very first clinical lung transplantation performed in 1963, over 40,000 heart–lung and lung transplantations have been performed worldwide (2,3). According to data from the International Society for Heart and Lung Transplantation (ISHLT), the main indications for adult lung transplantations are chronic obstructive pulmonary disease (COPD; 27% for bilateral and 43% for single lung transplantations), idiopathic pulmonary fibrosis (18% for bilateral and 35% for single lung transplantations), and cystic fibrosis (25% of all bilateral transplantations) (3).

Organ transplantation started in Turkey as early as 1969, the first procedure being a heart transplant. Successful kidney and liver transplants have increased since then, but lung transplants have not been prevalent because of various administrative and bureaucratic reasons. Their uncommonness is also due to a general lack of interest from physicians (4). Lung transplantation activity started at the end of the 1990s in Turkey, and the first successful lung transplant was performed at İstanbul Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital in 2009 (2,5). Currently, there are six certificated transplantation centers in Turkey, a young developing country with a population of 75 million people. Three of those centers actively perform lung transplantations. Of these centers, two are located in İstanbul, the most populated city in the country (2).

The outcome of successful lung transplantations in the country can only be studied from the few case reports that have been published so far (5–7). It has been reported that some lung transplant patients did not survive the procedure (2). According to the 2013 data from the Turkish Ministry of Health, the number of lung transplantations performed in Turkey was 7 in 2009, 3 in 2010, 5 in 2011, 25 in 2012, 32 in 2013, and 33 in 2014. Only two have been performed since 30 January 2015 (8; https://organ.saglik.gov.tr/organrapor). In addition to these procedures, two

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heart–lung transplantations were performed in 2012. The total number of solid organ transplants in Turkey exceeded 4000 in 2012 (8).

In order to actualize an efficient lung transplantation program, which would be a relatively new medical development in our country, it is necessary to determine priorities and develop appropriate strategies. To that end, a questionnaire study was planned to survey the situation by determining the level of interest and knowledge of pulmonologists and thoracic surgeons, the primary physicians referring candidate patients to lung transplantation centers.

2. Materials and methods

A questionnaire was prepared to establish the level of interest and knowledge of physicians about lung transplantation. It was approved by the institutional review board and was sent to all members of the Turkish Thoracic Society (3770 members in total at the time the study was conducted) in March 2014, 2131 physicians with expertise in pulmonology (435 residents, 1365 pulmonologists), 164 thoracic surgery specialists, and 167 residents.

The questionnaire consisted of 32 multiple-choice and open-ended questions related to personal knowledge, hospital information, and general and medical knowledge on lung transplantation, the details of which can be seen in Tables 1–7. Correct answers to some questions concerning lung transplant history and statistics were evaluated according to the ISHLT guidelines and transplant data of the Turkish Ministry of Health. Of the 2131 physicians, only 130 (6.1%) completed the questionnaire despite two follow-up messages sent 15 days after the initial invitation to participate.

Predictive analytics software for Windows (PASW), Version 18.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis of data. Descriptive statistics were presented as numbers and percentages for categorical variables and mean, standard deviation, median, and minimum and maximum values were used for numerical variables. When chi-square assumptions were met, a chi-square test was used for two and multiple-group comparisons of categorical variables; otherwise, Fisher's exact test was used. The Mann–Whitney U test was used for nonnormally distributed numerical variables. $P < 0.05$ was considered statistically significant.

able 1. Characteristics of the participant physicians according to their specialties.

Characteristics	Thoracic surgery N = 42 n (%)	Pulmonology N = 88 n (%)	P
Sex			
Female	3 (7.1)	52 (59.1)	<0.001*
Male	39 (92.9)	36 (40.9)	
Age			
20–30	2 (4.8)	14 (15.9)	0.225*
31–40	20 (47.6)	34 (38.6)	
41–50	11 (26.2)	27 (30.7)	
>50	9 (21.4)	13 (14.8)	
Duration of time as a physician in years			
1–5	2 (4.8)	11 (12.6)	0.492*
6–10	9 (21.4)	17 (19.5)	
11–15	11 (26.2)	17 (19.5)	
16–25	15 (35.7)	26 (29.9)	
>25	5 (11.9)	16 (18.4)	
Duration in the relevant specialty in years			
1–5	6 (14.3)	23 (26.7)	0.351*
6–10	15 (35.7)	21 (24.4)	
11–15	11 (26.2)	16 (18.6)	
16–25	8 (19.0)	20 (23.3)	
>25	2 (4.8)	6 (7.0)	

*Pearson's chi-square test.

3. Results

Of the 130 participants who completed the questionnaire, 42 (32.3%) were thoracic surgeons and 88 were pulmonologists. The characteristics of the participant physicians are presented in Table 1 according to their specialty. The number of female thoracic surgeons was remarkably low. Age and duration in the occupation were similar for the two groups of doctors.

When the characteristics of the hospitals that the physicians worked in were compared, the availability of cancer surgery, bronchoscopic or surgical volume reduction interventions for COPD patients, and solid organ transplantation practices were significantly higher in hospitals where thoracic surgeons worked than in those where pulmonologists did. There was no significant difference between the two groups in terms of the availability of lung transplantation where they worked (Table 2).

A significant difference was found between the two groups in terms of the answers related to the questions about lung transplantation (Table 3).

A significant difference was found between the two groups in terms of the answers to some questions about the sources of information concerning lung transplantation (Table 4).

There was also a significant difference between the two groups in terms of personal experiences and attitudes about lung transplantation (Table 5).

The participants were asked to rank, in order of priority, eight listed items relating to problems that should be solved about pulmonology and surgery in Turkey from a population perspective. The first priority problems ranked by the physicians in the two groups are presented in Table 6.

The specialty groups were compared in terms of the answers to the questions about lung transplantation in Turkey. The rate of correct answers to the questions was higher in the thoracic surgery group than in the pulmonology group. Correct answers were scored as one point and incorrect answers and unanswered questions were scored as zero points. Participants had total scores ranging from 0 to 6. Although the mean total scores of the thoracic surgery group were statistically significantly higher than those of the pulmonology group, the low mean scores obtained from both groups were intriguing (Table 7).

4. Discussion

Many centers around the world have made important progress on lung transplantation, especially in the last 30

Table 2. Characteristics of the hospitals that the physicians have been working in according to the specialties of the physicians.

Characteristics	Thoracic surgery N = 42 n (%)	Pulmonology N = 88 n (%)	P
Type of hospital			
State hospital	6 (14.3)	15 (17.4)	0.270**
University hospital	20 (47.6)	34 (39.5)	
Training and research hospital#	14 (33.3)	24 (27.9)	
Private university	2 (4.8)	4 (4.7)	
Private hospital	0 (0.0)	9 (10.5)	
Presence of an oncology clinic	32 (78.0)	61 (69.3)	0.303*
Available practices			
Cancer surgery	39 (92.9)	61 (70.1)	0.004*
Bronchoscopic or surgical lung volume Reduction interventions for COPD	29 (72.5)	38 (43.7)	0.003*
Solid organ transplantation	29 (72.5)	34 (40.0)	0.001*
Lung transplantation	10 (25.0)	11 (12.6)	0.082*

COPD: chronic obstructive pulmonary disease.
#Training and research hospitals in Turkey are state hospitals where residents and fellows are being trained; studies are conducted like in university hospitals, with a greater emphasis on health services.
*Pearson's chi-square test.
**Fisher's exact test.

Table 3. Opinions of the physicians about lung transplantation according to their specialties.

Opinions	Thoracic surgery N = 42 n (%)	Pulmonology N = 88 n (%)	P
Physicians who declared that they heard about performance of lung transplantation in Turkey	41 (100.0)	87 (98.9)	*
Physicians who declared that they know the number of certificated lung transplantation centers in Turkey by the end of 2013	28 (68.3)	32 (38.1)	0.002**
What is the number of lung transplantations performed in Turkey until 12 December 2013?			
1–15	3 (8.1)	32 (42.7)	0.001**
16–30	9 (24.3)	21 (28.0)	
31–50	10 (27.0)	9 (12.0)	
51–70	10 (27.0)	10 (13.3)	
>70	5 (13.5)	3 (4.0)	
Physicians who declared that they know the lung transplantation statistics in Turkey and worldwide	14 (35.0)	12 (14.1)	0.007**
What is the criterion that determines the success of lung transplantations in the world?			
Long survival	4 (10.5)	12 (16.9)	0.159**
Quality of life	7 (18.4)	5 (7.0)	
Long survival and quality of life	27 (71.1)	54 (76.1)	
Physicians who stated that there are specific conditions that should be considered for lung transplantation in Turkey	40 (97.6)	80 (94.1)	0.663***
What is the specific condition that should be considered?			
Psychosocial/patient noncompliance	26 (66.7)	51 (65.4)	0.890**
Referral of inadequate number of cases by pulmonologists	32 (82.1)	45 (57.7)	0.009**
Referral of cases with inappropriate indications by pulmonologists	18 (46.2)	38 (48.7)	0.794**
The difficulty of establishing a transplantation team in specialty hospitals	26 (66.7)	52 (66.7)	1.000**
Surgical competence	21 (53.8)	47 (60.3)	0.508**
Technical equipment of the center	29 (74.4)	55 (70.5)	0.663**
Easy access to the center	13 (33.3)	33 (42.3)	0.349**
Economic conditions	18 (46.2)	38 (48.7)	0.794**
Administrative conditions	21 (53.8)	36 (46.2)	0.433**
Others	1 (2.6)	7 (9.0)	0.266***
Do you know the indications of lung transplantation?			
Yes	29 (70.7)	45 (52.3)	0.049**
Partially	12 (29.3)	41 (47.7)	
Do you know the contraindications of lung transplantation?			
Yes	28 (70.0)	37 (43.0)	0.017***
No	1 (2.5)	5 (5.8)	
Partially	11 (27.5)	44 (51.2)	
What do you think about the timing of lung transplantation in Turkey			
An early attempt	1 (2.6)	0 (0.0)	*
A belated attempt	38 (97.4)	80 (100.0)	

*Analysis could not be performed due to inadequate number.
**Pearson's chi-square test.
***Fisher's exact test.

Table 4. Opinions of the physicians about the sources of information for lung transplantation according to their specialties.

Opinions	Thoracic surgery N = 42 n (%)	Pulmonology N = 88 n (%)	P
Have you participated in symposiums, courses, or congresses on lung transplantation?			
In Turkey	17 (65.4)	23 (39.7)	0.029*
Abroad	7 (43.8)	8 (20.0)	0.097**
Do you think that the information acquired in these meetings can contribute to practice?			
Yes	25 (65.8)	63 (85.1)	0.026**
No	8 (21.1)	4 (5.4)	
Partially	5 (13.2)	7 (9.5)	
What is the suitable way to obtain information about lung transplantation?			
Symposium, congress	8 (29.6)	33 (53.2)	0.040*
Informative brochures	4 (14.8)	17 (27.4)	0.198*
Books	5 (18.5)	11 (17.7)	1.000**
Online video conference	5 (18.5)	29 (46.8)	0.012*
Local meetings in the hospitals	8 (29.6)	28 (45.2)	0.170*
Training in transplantation centers in Turkey	10 (37.0)	23 (37.1)	0.996*
Training in transplantation centers abroad	16 (59.3)	13 (21.0)	<0.001*

*Pearson's chi-square test.
**Fisher's exact test.

Table 5. Personal experiences of the physicians on lung transplantation according to their specialties.

Experiences	Thoracic surgery N = 42 n (%)	Pulmonology N = 88 n (%)	P
Physicians who have had candidate patients for lung transplantation	29 (74.4)	76 (90.5)	0.019**
Physicians who have referred patients to transplantation centers	14 (35.0)	55 (64.7)	0.002**
The referred patient			
has undergone transplantation	8 (50)	18 (40)	*
was not found suitable for transplantation	2 (12.5)	8 (17.8)	
was not admitted to the related center	0 (0.0)	7 (15.6)	
was included on the transplantation list	1 (6.3)	0 (0.0)	
died while he/she was on the waiting list	0 (0.0)	1 (2.2)	
died while he/she was being evaluated for transplantation	0 (0.0)	1 (2.2)	
I have received no news from the patient	5 (31.3)	10 (22.2)	

*Analysis could not be performed due to inadequate number.
**Pearson's chi-square test.

years (9). Despite the improvement of surgical techniques and postoperative care, maturation of recipient selection criteria, development of donor location, and matching programs in a more systematic fashion, some specific issues and problems still need to be worked on (9–11). According to ISHLT data, adults who underwent lung transplantation between January 1994 and June 2011 had a median survival of 5.6 years, with unadjusted survival rates of 88% at 3 months, 79% at 1 year, 64% at 3 years, 53% at 5 years, and 31% at 10 years (12). In addition,

Table 6. Health problem of first priority in our country ranked by the physicians according to specialty groups.

Health problem	Thoracic surgery N = 42 n (%)	Pulmonology N = 88 n (%)
Smoking	18 (69.2)	41 (73.2)
Pulmonary tuberculosis	2 (10.0)	8 (14.5)
Lung cancer	4 (16.0)	4 (7.4)
Airway diseases	1 (3.8)	4 (7.0)
Pneumonia	0 (0.0)	5 (8.9)
Environmental/occupational diseases	1 (4.0)	3 (5.1)
Lung transplantation	1 (5.0)	0 (0.0)
Sleep-related diseases	0 (0.0)	0 (0.0)

lung transplantation provides clinically meaningful and statistically significant improvements in the quality of life of patients (13).

Successful results in lung transplantation have been increasing with each passing day, and research and development indicate that transplantation will be a safer treatment option for patients with end-stage respiratory failure in the coming years (14,15). The key factors affecting the success of lung transplantation centers are recipient selection, donor selection, surgical competence, short- and long-term medical follow-up, and research and development studies. Patients should be evaluated using a multidisciplinary approach, attendant medical personnel working in multiple related fields should be in close cooperation, and good teamwork should be established. If the recipient is not selected properly, the outcome may be poor despite high-quality donor organs and an uncomplicated surgery. It has been demonstrated that various risk factors related to the recipient are key to transplantation success (16). In the selection of patients for transplantation, disease-related mortality risk and transplantation-related mortality risk should be compared and should be considered in the decision-making process. Relative and absolute contraindications recommended in the ISHLT guidelines should be followed (17). If the physicians who refer cases to transplantation centers select suitable candidates and refer them in a timely manner, the transplantation centers can have a suitable case pool and optimal organ matching can be successful. Not having optimal organ matching is one of the main complaints of transplant surgeons in Turkey. Surgeons also feel that the mentality and conservative approach of pulmonologists should change and cases should not be delayed for referral. Otherwise, if the transplantation is performed only at the next available opportunity without optimal case-donor matching with the belief that the patient will die anyway if transplantation is not performed, the donor organ will be wasted and the prognosis of the recipient will not be good. Ultimately, trust in Turkish transplantation programs will be tarnished if recommended practices are not adhered to. On the other hand, pulmonologists, the primary doctors selecting and referring patients to lung transplant centers, want up-to-date information about the consequences of lung transplant surgery in Turkey and want to foresee the prognosis of their patients. Unfortunately, the perioperative mortality and long-term survival of these patients are not widely known in the pulmonology community in Turkey and success rates are mostly anecdotal.

There are several important ethical issues concerning lung transplantation such as the perspective of the community, priorities in resource allocation, regulations on organ donation, risks that recipients may be subjected to, and the conflict of interest of health professionals (18).

A major limitation of lung transplantation is a lack of donor organs. However, the numbers are expected to increase with the expansion of donor criteria and proliferation of new organ sources such as living donors, lobar transplantation, and reconditioning of lungs by ex vivo lung perfusion (19). Implementation of suitable donor-management protocols will also increase the number of transplantations (20). However, the economic conditions and cultural, geographic, and demographic characteristics of the country sometimes pose obstacles. For instance, Turkey's population is scattered over a very large area, hindering the establishment of dedicated health centers and specialization of physicians in a particular field. A similar situation is found in Australia, where pulmonologists are not always aware about lung transplantation as a treatment alternative (18). This has also been reported as an obstacle in Poland (21).

Postoperative patient care and long-term follow-up carry as much importance as the surgical procedure in the success of lung transplantation (22). A large multidisciplinary team, comprising many different

Table 7. The assessment of answers to the questions related to lung transplantation in Turkey.

	Thoracic surgery (N = 42)	Pulmonology (N = 88)	P
At what date and in which center was the first lung transplantation performed in Turkey?, n (%)			
Correct	16 (38.1)	12 (13.6)	0.004*
Incorrect	14 (33.3)	50 (56.8)	
Does not have an answer	12 (28.6)	26 (29.5)	
At what date and in which center was the first lung transplantation case with long-term survival operated in Turkey? Among adults, n (%)			
Correct	9 (21.4)	11 (12.5)	0.269**
Incorrect	1 (2.4)	6 (6.8)	
Does not have an answer	32 (76.2)	71 (80.7)	
At what date and in which center was the first lung transplantation case with long-term survival operated in Turkey? Among children, n (%)			
Correct	4 (9.5)	4 (4.5)	0.740**
Incorrect	1 (2.4)	2 (2.3)	
Does not have an answer	37 (88.1)	82 (93.2)	
How many certificated lung transplantation centers were there in Turkey by the end of 2013?, n (%)			
Correct	2 (4.8)	3 (3.4)	0.006**
Incorrect	26 (61.9)	29 (33.0)	
Does not have an answer	14 (33.3)	56 (63.6)	
How many lung transplantations have been performed in Turkey until 12 December 2013?, n (%)			
Correct	10 (23.8)	10 (11.4)	0.183*
Incorrect	27 (64.3)	65 (73.9)	
Does not have an ,	5 (11.9)	13 (14.8)	
Which criteria are used to determine the success of lung transplantation in the world?, n (%)			
Correct	27 (64.3)	54 (61.4)	0.901**
Incorrect	13 (31)	31 (35.2)	
Does not have an answer	2 (4.8)	3 (3.4)	
Total score, mean ± standard deviation (median)	1.62 ± 1.34 (1)	1.07 ± 1.01 (1)	0.016***

*Pearson's chi-square test.
**Fisher's exact test.
***Mann–Whitney U test.

professionals, must work and function together before, during, and after lung transplantation. According to the organ transplantation directives in Turkey, the physicians that should be included in the lung transplantation council established in hospitals performing transplantation are as follows: two surgeons in the transplantation team; two cardiologists (one being a pediatric cardiologist for pediatric patients) in the transplantation team; a clinical psychologist or a psychiatry specialist; an anesthesia and intensive care specialist; and a pulmonology specialist in the transplantation team (23). The other personnel, units, and equipment that should be available in the hospital are also specified in detail in the directive.

Our supposition at the beginning of this study was that the level of interest and knowledge of pulmonologists and thoracic surgeons in our country on lung transplantation was not sufficient. The results of the questionnaire seem to support this. The very low rate of response to the questionnaire (130/2131, 6.1%) is telling in and of itself and, in fact, this shows how low the interest is in lung

transplantation. Questions in the survey were prepared taking into consideration the possible underlying reasons for the lack of interest and knowledge about the subject. If the physician is working at an institution where the chance of seeing potential recipients is low, if he or she is a high-ranking doctor, or if the doctor is not involved in surgical interventions, then referrals for lung transplantation will be minimal. Furthermore, if lung cancer surgery or lung volume reduction surgery (the previous procedure for lung transplantation) are not performed in that center, this may indicate that the technical equipment, team competence of the center, and the physicians working there may not be ready to accommodate an innovation such as lung transplantation. It is expected that surgeons, the new generation of physicians, and doctors working in universities or training research hospitals are more open to the idea of lung transplantation. Of the physicians who completed the questionnaire, 86% of the thoracic surgeons and 70% of the pulmonologists were working in a university or a training and research hospital. These are state hospitals where residents and fellows are being trained and studies are being conducted with a greater emphasis on health services. Moreover, doctors between the ages of 30 and 50, those working in the occupation between 11 and 25 years, and those working in the relevant specialty area for less than 15 years constituted the majority of the respondents. Nevertheless, the reasons for the insufficient level of interest and knowledge even in these groups may be a decrease in participation in questionnaire studies, in Turkish Thoracic Society activities, and in the desire and ability to act in concert as a result of political or social changes and today's changing health system conditions. In Turkey, there are issues related to an increase of bureaucratic problems for physicians, long working hours, increasing patient load, and the computerization of the medical practice.

In general, the physicians who participated in the questionnaire were of the opinion that meetings and training on lung transplantation would be beneficial. Since 2009, the Turkish Thoracic Society has organized courses, conferences, and panels for lung transplantation at its Annual Congress. However, the 25–30 physicians who make up the leadership of this group have remained static and unchanged for several years. If lung transplantation is to flourish, new colleagues must be encouraged to participate.

Almost all of the physicians who completed the questionnaire stated that they were aware of the issues surrounding lung transplantation in Turkey. On the other hand, although the rate of those who stated that they knew the statistics was higher among surgeons, it was still low. In the majority of the hospitals where the participants work, there are oncology clinics and cancer surgery, bronchoscopic and surgical lung volume reduction interventions, and solid organ transplantation practices. Overall, 25% of the thoracic surgeons and 12.6% of the pulmonologists stated that lung transplantation is performed in the hospitals that they are working in. The rate of thoracic surgeons who reported the referral of an inadequate number of cases as a problem was higher than the rate of pulmonologists. The rate of thoracic surgeons who stated that they knew the indications and contraindications of lung transplantation was higher than that of the pulmonologists, and almost all of the participant physicians thought that the development of a successful lung transplantation program was overdue in our country.

The rate of correct answers to the questions related to the practices in Turkey was higher in the thoracic surgery group when compared to that of the pulmonology group. In the scoring based on correct answers, the total scores of the thoracic surgery group were significantly higher in comparison to that of the pulmonology group. However, the rate of correct answers about the practices in the country was generally disappointing in both groups. Of a possible six as a perfect score, thoracic surgeons averaged 1.62, although they thought they knew the local and international lung transplant statistics and were also aware of the indications and contraindications of the procedure. It is thought-provoking that the rate of correct answers about the number of licensed centers was lower than 5%.

The rate of physicians who stated that they had had candidate patients for lung transplantation and those who reported that they had referred patients to a center for transplantation were significantly higher among pulmonologists in comparison to thoracic surgeons. Smoking ranked in first place among problems related to pulmonology and surgery that should be solved in Turkey. Only one thoracic surgeon indicated lung transplantation as the primary problem.

Knowledge of lung transplantation remains low among physicians in Turkey. This is despite increasing activity, although information on outcomes is hard to determine. Turkey urgently needs to establish a more robust system for lung transplantations. In order for this system to be successful, adequate and continuous training, adequate equipment and financing, a focused multidisciplinary team, and interspecialty cooperation is mandatory. Also, the understanding and enthusiasm of pulmonologists must change. Through improved education and training, physicians should be made aware that lung transplantation is a treatment option for patients with end-stage lung diseases. In order to make this possible, teams in lung transplantation centers should share their short- and long-term survival rates at regional, national, and international meetings. They should also participate in the ISHLT Registry and center audits of complications. Death rates and causes of death should be shared and learned from to improve the quality of the national health service. Together, these initiatives will increase the trust and motivation of pulmonologists to refer patients to transplantation centers. In turn, this will transfer

more patients to the waiting lists for ideal matching to be performed. Financial and administrative support is also an essential component of a successful lung transplantation program, and further engagement with government and hospital administrators should be improved.

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