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# An Analysis of Free-Text Refusals as an Indicator of Readiness to Accept Organ Offers in Liver Transplantation

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Racial/ethnic minorities experience higher rates of wait-list mortality and longer waiting times on the liver transplant wait list. We hypothesized that racial/ethnic minorities may encounter greater logistical barriers to maintaining “readiness” on the wait list, as reflected in offer nonacceptance. We identified all candidates who received an organ offer between 2009 and 2018 and investigated candidates who did not accept an organ offer using a free-text refusal reason associated with refusal code 801. We isolated patients who did not accept an organ offer due to “candidate-related logistical reasons” and evaluated their characteristics. We isolated 94,006 “no 801” patients and 677 “with 801 logistical” patients. Common reasons for offer decline among the 677 were 60% “unable to travel/distance,” 22% “cannot be contacted,” 13% “not ready/unspecified,” and 5% “financial/insurance.” Compared to “no 801,” “with 801 logistical” patients were more likely to be Hispanic (19% vs. 15%,  $P < 0.01$ ). Multivariate logistic modeling showed Hispanic (odds ratio [OR] 1.44, 95% confidence interval [CI] 1.17–1.76,  $P < 0.01$ ) and multiracial/other ethnicity (OR 1.82, 95% CI 1.08–3.05,  $P = 0.02$ ) were associated with “with 801 logistical” status. The “with 801 logistical” patients were listed with higher allocation (inclusive of exception points) Model for End-Stage Liver Disease scores (16 vs. 15,  $P < 0.01$ ) and remained longer on the wait list (median 428 days vs. 187 days,  $P < 0.01$ ). *Conclusion:* In this analysis of wait-list candidates, we isolated 677 patients who declined an organ offer with a free-text reason consistent with a “candidate-related logistical reason.” Compared with non-Hispanic Whites, Hispanics were at 1.44 odds of not accepting organ offers due to logistical reasons. These limited findings motivate further research into interventions that would improve candidates’ “readiness” to accept organ offers and may benefit racial/ethnic minorities on the liver-transplantation wait list. (*Hepatology Communications* 2022;6:1227–1235).

Liver transplantation is the ultimate life-saving treatment for patients with end-stage liver disease, but transplantation is a complex process with multiple steps, including referral, evaluation, wait-listing, and finally the surgery itself.<sup>(1,2)</sup> Substantial racial/ethnic disparities have been documented at every step of the transplantation process.<sup>(1-5)</sup> The introduction of the Model for End-Stage

Liver Disease (MELD) score as an objective metric to prioritize transplant wait-list candidates by severity of illness in 2002 was considered one of the most important policy interventions to affect racial/ethnic disparities. Initial studies in the late 2000s after the introduction of the MELD indicated that minorities no longer had differential wait-list mortality rates compared with non-Hispanic Whites.<sup>(6)</sup>

*Abbreviations:* aOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; HCC, hepatocellular carcinoma; IQR, interquartile range; MELD, Model for End-Stage Liver Disease; OPTN, Organ Procurement and Transplantation Network; OR, odds ratio; PTR, Potential Transplant Recipient; STAR, Standard Transplant Analysis and Research; UNOS, United Network for Organ Sharing.

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More recent analyses, however, have shown that racial/ethnic disparities on the wait list persisted despite initial improvements seen after the implementation of the MELD score.<sup>(7-9)</sup> A 2020 analysis of the United Network for Organ Sharing (UNOS) registry from 2005 to 2016 showed that wait-listed non-White patients had lower rates of transplantation compared with non-Hispanic Whites.<sup>(7)</sup> Moreover, for those who were ultimately transplanted, wait times from listing to transplantation were estimated to be 20%–40% longer for Black and Hispanic patients compared with non-Hispanic Whites despite the implementation of the Share 35 policy.<sup>(10)</sup>

Although some of these disparities on the wait list have been shown to be due to differential distribution of racial/ethnic minorities in regions and donor service areas with longer waiting time,<sup>(11)</sup> there may be other contributing factors not yet explored. Maintenance of active status, or “readiness,” on the transplant wait list requires obtaining updated laboratory and imaging studies, clinical follow-up, financial clearance, and psychosocial clearance. Yet, multiple prior studies have shown that racial/ethnic minorities encounter more barriers (clinical, psychosocial, and financial) to accessing tertiary or quaternary medical care, such as liver transplantation.<sup>(1,12-14)</sup> In the Organ Procurement and Transplantation Network (OPTN) “reasons of refusal” coding system, offer refusal code 801 is often used to turn down potential organ offers when a candidate is “not ready.”<sup>(15)</sup>

We hypothesized that racial/ethnic minority wait-list candidates would be more likely to have liver offers turned down for being “not ready” logistically to accept offers. In this study, we sought to better understand the demographics of wait-list candidates who did not accept offers, the circumstances under which they did not accept offers, and the factors associated with offer nonacceptance through a retrospective analysis of free-text entries associated with refusal code 801 in the UNOS transplant registry.

## Patients and Methods

This is a retrospective study of all non–status 1 adult ( $\geq 18$  years old) transplant wait-list candidates who received at least one organ offer between January 1, 2009, through December 31, 2018. Candidates who were listed as status 1 (e.g., with fulminant hepatic failure or acute hepatic necrosis) were excluded from all analyses. Data on liver-transplant wait-list candidates were obtained from the UNOS Standard Transplant Analysis and Research (STAR) files, and match-run/offer-acceptance data were obtained from the Potential Transplant Recipient (PTR) files as of March 31, 2019.

## FREE-TEXT OFFER REFUSAL CODES

We extracted all donor organ offers and refusal codes between January 1, 2009, through December

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31, 2018, from the PTR database. PTR recipient refusal codes are categorized based on potential recipient-related reasons, histocompatibility-related reasons, program-related reasons, donor-related reasons, bypass, and other reasons by OPTN conventions (Supporting Table S1).<sup>(15)</sup> “Bypass” organ offers were excluded from analysis, as candidates who are “bypassed” in the offer process were typically not evaluated for that potential organ offer due to the urgent medical condition of a different candidate. We then isolated all refusal code 801s, which is defined as “recipient ill, unavailable, refused, or temporarily unsuitable.” Because 7% (100,326 of 1,366,500) of non-bypass offer refusals in the 10-year study period were listed with refusal code 898 (defined as “other specify”), we also manually reviewed the free-text refusal reason associated with 898 codes and recategorized those codes in accordance with existing codes and categories (Supporting Table S1). Given the heterogeneous nature of refusal code 801, we focused our main analyses on free-text refusal reasons entered with refusal code 801 and code 898 that were recoded to 801. We manually categorized all of the free-text reasons mentioned previously (both those initially entered with refusal code 801 and those entered with refusal code 898 that were ultimately recoded to 801) into potential “candidate-related logistical reasons” (defined as “cannot be contacted,” “financial/insurance,” “unable to travel/distance,” and “not ready/unspecified”) and “non-logistical reasons” (defined as “blood products not ready/available,” “declined offer,” and “too ill to transplant”).

## CANDIDATE CHARACTERISTICS AND COHORTS

Based on these definitions, we made comparisons between those candidates who did not accept at least one organ offer using refusal code 801 (or code 898 recategorized to 801) with a free-text reason consistent with potential “candidate-related logistical issue,” and those who did not encounter a refusal code 801 during their time on the wait list. These two cohorts were designed as “with 801 logistical” and “no 801,” respectively. Demographic data on wait-list candidates included age, sex, race/ethnicity, height, weight, and calculated body mass index at the time of listing. Clinical variables included candidate ABO blood type, etiology of liver disease, hepatocellular carcinoma

(HCC) exceptions, initial and final laboratory MELD scores, and initial and allocation (inclusive of exception points) MELD scores. Race/ethnicity was classified into the following categories: non-Hispanic White, Black, Hispanic, Asian, or other/multiracial. Etiologies of liver disease were grouped as follows: hepatitis C virus, alcoholism, nonalcoholic fatty liver disease, cholestasis, hepatitis B virus, and other. We extract limited socioeconomic indicators available in the STAR data set, including citizenship, education status, employment status, and primary insurance/payor at the time of transplant. Moreover, we tabulated the initial listing center and UNOS region distributions of “with 801 logistical” and “no 801” candidates.

## STATISTICAL ANALYSES

Clinical characteristics and laboratory data were summarized by medians and interquartile ranges (IQRs) for continuous variables or numbers and percentages (%) for categorical variables. Comparisons among the three groups were performed using chi-square and Kruskal-Wallis tests. Univariate logistic regression models were used to assess for selected clinical, demographic, and socioeconomic factors associated “with 801 logistical” status. Covariates were then selected for inclusion into multivariate logistic modeling, with variables selected based on group significance testing in descriptive analyses. A significance level of  $\alpha = 0.20$  was used for inclusion into multivariate modeling with stepwise backward selection of covariates. We included initial allocation (inclusive of exception points) MELD score as the only MELD variable, as it was significantly colinear with initial laboratory MELD score and final allocation (inclusive of exception points) and laboratory MELD scores. Covariates ultimately included in the multivariate logistic regression model included race/ethnicity, wait-list candidate ABO status, HCC exceptions, initial allocation (inclusive of exception points) MELD score, and employment status.

In addition to assessing factors associated with “with 801 status,” we also tabulated wait list–related outcomes: pre-transplantation wait-list mortality, defined as death on the wait list or delisting due to illness; or deceased donor liver transplantation. Patients who remained on the wait list after December 31, 2018, received a living donor liver transplant or removed from the wait list for nonmedical reasons

(defined as “condition improved,” “other,” “refused transplant,” “transferred to another center,” and “unable to contact candidate”) were censored from all analyses. Two-sided *P* values < 0.05 were considered statistically significant in all analyses. Analyses were performed using STATA statistical software, version 16.1 (StataCorp, College Station, TX). The institutional review board at the University of California, San Francisco, approved this study.

## Results

During the 10-year study period from January 1, 2009, through December 31, 2018, there were a total of 1,366,500 non-bypass offer refusals. Of these offer refusals, 4% (53,751) were not accepted under code 801 and 7% (100,326) were not accepted under code 898 with a free-text refusal reason. Of the 100,326 refusal code 898s that occurred, 5% (5,290) were re-categorized to code 801 based on manual review. Of the 53,751 refusal code 801s that occurred, 1% (701) had a secondary refusal free-text refusal reason.

After accounting for refusal code 801 and re-categorized refusal code 801 (from code 898), there were 94,006 “no 801” patients who had at least one organ offer but did not refuse an organ with code 801 and 21,649 patients who did not accept at least one offer with code 801. Of these 21,649 patients who did not

accept at least one offer with code 801, 6% (1,368) had a free-text refusal reason listed.

## FREE-TEXT REFUSAL REASONS

Of the 1,368 patients who did not accept an organ with code 801 and had a free-text refusal reason listed, 677 (49%) declined based on “candidate-related logistical reasons,” and 691 (51%) declined based on other reasons (Fig. 1). Among the 677 “with 801 logistical” patients, the most common refusal reasons were as follows: 404 (60%) were “unable to travel/distance,” 152 (22%) were “cannot be contacted,” 88 (13%) were “not ready/unspecified,” 33 (5%) were due to “financial/insurance” issues. Of those 691 patients who did not accept an organ offer based on nonlogistical reasons, the most common refusal reasons were as follows: 519 (75%) were “too ill to transplant,” 128 (19%) “declined offers,” and 44 (6%) were due to “blood products not ready/available.”

## CENTER AND REGION DISTRIBUTIONS OF “WITH 801 LOGISTICAL” CANDIDATES

The center distributions of “with 801 logistical” candidates are presented in Fig. 2. Of the 91 transplant centers that had at least 1 “with 801 logistical” candidate, 10 transplant centers were the listing centers for

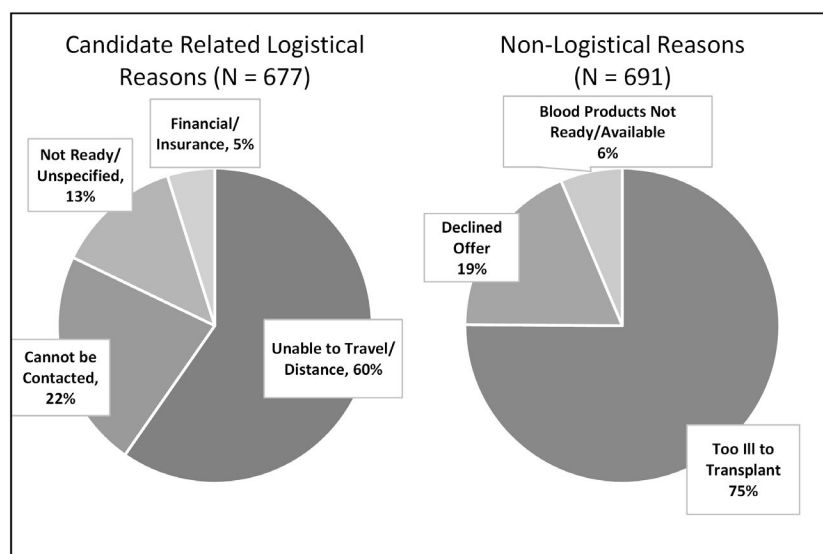
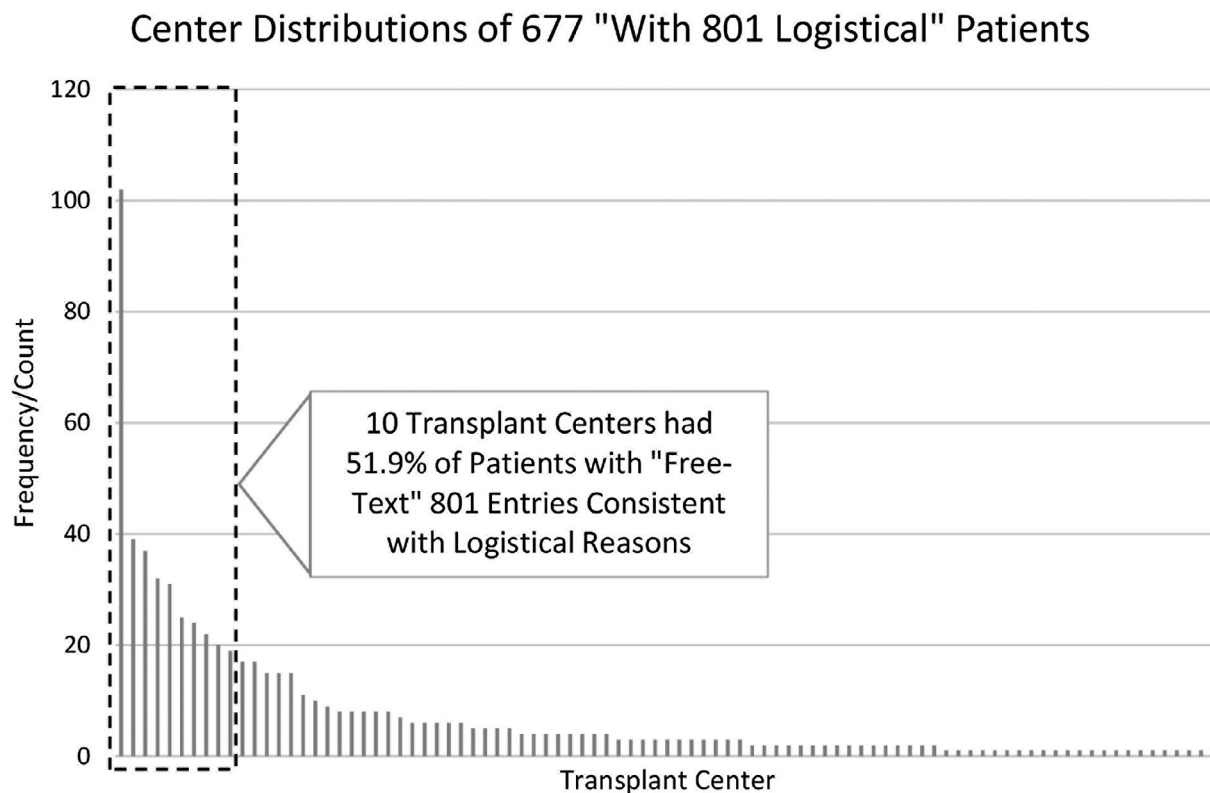


FIG. 1. Free-text refusal reasons categorized into “candidate-related logistical reasons” and “non-logistical reasons.”





**FIG. 2.** Listing center distributions of “with 801 logistical” candidates.

351 (51.9%) of the “with 801 logistical” candidates. Thirty transplant centers were the listing centers for 542 (80.1%) of “with 801 logistical” candidates. The “with 801 logistical” candidates were concentrated in UNOS regions 9 (120 candidates, 17.7%), 4 (119 candidates, 17.6%), 11 (69 candidates, 10.2%), and 5 (67 candidates, 9.9%). In comparison, “no 801” candidates were concentrated in regions 5 (15,010 candidates, 16.0%), 2 (12,214 candidates, 13.05%), 3 (11,899 candidates, 12.7%), and 4 (11,352 candidates, 12.1%).

### **CHARACTERISTICS OF CANDIDATES WHO DID NOT ACCEPT OFFERS DUE TO LOGISTICAL REASONS**

The characteristics of the 677 “with 801 logistical” patients are listed in comparison with 94,006 “no 801” patients in Table 1. Compared to “no 801” patients, “with 801 logistical” patients were similar in age, gender, height, weight, body mass index, and etiology of

liver disease. Compared to “no 801” patients, “with 801 logistical” patients were less likely to be non-Hispanic White (68% vs. 71%,  $P = 0.04$ ) and more likely to be Hispanic (19% vs. 15%,  $P < 0.01$ ). In addition, “with 801 logistical” patients were more likely to have been listed with an HCC exception (21% vs. 14%,  $P < 0.01$ ). “With 801 logistical” patients had lower initial laboratory MELD scores (13 vs. 15,  $P < 0.01$ ) but higher initial allocation (inclusive of exception points) MELD scores (16 vs. 15,  $P < 0.01$ ). At the end of their wait-list time, compared with “no 801” patients, “with 801 logistical” patients also had lower final laboratory MELD scores (16 vs. 18,  $P < 0.01$ ) but higher final allocation (inclusive of exception points) MELD scores (25 vs. 23,  $P < 0.01$ ).

Socioeconomic indicators available in the UNOS STAR data set (notably education level, citizenship status, employment status, and insurance status at the time of transplant) of “no 801” and “with 801 logistical” candidates are presented in Table 2. Compared to “no 801” candidates, “with 801 logistical” candidates

**TABLE 1. BASELINE CHARACTERISTICS OF “NO 801” VERSUS “WITH 801 LOGISTICAL” CANDIDATES**

	“No 801” (n = 94,006)	“With 801 Logistical” (n = 677)	PValue
Age (years, IQR)	56 (50-62)	56 (48-62)	0.18
Female	33,493 (36)	243 (36)	0.89
Race/ethnicity			<0.01
Non-Hispanic White	67,060 (71)	458 (68)	0.04
Black	7,750 (8)	55 (8)	0.91
Hispanic	14,098 (15)	126 (19)	0.01
Asian	3,749 (4)	23 (3)	0.43
Multiracial/other	1,349 (1)	15 (2)	0.09
Height (cm)	173 (164-179)	173 (165-180)	0.5
Weight (kg)	83 (70-97)	83 (71-97)	0.86
Body mass index (kg/m <sup>2</sup> )	28 (25-32)	28 (25-32)	0.76
Candidate ABO status			<0.01
O	44,401 (47)	303 (45)	
A	35,259 (38)	296 (44)	
B	11,105 (12)	59 (9)	
AB	3,241 (3)	19 (3)	
Etiology of liver disease			0.13
Hepatitis C virus	30,423 (32)	248 (37)	
Alcoholism	21,519 (23)	130 (19)	
Nonalcoholic fatty liver disease	12,803 (14)	86 (13)	
Hepatitis B virus	2,587 (3)	17 (3)	
Cholestasis	10,647 (11)	77 (11)	
Other etiologies	16,027 (17)	119 (18)	
HCC exception points	12,737 (14)	140 (21)	<0.01
Initial laboratory MELD score (IQR)	15 (11-22)	13 (11-18)	<0.01
Initial allocation MELD score (IQR)	15 (11-22)	16 (11-24)	<0.01
Final laboratory MELD score (IQR)	18 (12-27)	16 (10-23)	<0.01
Final allocation MELD score (IQR)	23 (15-30)	25 (16-31)	0.01

Note: Continuous variables are summarized by medians and IQRs. Categorical variables are summarized by numbers and percentages (%). Comparisons between groups were performed using chi-square and Kruskal-Wallis tests as appropriate for categorical variables and continuous variables, respectively.

did not differ significantly with regard to education levels and citizenship status. A higher percentage of “with 801 logistical” candidates were actively working at the time of wait-list registration at 32%, compared with 23% in the “no 801” population ( $P < 0.01$ ). Insurance status for “no 801” and “with 801 logistical” candidates showed no significant differences with

**TABLE 2. SOCIOECONOMIC INDICATORS OF “NO 801” VERSUS “WITH 801 LOGISTICAL” CANDIDATES**

	“No 801”	“With 801 Logistical”	PValue
Education status*	n = 93,969	n = 677	0.06
None	300 (0)	2 (0)	
Grade school	4,997 (5)	38 (6)	
High school	37,166 (40)	233 (34)	
Attended college	21,829 (23)	151 (22)	
Associate/bachelor degree	15,410 (16)	130 (19)	
Post-college	6,350 (7)	53 (8)	
Unknown	7,917 (8)	70 (10)	
Citizenship status*	n = 93,983	n = 677	0.62
U.S. citizen	89,750 (95)	649 (96)	
U.S. resident	1,400 (1)	7 (1)	
Non-U.S. resident	2,856 (3)	21 (3)	
Employment/income Status*	n = 90,936	n = 647	<0.01
No	66,677 (73)	415 (64)	
Yes	21,002 (23)	209 (32)	
Unknown	3,257 (4)	23 (4)	
Insurance status*	n = 50,736	n = 378	
Public insurance	22,925 (45)	184 (49)	0.17
Medicaid	7,226 (14)	43 (11)	0.11

Note: Continuous variables are summarized by medians and IQRs. Categorical variables are summarized by numbers and percentages (%).

\*Percentages and statistics calculated for limited proportion of sample with available data.

regard to the proportion of patients whose primary payor was a public insurance or Medicaid.

The results of univariate and multivariate logistics regression models to determine factors associated with not accepting an organ offer due to logistical regions (“with 801 logistical”) are presented in Table 3. The following covariates were included in the multivariate logistic model for associates of “with 801 logistical” classification: race/ethnicity, wait-list candidate ABO status, HCC exceptions, initial allocation (inclusive of exception points) MELD score, and employment/income status. The significantly associated factors/characteristics in the adjusted model included Hispanic ethnicity (odds ratio [OR] 1.44, 95% confidence interval [CI] 1.17-1.76,  $P < 0.01$ ), multiracial/other ethnicity (OR 1.82, 95% CI 1.08-3.05,  $P = 0.02$ ), A blood type (OR 1.28, 95% CI 1.09-1.51,  $P < 0.01$ ), HCC exceptions (OR 1.28, 95% CI 1.05-1.56,  $P < 0.01$ ), and actively working status (OR 1.42, 95% CI 1.20-1.69,  $P < 0.01$ ).

**TABLE 3. LOGISTIC REGRESSIONS OF FACTORS ASSOCIATED WITH NOT ACCEPTING ORGAN OFFER DUE TO LOGISTICAL REASONS**

	Univariable Logistic Regression			Multivariable Logistic Regression		
	OR	95% CI	PValue	OR	95% CI	PValue
<b>Race/Ethnicity</b>						
Non-Hispanic White	Ref			Ref		
Black	1.04	0.78-1.38	0.79	1.18	0.88-1.57	0.26
Hispanic	1.31	1.07-1.60	<0.01	1.44	1.17-1.76	<0.01
Asian	0.90	0.59-1.37	0.62	0.86	0.56-1.33	0.51
Multiracial/Other	1.63	0.97-2.73	0.07	1.82	1.08-3.05	0.02
<b>Candidate ABO Status</b>						
O	Ref			Ref		
A	1.23	1.05-1.44	0.01	1.28	1.09-1.51	<0.01
B	0.78	0.59-1.03	0.08	0.78	0.58-1.04	0.09
AB	0.86	0.54-1.37	0.52	0.88	0.55-1.43	0.61
HCC exception points	1.66	1.38-2.01	<0.01	1.28	1.05-1.56	0.02
Initial allocation MELD	0.96	0.95-0.97	<0.01	0.96	0.95-0.97	<0.01
<b>Employment status</b>						
Not working	Ref			Ref		
Actively working	1.60	1.35-1.89	<0.01	1.42	1.20-1.69	<0.01
Unknown	1.13	0.74-1.73	0.56	1.04	0.68-1.58	0.87

Note: Significance level of  $P < 0.20$  was used for inclusion into multivariate modeling with stepwise backward selection of covariates. Covariates ultimately included in the multivariate model included race/ethnicity, candidate ABO status, HCC exception points, initial allocation MELD, and employment status.

**TABLE 4. TRANSPLANTATION OUTCOMES FOR “NO 801” VERSUS “WITH 801 LOGISTICAL” CANDIDATES**

	“No 801” (n = 94,006)	“With 801 Logistical” (n = 677)	PValue
Wait-list outcome		0.02	
Censored	11,424 (12)	91 (13)	
Death or too sick	16,933 (18)	91 (13)	<0.01
Deceased donor liver transplantation	52,329 (56)	401 (59)	0.06
Other removal	13,320 (14)	94 (14)	0.83

Note: Ordinal and categorical variables are described as values with percentages in parenthesis.

## TIMING OF REFUSAL CODE 801

Among the 677 “with 801 logistical” candidates, 386 (57%) had only one instance of refusal code 801, and 291 (43%) had multiple instances. For the 291 patients who had more than one instance of refusal code 801, the median time between first and last refusal code 801 was 34 days (IQR 14-172 days). The median time-to-first-refusal code 801 among all “with 801 logistical” candidates was 135 days (IQR 22-373 days), and the median time from first refusal code 801 to the last status update

was 135 days (IQR 40-358 days). The median allocation (inclusive of exception points) MELD score at refusal code 801 was 22 (IQR 16-28). Overall, compared to “no 801” patients who spent a median of 187 days (IQR 42-535 days), “with 801 logistical” patients spent a significantly longer amount of time on the wait list at a median of 428 days (IQR 181-945 days,  $P < 0.01$ ). “No 801” patients saw a median of 5 (IQR 2-12) organ offers during their time on the wait list, while “with 801 logistical” patients saw a median of 16 (IQR 9-30) organ offers ( $P < 0.01$ ).



## WAIT-LIST OUTCOMES OF CANDIDATES WHO DID NOT ACCEPT OFFERS DUE TO LOGISTICAL REASONS

The wait-list outcomes of the 94,006 “no 801” candidates and 677 “with 801 logistical” are presented in Table 4. There were no significant differences in the rates of deceased-donor liver transplantation between “no 801” and “with 801 logistical” candidates (59% vs. 56%,  $P = 0.06$ ). Compared to “no 801” candidates, “with 801 logistical” candidates had a lower rate of death or delisting due to illness (13% vs. 18%,  $P < 0.01$ ).

## Discussion

Using national registry data over a 10-year period, we attempted to better characterize the circumstances of candidates who did not accept organ offers because they were “not ready” as indicated by free-text refusal reasons associated with refusal codes 801 or 898. We found that 49% of the 1,368 patients who had free-text refusal reasons associated with declining an organ offer did not accept due to a potential logistical related issue, defined as “unable to travel/distance,” “cannot be contacted,” “not ready/unspecified,” or “financial/insurance” issues.

Among the 677 “with 801 logistical” patients, Hispanics were overrepresented at 19%, compared with a larger cohort of patients who did not encounter refusal code 801 (“no 801”) at 15%. In adjusted logistic regression modeling, compared to non-Hispanic Whites, Hispanics were at 1.44 odds, and those who identified as multiracial/other were at 1.82 odds of not accepting an organ offer due to a candidate-related logistical reason. The patients who had declined organ offers due to logistical issues spent a median of 428 days on the wait list, while those who did not decline an organ offer using code 801 only spent a median of 187 days. The “with 801 logistical” patients also saw (and declined) many more organ offers at a median of 16 organ offers compared with “no 801” patients, who only saw a median of 5 organ offers. When we investigated associations between socioeconomic indicators in the UNOS database with “with 801 logistical” status, we found that these patients were more likely to be working at the time of transplant listing. Of note, there are no significant differences with regard to citizenship/residency, education, or insurance status. Fortunately, in our analyses, despite longer wait-list times and refusing more

organ offers, “with 801 logistical” patients did not have a significantly different deceased donor liver-transplant rate compared with “no 801” patients. In addition, “with 801 logistical” patients were less likely to die or be delisted due to illness compared with “no 801” patients. These results must be interpreted with significant caution due to the selection bias that occurred in isolating the “with 801 logistical” patient population.

The use of refusal code 801 (defined as “recipient ill, unavailable, refused, or temporarily unsuitable”) is exceptionally heterogenous, and the proportion of 801 refusal codes of the total refusal codes by center ranged between 0% and 40%. In our analyses of center distributions, of the 677 “with 801 logistical” patients, we found that 10 centers were responsible for listing 51.9% of these candidates. Moreover, “with 801 logistical” candidates were concentrated in regions markedly different than “no 801” candidates. These data indicate that there is likely significant center-related heterogeneity in the use of free-text refusal reasons. As such, the findings concerning the 677 “with 801 logistical” patients may not be broadly generalizable. Despite these issues, the findings of a greater proportion of minorities (specifically Hispanics) among this smaller cohort and higher participation in employment at the time of listing may be directionally consistent with previous literature noting that minorities may face greater barriers to transplantation.

The potential “candidate-related logistical reasons” for declining organs also suggest that they are targets for interventions to improve a candidate’s probability of successfully accepting organ offers. Examples of strategies to improve transplant “readiness” are (1) removing barriers for transportation to the transplant center; (2) obtaining multiple points of contact for the patient/caregivers; (3) proactive maintenance of financial/insurance clearance; (4) patient education regarding the need for updated clinical information to maintain active status; and (5) early cross-matching for blood products needed for surgery. Given that Hispanic patients were approximately 24% more likely to have a “candidate-related logistical reason” for declining an organ offer in our cohort of “with 801 logistical” patients, implementation of such targeted strategies may help to reduce racial or ethnic disparities in wait-list outcomes.

As with other analyses of the UNOS registry, our analyses have several limitations. First, we defined our predictor using a manual review of free-text refusal reasons associated with refusal codes 801 and 898; this

methodology may be subject to misclassification and selection biases, as certain transplant centers may be more likely to enter free-text refusal reasons or may have used other refusal codes, such as donor-related code 830 “donor age or quality,” to refuse organs when it was due to a candidate-related logistical issue. Moreover, given our definition of “with 801 logistical,” we had artificially excluded any patients who did not accept organ offers under free-text reasons consistent with “too ill to transplant.” The consequence of these selection biases with regard to isolating patients who did not accept organ offers with free-text refusal reasons consistent with “candidate-related logistical reason” could be seen in the marginally higher rates of deceased-donor liver transplantation in this group (59% vs. 56%) and significantly lower rates of death or delisting due to illness (13% vs. 18%) compared to the “no 801” group. Second, we only analyzed candidates who received at least one organ offer during the time they were on the wait list and excluded those candidates who never saw an organ offer. Therefore, there is an inherent selection bias away from the null in the populations examined (more clinically ill to have drawn organ offers), and our results and implications cannot be necessarily generalized to those candidates who never drew organ offers. Finally, as previously discussed, our use of free-text refusal reasons means that we only evaluated a small percentage (3%) of the overall population of patients who did not accept at least one organ offer with refusal code 801. Although this is the best available data regarding this line of investigation, the characteristics/experiences of “with 801 logistical” patients are not likely to be reflective of broader wait-list populations. To address this data gap, there is an ongoing effort by OPTN to rationalize and simplify refusal reasons to improve clarity surrounding organ offer refusals.<sup>(15)</sup>

Despite these limitations, our study dissects and analyzes potential barriers to preventing candidates from being “ready” to accept offers on the liver transplant wait list by analyzing the occurrences and circumstances surrounding refusal code 801. We found Hispanic ethnicity and multiracial/other ethnicity associated with those who did not accept organ offers due to related logistical problems. These findings imply that racial/ethnic minorities may face a greater burden of missed transplant opportunities due to not being “ready.” Targeted interventions to improve the “readiness” of candidates to accept potential organ offers may ultimately benefit racial/ethnic minorities on the liver transplant wait list.

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## Supporting Information

Additional Supporting Information may be found at [onlinelibrary.wiley.com/doi/10.1002/hep4.1865/supinfo](https://onlinelibrary.wiley.com/doi/10.1002/hep4.1865/supinfo).