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Going the distance: Geographic effects of the lung transplant composite allocation score

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BACKGROUND: In March 2023, the lung allocation policy underwent major changes from a tiered structure to a composite allocation score (CAS). The goal was to improve allocation equity for disadvantaged groups by deprioritizing transplant distance. This study examines the effects of CAS on geographic trends and transportation efficiency.

METHODS: A retrospective cohort study was conducted using the United Network for Organ Sharing database, queried for adult lung transplants from September 1, 2022 to September 1, 2023. Outcomes were nautical distance of transplant, ischemic time, and flight required for transport (estimated as distance > 100 miles). Perioperative complications and early survival were analyzed, with propensity matching to account for baseline differences.

RESULTS: A total of 1,394 pre-CAS and 1,197 post-CAS patients were included in the study cohort. Post-CAS recipients were less likely to be ABO type O (39.2% vs 47.3%, $p < 0.001$) and were less likely to be an identical ABO match (82.7% vs 91.0%, $p < 0.001$). The CAS cohort traveled significantly further (354.0 miles [interquartile range (IQR): 139-657] vs 195.0 miles [IQR: 78-388], $p < 0.001$). CAS patients had longer ischemic times (6.8 hours [IQR: 5.3-8.9] vs 6.0 hours [IQR: 4.8-7.5], $p < 0.001$), and CAS procurements were more likely to require a flight for transport ($n = 934$, 78.0% vs $n = 991$, 71.1%, $p < 0.001$). However, waitlist time was shorter (28 days [IQR = 9-83] vs 33 days [IQR = 11-109]) as was the length of stay (24.21 ± 17.84 days vs 31.44 ± 30.19 days, $p < 0.001$) for CAS recipients, which remained true after propensity matching.

CONCLUSIONS: The lung CAS policy change was intended to eliminate geographic boundaries for disadvantaged patients but has expanded transplant distances, with an expected increase in ischemic time and need for flights which affect transplant economics. Although efforts were made to improve transplant availability for the disadvantaged ABO type O group, early assessment of the recipient cohort showed that recipients with blood group type O were actually less likely to be transplanted under the new policy. Positive effects include an overall decrease in waitlist time, but further investigation is warranted to evaluate the effectiveness, equity, and economic sustainability of the new policy.

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Background

Transplantation is the final treatment for end-organ failure, and the equitable allocation of organs is paramount in all solid organ transplants. In lung transplantation, the allocation policy underwent a major change in 2023, from the previous lung allocation score (LAS) to a composite allocation score (CAS) that, if successful, may serve as a prototype for other solid organ allocation policies in the future.

Under the previous LAS model, implemented in 2005, organs were prioritized based on LAS (reflecting lung disease severity and urgency), blood type matching, and distance from the donor hospital. The system used a hierarchical approach in which geography was a main driver: ABO-identical candidates were ordered by LAS score within a 250-mile radius from the donor hospital, followed by ABO-compatible matches, before expanding to a 500-mile radius.[1] Concerns arose that patients with certain biological factors (ABO blood type O,[2] shorter stature,[3] and allosensitization[4]) were less likely to be transplanted. As a result, in March 2023, a single CAS was created, using weighted attributes that accounted for the waitlist and post-transplant survival (25% each), candidate biology (15%), and patient access (25%). Geographic considerations and proximity efficiency are incorporated at the time of organ offer (only 5% each).[1]

Given the major changes to geographic priority, this study examines the effects of the CAS policy on travel efficiency and early perioperative outcomes. We focus on distance traveled, ischemic time, and likelihood of requiring a flight for transportation.

Methods

Study design

Our retrospective cohort study complies with the International Society for Heart and Lung Transplantation ethics statement and has been approved by the Institutional Review Board of the Massachusetts General Hospital (protocol 2017P001969, approved on September 28, 2017). To establish our cohort, we retrieved all adult lung transplant recipients from September 1, 2022 to September 9, 2023, excluding multiorgan transplants, prior lung transplants, and those lost to follow-up within the United Network for Organ Sharing database. Comparing lung transplants before and after the CAS policy implementation, our primary outcome was transportation distance, measured by patients' median distance to treatment center. A binary "flight for transport" variable was created when the distance traveled exceeded 100 miles. Secondary outcomes included early transplant outcomes, such as patient survival time, cold ischemic time, waitlist time, and patient length of stay.

Statistical analysis

Statistical analysis was done using R software (R Core Team).[5] Greater than 10% missingness in a given variable in the dataset resulted in exclusion from calculations, with percent missingness reported in each table. The Anderson-Darling test was used for normality testing, with a $p < 0.05$ indicating a non-normal distribution. Two-way *t*-tests were used to compare normal continuous variables, Mann Whitney U tests for non-normal continuous variables, and Fisher exact tests for categorical variables. For all analyses, an alpha of 0.05 was used for significance. The nearest-neighbor method was used for propensity matching using a 1:1 ratio, a well-documented methodology in prior cardiovascular research.[6] Successful matching was indicated by an standard mean deviation (SMD) <0.150 for all matched variables (Supplementary Table 1).

Results

Recipient characteristics

Our total study cohort included 1,159 lung transplants before the CAS policy change, compared to 1,358 lung transplants after the policy change within the study period. Post-CAS recipients were younger (62 vs 63 years old, $p < 0.001$) with fewer patients with a history of severe COVID (2.1% vs 3.9%, $p = 0.012$) and fewer single lung transplants (15.4% vs 19.5%, $p = 0.009$). After the CAS policy change, the percentage of recipients with ABO type O decreased (39.2% vs 47.3%, $p < 0.001$) and ABO type A became the new majority (42.5% vs 38.4%, Table 1). Among transplanted pairs, there were fewer post-CAS recipients with an identical ABO match with their donor (82.7% vs 91.0%, $p < 0.001$). Otherwise, there were no significant differences in recipient ethnicity ($p = 0.527$) or the etiology of their lung disease ($p = 0.200$). Post-CAS patients were more likely to be hospitalized at the time of transplant (31.4% vs 26.1%, $p = 0.004$) but otherwise had no significant differences between their functional status ($p = 0.093$), forced expiratory volume in 1 second (FEV1)/forced vital capacity (FVC) ($p = 0.286$), need for prostacyclin ($p = 0.689$), inhaled nitrous oxide ($p = 0.717$), ventilation ($p = 0.902$), or mechanical support at transplant ($p = 0.709$). Additional characteristics of the cohorts are summarized in Table 1.

Donor and transplant characteristics

Post-CAS donors were more likely male (62.2% vs 58.1%, $p = 0.04$) with donation after circulatory death (12.1% vs 8.5%, $p = 0.003$). There were no significant differences in donor ethnicity ($p = 0.664$) or donor comorbidities, such as diabetes ($p = 0.232$), CDC, Centers for Disease Control and Prevention high-risk status ($p = 0.699$), body mass index (BMI) ($p = 0.628$), or history of alcohol ($p = 0.575$) or cocaine ($p = 0.505$). Extended lung criteria did not differ significantly between pre- and post-CAS cohorts (age >55 years ($p = 0.112$), history of smoking ($p = 0.107$), purulence on bronchoscopy ($p = 0.560$), evidence of infiltrates on chest X-ray ($p = 0.138$), and PaO_2/FiO_2 (P/F) ratio <300 ($p = 0.248$)). There were no significant differences in gender mismatch ($p = 0.077$), BMI mismatch ($p = 0.208$), or human leukocyte antigen mismatch ($p = 0.228$).

Table 1 Baseline Demographics

Characteristics	Pre-CAS	Post-CAS	*p*	Missing
n	1,358	1,159		
Age (recipient) (median [IQR])	63.0 [56.0, 68.0]	62.0 [55.0, 66.0]	< 0.001	0.0
Male (recipient) (%)	815 (60.0)	663 (57.2)	0.166	0.0
Ethnicity (recipient) (%)			0.527	0.0
White	986 (72.6)	848 (73.2)		
Black	113 (8.3)	103 (8.9)		
Hispanic	202 (14.9)	149 (12.9)		
Asian	45 (3.3)	46 (4.0)		
Other	12 (0.9)	13 (1.1)		
Blood type (recipient) (%)			< 0.001	0.0
A	522 (38.4)	493 (42.5)		
AB	49 (3.6)	59 (5.1)		
B	145 (10.7)	153 (13.2)		
O	642 (47.3)	454 (39.2)		
Height (recipient) (median [IQR])	1.7 [1.6, 1.8]	1.7 [1.6, 1.8]	0.576	0.0
BMI (recipient) (median [IQR])	26.3 [23.1, 29.5]	26.5 [22.9, 29.9]	0.328	0.0
Lung disease (recipient) (%)			0.268	0.0
CF/bronchiectasis	44 (3.2)	47 (4.1)		
Obstructive	246 (18.1)	229 (19.8)		
Other	285 (21.0)	264 (22.8)		
Pulmonary hypertension	57 (4.2)	49 (4.2)		
Restrictive	726 (53.5)	570 (49.2)		
Severe COVID (%)	53 (3.9)	24 (2.1)	0.012	0.3
Functional status at transplant (recipient) (%)			0.093	2.6
10%-30%	279 (21.1)	286 (25.4)		
40%-60%	768 (58.0)	613 (54.3)		
70%-90%	276 (20.8)	228 (20.2)		
100%	1 (0.1)	1 (0.1)		
Hospitalized at transplant (recipient) (%)	353 (26.1)	363 (31.4)	0.004	0.4
ICU at transplant (recipient) (%)	201 (14.9)	206 (17.8)	0.054	0.4
FEV1/FVC at transplant (recipient) (median [IQR])	1.0 [0.8, 1.1]	1.0 [0.6, 1.1]	0.286	6.7
Ventilator-dependent at transplant (recipient) (%)	55 (4.1)	49 (4.2)	0.902	0.0
Prostacyclin at transplant (recipient) (%)	20 (1.5)	14 (1.2)	0.689	0.0
Inhaled NO at transplant (recipient) (%)	21 (1.5)	21 (1.8)	0.717	0.0
Mechanical support at transplant (recipient) (%)			0.709	1.7
ECMO VA	12 (0.9)	8 (0.7)		
ECMO VV	41 (3.1)	33 (2.9)		
Invasive mechanical ventilation	7 (0.5)	3 (0.3)		
None	1,278 (95.5)	1,093 (96.1)		
Diabetes (recipient) (%)	245 (18.0)	216 (18.8)	0.678	0.3
Steroids (recipient) (%)	423 (31.5)	394 (34.3)	0.143	1.0
History of smoking (recipient) (%)	771 (56.8)	647 (55.8)	0.661	0.0
Transfused before transplant (recipient) (%)	192 (14.3)	149 (12.9)	0.359	0.6
Creatinine at transplant (recipient) (median [IQR])	0.8 [0.7, 0.9]	0.8 [0.7, 0.9]	0.322	0.4
Age > 55 (donor) (%)	154 (11.3)	108 (9.3)	0.112	0.0
Male (donor) (%)	789 (58.1)	721 (62.2)	0.040	0.0
Ethnicity (donor) (%)			0.664	0.0
White	794 (58.5)	709 (61.2)		
Black	235 (17.3)	185 (16.0)		
Hispanic	262 (19.3)	214 (18.5)		
Asian	53 (3.9)	38 (3.3)		
Other	14 (1.0)	13 (1.1)		
BMI (donor) (median [IQR])	25.9 [22.8, 30.0]	26.2 [23.1, 30.1]	0.628	0.2
History of smoking > 20 pk-year (donor) (%)	112 (8.5)	118 (10.5)	0.107	3.5
History of cocaine use (donor) (%)	308 (23.4)	240 (22.1)	0.505	4.5
History of heavy alcohol (donor) (%)	287 (21.9)	255 (22.9)	0.575	3.7
CDC high-risk donor (%)	246 (18.1)	199 (17.4)	0.699	0.7
Diabetes (donor) (%)	125 (9.4)	91 (8.0)	0.232	1.8
Purulence on bronchoscopy (donor) (%)	190 (14.3)	171 (15.2)	0.560	2.6

(*continued on next page*)

Table 1 (*Continued*)

Characteristics	Pre-CAS	Post-CAS	*p*	Missing
Chest X-ray (donor) (%)			0.138	0.4
Infiltrates	882 (65.0)	783 (68.1)		
No infiltrates	465 (34.3)	363 (31.6)		
Unknown	10 (0.7)	4 (0.3)		
P/F ratio < 300 (donor) (%)	183 (13.5)	173 (15.2)	0.248	0.8
Single lung transplant (%)	265 (19.5)	179 (15.4)	0.009	0.0
DCD donation (%)	115 (8.5)	140 (12.1)	0.003	0.0
Gender mismatch (F- > M) (%)	218 (16.1)	156 (13.5)	0.077	0.0
BMI mismatch > 20% (%)	629 (46.5)	508 (43.9)	0.208	0.2
ABO match—identical (%)	1,236 (91.0)	959 (82.7)	< 0.001	0.0
HLA mismatch (# alleles) (mean (SD))	4.7 (1.1)	4.6 (1.0)	0.228	8.5
Thymoglobulin induction (%)	53 (3.9)	36 (3.1)	0.330	0.0
Basiliximab induction (%)	1,134 (83.6)	925 (79.8)	0.017	0.0
Transplant year (%)	482 (35.5)	1,159 (100.0)	< 0.001	0.0
Total waitlist days (median [IQR])	33.0 [11.0, 109.0]	28.0 [9.0, 82.5]	0.002	0.0
Region (%)			0.005	0.0
1	27 (2.0)	40 (3.5)		
2	155 (11.4)	137 (11.8)		
3	157 (11.6)	100 (8.6)		
4	129 (9.5)	80 (6.9)		
5	251 (18.5)	215 (18.6)		
6	26 (1.9)	22 (1.9)		
7	129 (9.5)	139 (12.0)		
8	85 (6.3)	56 (4.8)		
9	102 (7.5)	79 (6.8)		
10	165 (12.2)	153 (13.2)		
11	132 (9.7)	138 (11.9)		
Overall center volume (%)			0.503	0.0
High	68 (5.0)	54 (4.7)		
Moderate	689 (50.7)	615 (53.1)		
Low	601 (44.3)	490 (42.3)		
Distance (miles) (median [IQR])	195.0 [78.0, 389.0]	352.0 [131.5, 651.5]	< 0.001	0.0
Flight for transport (%)	965 (71.1)	899 (77.6)	< 0.001	0.0
Ischemic time (hours) (median [IQR])	6.0 [4.8, 7.5]	6.7 [5.3, 8.8]	< 0.001	1.0

Abbreviations: BMI, body mass index; CAS, composite allocation score; CDC, Centers for Disease Control and Prevention; CF, cystic fibrosis; DCD, donation after circulatory death; ECMO VA, venoarterial extracorporeal membrane oxygenation; ECMO VV, venovenous extracorporeal membrane oxygenation; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; HLA, human leukocyte antigen; ICU, intensive care unit; IQR, interquartile range; NO, nitrous oxide; P/F, PaO_2/FiO_2 ratio; SD, standard deviation.

Geographic effects

In our study cohort, post-CAS transplants traveled significantly further (352 miles [interquartile range (IQR): 132-652] vs 195 miles [IQR: 78-389], $p < 0.001$) (Figures 1 and 2). These travel differences were especially pronounced among intensive care unit (ICU) patients (472 miles vs 187 miles) but also persisted in non-ICU cohorts (334 miles vs 195 miles). With this longer travel time, post-CAS patients had longer ischemic times (6.7 hours [IQR: 5.3-8.8] vs 6.0 hours [IQR: 4.8-7.5], $p < 0.001$), and post-CAS procurements were more likely to require a flight for transport ($n = 899$, 77.6% vs $n = 965$, 71.1%, $p < 0.001$) (Figure 2). There were also significant regional differences, with regions 3 and 4 experiencing the largest percent decreases in case volume following the CAS allocation change (region 3: 11.4% → 8.7%, $p = 0.005$, Region 4: 9.6% → 6.9%, $p = 0.005$) and region 7 seeing the largest percent increase in case volume (region 7: 9.5% → 12.0%, $p = 0.005$) (Figure 3).

Early outcomes

Unmatched post-CAS patients spent significantly less time on the waitlist (28 days [IQR = 9-83] vs 33 days [IQR = 11-109], $p = 0.002$) and less time in hospital (24.14 ± 17.02 days vs 30.58 ± 30.66 days, $p < 0.001$). Among unmatched pre- and post-CAS cohorts, there were no significant differences in airway dehiscence ($p = 0.251$), need for reintubation ($p = 0.860$), acute rejection ($p = 0.835$) or treatment for acute rejection ($p = 0.462$) before discharge, or differences in ECMO at 72 hours postoperatively ($p = 0.883$). Following propensity matching, the significant difference in length of stay persisted (24.21 ± 17.84 days vs 31.44 ± 30.19 days, $p < 0.001$), but all other outcome differences remained nonsignificant (Table 2). Finally, between pre- and post-CAS cohorts, with the caveat of limited follow-up, there was no significant difference in overall survival for both unmatched ($p = 0.53$) and propensity-matched ($p = 0.93$) cohorts (Figure 4).

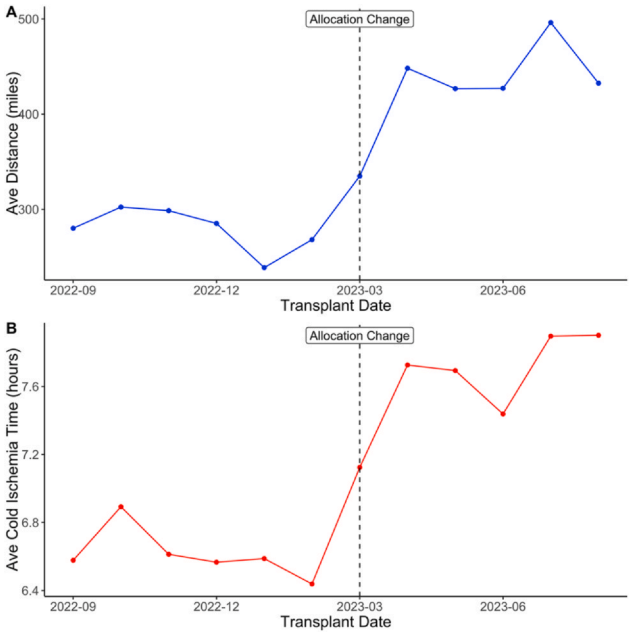

Figure 1 Change in average distance traveled and cold ischemia time pre- and post-CAS. Over the study period, following the CAS allocation change (dashed vertical line), we see an immediate and sustained increase in the average distance traveled of the lung transplant (miles) (blue line) and average cold ischemia time of the lung transplant (hours) (red line).

Discussion

The lung transplant CAS serves as the first implementation of a continuous distribution policy for solid organ transplants and the first major change in lung allocation in 2 decades. The previous LAS policy had been successful in decreasing waitlist mortality compared to the historical first-come, first-served model but was limited by hard boundaries in a hierarchical model. These geographic boundaries led to a lawsuit against the lung allocation system in 2017, prompting an Organ Procurement and Transplantation Network decision that organ allocation be as geographically broad as possible. This consideration became a major driver in the new CAS policy. Our study examines the effects of this change on recipient characteristics, transportation distance and efficiency, and early outcomes.

Effect on recipients

Under the previous LAS policy, concerns arose that patients with certain biologic characteristics were disadvantaged, specifically those with ABO blood type O, short stature, and higher calculated panel reactive antibody (cPRA).[2-4] As a result, these factors were included under Candidate Biology, accounting for 15 points (out of 100) under the new CAS system. Urgency was prioritized with waitlist survival accounting for 25 points.[1] Our results demonstrate an increase in hospitalized candidates receiving transplants, but otherwise no significant difference in recipient disease severity or acuity at the time of transplant (functional status at transplant, ICU status, need for ventilation or ECMO) under the new CAS system. Similarly, we found no difference in median recipient height ($p = 0.576$); cPRA was unable to be evaluated due to large amounts of missing data. Importantly, under the new CAS system, blood type O recipients were actually less likely to be transplanted (39.2%) than under the previous LAS policy (47.3%)—the opposite effect from what was intended. The percentage of ABO-identical matches decreased (91.0%-82.7%) as well. These findings were recently corroborated by a separate Organ Procurement and Transplantation Network study, which showed that type O donor lungs were being allocated to types A, B, or AB recipients, further disadvantaging type O recipients.[7] These results suggest that the new CAS policy may not be effective in addressing the previously noted disadvantages, and additional modifications are necessary. One such policy change was implemented in September 2023, giving additional allocation points to ABO type O candidates[7]; however, longer follow-up is needed to assess whether this change is sufficient.

Effect on distance and economics

After the CAS policy change, transport distances almost doubled, with a median of 352 miles compared to 195 miles, leading to longer out-of-body times (6.7 hours vs 6.0 hours). With the advent of novel transportation and preservation devices, this extension in potential ischemic time may not be as much of a consideration in the modern era,[8-10] but historically with conventional preservation, ischemic time was a major concern, particularly among low-volume centers, and 6 hours was considered the upper limit.[11-14] While the effect of ischemic time on lung transplant outcomes is controversial today, several modern studies continue to warn against prolonged ischemic time, noting increased rates of graft dysfunction, complications, and survival.[15,16] Until the effect of prolonged ischemic time can be definitively established, and because the CAS policy affects all transplant centers, including low-volume centers and those without access to novel preservation devices, the extension in ischemic time and distance must be regarded with caution.

As transplant distance increases, the need for flights and subsequent costs also increases. Our results demonstrate 77.6% of lung transplants require flights (estimated by nautical distance > 100 miles) under the new CAS policy, compared to 71.1% previously. In the past, when geographic boundaries were expanded (under the 2017 policy change from donor service areas to nautical distance), organ costs doubled ($34,000-$70,203) with greater resource utilization and transportation costs for further organs.[17] Another study echoed this conclusion, demonstrating double the travel cost and increased total procurement cost with increased travel distance.[18] As the geographic distances have increased again under the 2023 policy, we expect these costs to continue to rise, not to mention the cost of negative fly-outs (a procurement team flying to a donor hospital but declining the organ) which is not

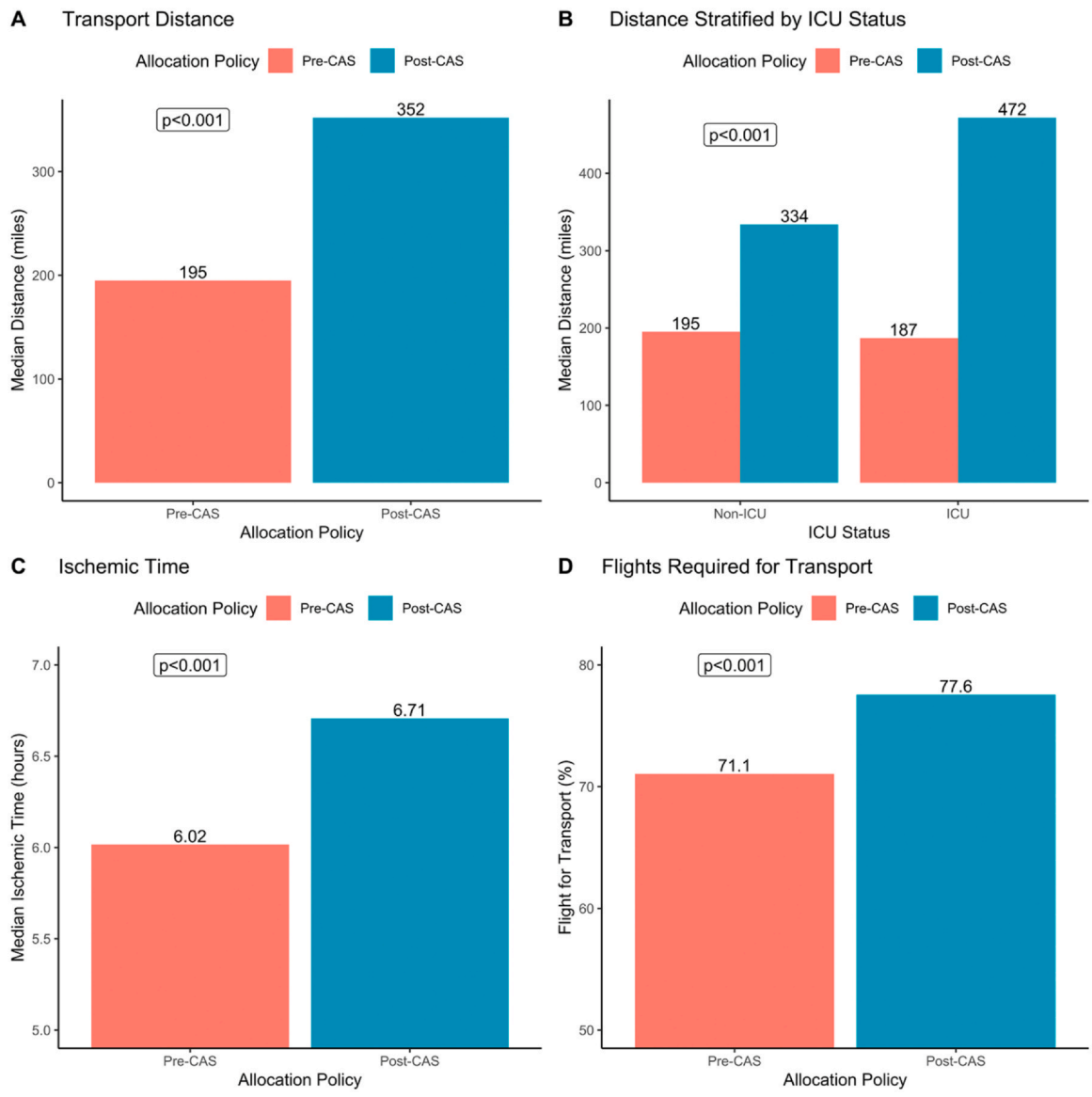

Figure 2 Geographic effects of CAS. Post-CAS allocation change, (A) lung transplants traveled further, (B) especially for ICU patients, (c) had higher median cold ischemic times, and (d) more often required a flight for transport. *t*-test comparisons were made between the pre (red bars) and post (blue bars) CAS cohorts and *p* values were reported above each graph. CAS, composite allocation score; ICU, intensive care unit.

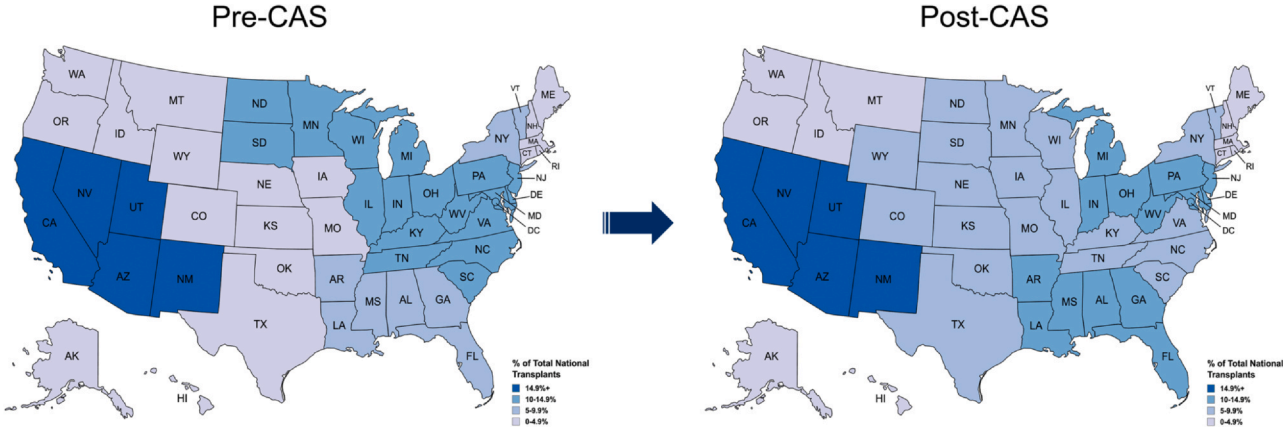

Figure 3 Regional caseload distribution by percentage of total transplants. Regional distribution of caseload shifted following the CAS allocation change, with region 3 (FL, GA, AL, MS, AR, and LA) and region 4 (OK and TX) seeing the largest percentage decreases in case volume, and region 7 (IL, WI, MN, ND, and SD) seeing the largest percentage increase in case volume. CAS, composite allocation score.

Table 2 Outcomes

Outcomes	Pre-CAS	Post-CAS	*p*	Pre-CAS	Post-CAS	*p*
n	1,358	1,159		758	758	
Airway dehiscence before discharge (%)	29 (2.2)	17 (1.5)	0.295	15 (2.0)	12 (1.6)	0.719
Reintubated before discharge (%)	273 (20.6)	228 (20.4)	0.971	153 (20.5)	152 (20.6)	0.987
ECMO at 72 hours (%)	140 (10.4)	110 (9.7)	0.612	81 (10.7)	83 (11.1)	0.877
Acute rejection before discharge (%)	71 (5.3)	63 (5.5)	0.822	41 (5.4)	45 (6.0)	0.701
Treated for acute rejection before discharge (%)	58 (4.3)	57 (5.0)	0.449	33 (4.4)	40 (5.3)	0.443
Length of stay (days) (mean (SD))	30.37 (29.61)	24.23 (17.13)	< 0.001	31.15 (30.85)	24.66 (18.07)	< 0.001
30-day graft failure (%)	29 (2.1)	19 (1.6)	0.447	16 (2.1)	12 (1.6)	0.567
30-day mortality (%)	28 (2.1)	16 (1.4)	0.251	15 (2.0)	9 (1.2)	0.304

Abbreviations: CAS, composite allocation score.

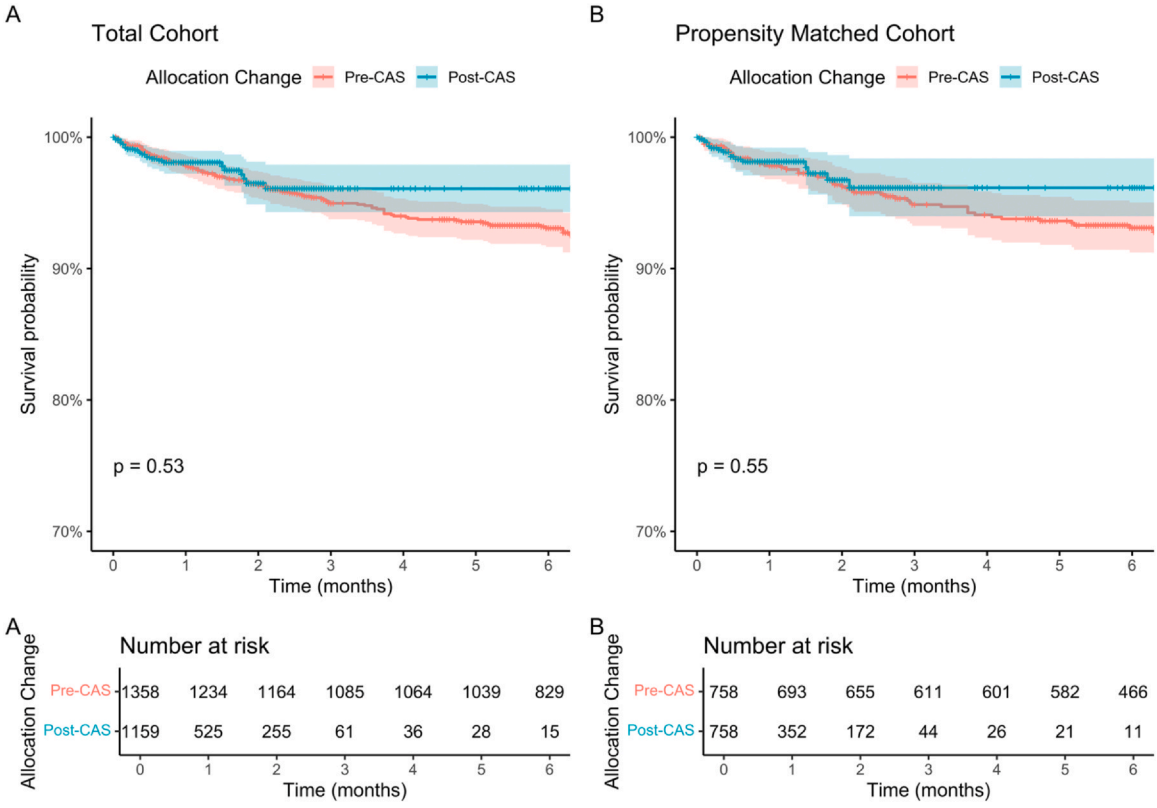

Figure 4 Kaplan-Meier survival. There were no significant differences within the (A) unmatched, total cohort and (B) propensity-matched cohort. The 95% confidence intervals are displayed. CAS, composite allocation score.

accounted for. This projected increase in transport costs may be somewhat offset by reduced costs in post-transplant hospital stay, as the average length of stay significantly decreased in the post-CAS era (median 31-24 days). Furthermore, transplanting sicker patients (candidates who are frequently hospitalized or remain in-hospital for heart failure exacerbations) may reduce overall hospital visits and admissions in the heart failure population and decrease health care costs. We are unfortunately limited by data available in the United Network for Organ Sharing database to be able to quantify and assess these hypotheses, and emphasize that further investigation is needed. Ultimately, cost-effectiveness is secondary to waitlist survival and transplant outcomes, until that data are available, we must remain cognizant of the economics to ensure sustainability of the proposed policy.

Effect on early outcomes

Overall, the CAS policy change led to a decrease in total waitlist time for recipients, from a median of 33 to 28 days ($p = 0.017$). We found no significant differences in perioperative complications (airway dehiscence, ECMO at 72 hours, acute rejection before discharge) or early survival, although with only 3 to 6 months of follow-up, this conclusion remains premature. After the CAS policy, the average hospital length of stay decreased (median 31-24 days), but this may reflect temporal changes in center practices or unrelated improvements to postoperative care. Ultimately, longer follow-up is required to understand the effects of the CAS policy on post-transplant survival, as well as studies focused on waitlist mortality.

Limitations

This is a retrospective study with a potential for selection bias. By comparing pre- and post-CAS policy, there is an inherent temporal difference in the 2 cohorts, with the risk of additional confounders that were not accounted for, such as changes in center policy or practices, advances in perioperative care, or other factors that have changed over time, unrelated to the CAS policy. This early study includes only 6 months of patients post-CAS, which limits our ability to assess postdischarge outcomes and survival beyond a few months. We focus here on lung transplant recipients, which presents an important, albeit incomplete, picture of the effect of CAS, as the scope of the study did not include effects on waitlist candidates and waitlist mortality. Thus, we narrowed the focus of the study to concentrate on geographic outcomes of the CAS policy, and the make-up of the recipient cohort to assess the intended changes to the allocation policy. The important question of post-transplant and waitlist survival requires longer follow-up which is yet unavailable.

Conclusion

The lung transplant CAS represents the first solid organ allocation policy to move toward a continuous distribution model. The primary goals for the CAS policy change were to address inequities for certain recipient groups that were thought to be propagated by geographic restrictions. Our study demonstrates a significant increase in median transport distance as a result of the CAS policy change, with expected consequences such as increased ischemic time and need for transport flights. Early assessment of the recipient cohort showed that the CAS policy may not have had its intended effect on addressing recipient inequity, as the factors in concern (height, cPRA) did not change significantly, and recipients with blood group type O were actually less likely to be transplanted under the new policy. Positive effects include an overall decrease in waitlist time, but further investigation is warranted to evaluate the effectiveness, equity, and economic sustainability of the new policy.

Author Contributions

The first author, Selena Li, and senior author Asishana Osho contributed to the study design. Data analysis was performed by Selena Li and reviewed for statistical rigor by Asishana Osho with a formal statistical review by Ruby Singh, biostatistician. The manuscript was written by Selena Li with contributions from authors (Alisa Pugacheva, Asishana Osho, Alireza S. Rabi, Eriberto Michel, and Antonia Kreso) and a final review from senior authors (Nathaniel Langer and Asishana Osho).

Disclosure statement

There are no disclosures.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jhlto.2024.100128.

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