

# Access to Transplant Care and Services Within the Veterans Health Administration

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The VHA provides timely solid organ transplant care and services with outcomes comparable to that of nationally reported estimates.

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**T**he Veterans Health Administration (VHA) provides health care services to over 9 million eligible and enrolled veterans out of a US veteran population of 18.9 million.<sup>1</sup> In 2014, an Office of Inspector General (OIG) investigation identified timely access to health care within the VHA as a serious concern.<sup>2</sup> In direct response, Congress enacted the Veterans Access, Choice, and Accountability Act (VACAA) of 2014 to expand access to care options available to veterans through referral to non-VA community care providers when the veteran is waiting longer than 30 days for an outpatient appointment or services, resides a significant distance ( $\geq 40$  miles) from a VA facility, or experiences an undue burden to receive care and services.<sup>3</sup> The VHA also responded, implementing several initiatives to improve veteran access to VHA health care generally, including the MyVA transformation and the proliferation of connected health technology; including telehealth capability and the expanded use of secure messaging.<sup>4,6</sup>

This study examined veterans' access to the VA transplant program (VATP) for fiscal year (FY 2014 to FY 2016). Timeliness of services and outcomes in relationship to the distance from a VA transplant center (VATC) were evaluated.

## METHODS

The VATP comprises the following VATCs: 5 heart (Madison, Wisconsin; Nashville, Tennessee; Palo Alto, California; Richmond, Virginia; and Salt Lake City, Utah); 7 kidney (Birmingham, Alabama; Bronx, New York;

Houston, Texas; Iowa City, Iowa; Nashville, Tennessee; Pittsburgh, Pennsylvania; and Portland, Oregon); 6 liver (Houston, Texas; Madison, Wisconsin; Nashville, Tennessee; Pittsburgh, Pennsylvania; Portland, Oregon; and Richmond, Virginia); and 2 lung (Madison, Wisconsin; and Seattle, Washington).

In 2012, the VHA published a policy to establish timeliness standards for a VATC initial review decision and referral evaluation.<sup>7</sup> In 2013, the VHA National Surgery Office (NSO) implemented a secure intranet-based application called TRACER to facilitate the referral process and track timeliness of initial review decision, evaluation, United Network of Organ Sharing (UNOS) waitlisting, and transplantation.

The referral process is as follows: The referring VA medical facility submits veteran candidate health information into TRACER, selects a VATC, and then TRACER notifies the VATC. The VATC reviews the information and submits an initial review decision as to whether the clinical information supports further evaluation within 48 hours for an emergency referral and 5 business days for a stable referral. If accepted, the VATC completes an evaluation within 30 calendar days of the referral submission date. On evaluation and acceptance, the VATC accepts handoff for transplant-related care, orders additional testing as needed, and waitlists the veteran with UNOS when the clinical status is deemed appropriate.<sup>4</sup>

The TRACER data from 3 separate cohorts were analyzed from October 1, 2013, to September 30, 2016, with a follow-up event capture through March 31, 2017:

(1) the referral cohort, representing all referrals to the VATP; (2) the waitlist cohort, representing those undergoing initial UNOS waitlisting; and (3) the transplant cohort, representing those receiving a solid organ transplant. The straight-line distance between the referring VA medical facility and the VATC was determined for each referral and categorized as follows: less than 100 miles, 100 to 300 miles, 301 to 500 miles, and greater than 500 miles.

Mortality outcomes in the TRACER database were confirmed using the VHA Vital Status file, which combines the Centers for Medicare & Medicaid Services, Social Security Administration, and VHA internal utilization data to determine a best source, including flagging of records that indicate a death date followed by use of VA services.<sup>8,9</sup> Records flagged with VA use after death were not considered deaths in this analysis. The NSO regularly refreshes veteran vital status information in the TRACER database for analysis of long-term outcomes.

The analysis methods for this study included Kruskal-Wallis nonparametric 1-way analysis of variance to compare timeliness metrics by distance group, Fine and Gray competing risks models to compare mortality on the UNOS list by distance group, and log-rank and Wilcoxon-Gehan tests to compare patient survival distributions by distance group.<sup>10-14</sup> Analysis was generated using SAS software, version 9.4 (Cary, North Carolina) as well as the R statistical software application (r-project.org).<sup>15</sup> Publicly available solid organ transplant survival rates were obtained from the Scientific Registry for Transplant Recipients (SRTR).<sup>16</sup>

## RESULTS

For FY 2014 to FY 2016, the referral cohort identified 6,009 veteran referrals to a VATC for solid organ transplant of which 3,500 underwent an evaluation, and 2,137 were waitlisted for solid organ transplant with UNOS (Table 1). Overall, 9.6% of referrals, 13.8% of evaluations, and 15.8% of those waitlisted were from VA referring centers less than 100 miles of the VATC. Alternatively, 37.2% of referrals, 33.3% of evaluations, and 30.4% of waitlistings were assigned a referral distance of greater than 500 miles. This

**TABLE 1** Referrals, Evaluations, and Veterans Waitlisted by Distance, Fiscal Years 2014 to 2016

Distance, miles	Referrals, No. (%)	Evaluations, No. (%)	Listings, No. (%)
<b>Heart</b>			
< 100	51 (10.8)	43 (14.1)	22 (16.2)
100-300	144 (30.6)	84 (27.5)	39 (28.7)
301-500	106 (22.5)	73 (23.9)	27 (19.9)
> 500	170 (36.1)	106 (34.6)	48 (35.3)
All distances	471	306	136
<b>Kidney</b>			
< 100	276 (8.4)	230 (11.8)	164 (12.8)
100-300	964 (29.4)	592 (30.3)	390 (30.5)
301-500	869 (26.5)	456 (23.3)	313 (24.5)
> 500	1,167 (35.6)	675 (34.6)	413 (32.3)
All distances	3,276	1,953	1,280
<b>Liver</b>			
< 100	235 (12.6)	203 (18.6)	146 (22.0)
100-300	642 (34.4)	386 (35.3)	237 (35.7)
301-500	371 (19.9)	212 (19.4)	127 (19.1)
> 500	619 (33.2)	292 (26.7)	154 (23.2)
All distances	1,867	1,093	664
<b>Lung</b>			
< 100	15 (3.8)	7 (4.7)	6 (10.5)
100-300	38 (9.6)	20 (13.5)	4 (7.0)
301-500	64 (16.2)	29 (19.6)	12 (21.1)
> 500	278 (70.4)	92 (62.2)	35 (61.4)
All distances	395	148	57
<b>All organs</b>			
< 100	577 (9.6)	483 (13.8)	338 (15.8)
100-300	1,788 (29.8)	1,082 (30.9)	670 (31.4)
301-500	1,410 (23.5)	770 (22.0)	479 (22.4)
> 500	2,234 (37.2)	1,165 (33.3)	650 (30.4)
All distances	6,009	3,500	2,137

suggests that a referral distance less than 100 miles provides a small but measurable positive benefit, whereas a referral distance of greater than 500 miles impacts the veteran negatively. Further analysis of the 577 referrals from less than 100 miles determined that 456 (79.0%) originate from the VATC as a direct referral. Of the 338 waitlisted referrals less than 100 miles, only 53 (15.7%) were from a separate VA medical facility, indicating a preference for VATCs

**TABLE 2** Timeliness of Referral, Initial Decision Review, Evaluation, and Waitlisting

Distances, miles	Referrals			Emergency Reviews						Stable Reviews					Completed
	Submitted	Closed After Referral	Discontinued	Total Decisions	Eligible Decisions	Closed After Decision	> 48 h, No. (%)	Median, h	IQR, h	Total Decisions	Eligible Decisions	Closed After Decision	> 5 Bus. Days, No. (%)	Median Bus. Days (IQR)	
<b>FY 2014</b>															
< 100	173	-	7	9	9	1	-	0	0-2	157	139	4	15 (9.6)	2 (1-3)	143
100-300	538	-	81	25	18	1	2 (8.0)	1	1-17	432	298	16	77 (17.8)	3 (2-5)	299
301-500	406	1	47	22	18	2	1 (4.5)	5	2-22	336	225	10	71 (21.1)	4 (2-5)	231
> 500	729	2	77	26	21	4	3 (11.5)	16	2-39	624	379	23	91 (14.6)	3 (2-5)	372
All distances	1,846	3	212	82	66	8	6 (7.3)	3	1-20	1,549	1,041	53	254 (16.4)	3 (2-5)	1,045
<b>FY 2015</b>															
< 100	185	1	4	13	11	-	-	2	1-6	167	151	9	11 (6.6)	1 (1-3)	153
100-300	545	1	40	25	17	-	2 (8.0)	4	1-23	479	338	18	72 (15.0)	3 (2-5)	337
301-500	466	2	33	23	16	3	1 (4.3)	3	1-24	408	262	22	82 (20.1)	3 (2-5)	253
> 500	734	2	69	34	18	4	5 (14.7)	17	3-22	629	396	19	62 (9.9)	3 (2-4)	391
All distances	1,930	6	146	95	62	7	8 (8.4)	4	1-22	1,683	1,147	68	227 (13.5)	3 (2-4)	1,134
<b>FY 2016</b>															
< 100	219		10	15	13	1	-	3	2-7	194	180	5	2 (1.0)	1 (1-2)	187
100-300	705	4	51	25	15	-	-	17	4-27	625	453	22	67 (10.7)	3 (2-5)	446
301-500	538	3	44	16	11	2	-	13	3-23	475	305	28	42 (8.8)	2 (2-5)	286
> 500	771	2	63	34	21	9	-	4	3-8	672	425	35	58 (8.6)	3 (2-4)	402
All distances	2,233	9	168	90	60	12	-	6	3-23	1,966	1,363	90	169 (8.6)	3 (2-4)	1,321
<b>All years</b>															
< 100	577	1	21	37	33	2	-	2	1-6	518	470	18	28 (5.4)	1 (1-3)	483
100-300	1,788	5	172	75	50	1	4 (5.3)	5	1-24	1,536	1,089	56	216 (14.1)	3 (2-5)	1,082
301-500	1,410	6	124	61	45	7	2 (3.3)	6	2-23	1,219	792	60	195 (16.0)	3 (2-5)	770
> 500	2,234	6	209	94	60	17	8 (8.5)	5	3-21	1,925	1,200	77	211 (11.0)	3 (2-4)	1,165
All distances	6,009	18	526	267	188	27	14 (5.2)	5	2-22	5,198	3,551	211	650 (12.5)	3 (2-5)	3,500

Abbreviations: bus., business; FY, fiscal year; IQR, interquartile range.

Closed After Evaluation	Evaluations			Listings	
	Telehealth, No. (%)	> 30 Days, No. (%)	Median Days (IQR)	Completed	Median Days (IQR)
31	2 (1.4)	31 (21.7)	22 (11-29)	106	69 (31-119)
88	50 (16.7)	131 (43.8)	29 (22-44)	197	91 (45-159)
70	30 (13.0)	96 (41.6)	29 (24-44)	152	98 (57-220)
138	57 (15.3)	220 (59.1)	35 (26-54)	209	98 (61-220)
327	139 (13.3)	478 (45.7)	30 (22-48)	664	90 (49-182)
30	0 (0.0)	26 (17.0)	20 (9-28)	112	45 (24-91)
98	72 (21.4)	71 (21.1)	26 (20-29)	209	84 (37-154)
70	51 (20.2)	69 (27.3)	27 (22-32)	164	89 (63-190)
142	72 (18.4)	131 (33.5)	28 (22-36)	209	78 (47-144)
340	195 (17.2)	297 (26.2)	26 (20-32)	694	76 (39-152)
37	4 (2.1)	23 (12.3)	20 (10-27)	120	62 (32-109)
117	87 (19.5)	58 (13.0)	26 (20-28)	264	73 (41-120)
78	59 (20.6)	37 (12.9)	26 (21-29)	163	78 (51-139)
112	71 (17.7)	55 (13.7)	26 (21-28)	232	68 (41-137)
344	221 (16.7)	173 (13.1)	25 (20-28)	779	70 (41-127)
98	6 (1.2)	80 (16.6)	21 (10-28)	338	57 (31-106)
303	209 (19.3)	260 (24.0)	26 (20-30)	670	78 (42-143)
218	140 (18.2)	202 (26.2)	27 (22-32)	479	86 (56-173)
392	200 (17.2)	406 (34.8)	28 (22-39)	650	82 (47-161)
1,011	555 (15.9)	948 (27.1)	27 (21-32)	2,137	78 (43-148)

to process direct referrals in a manner that promotes waitlisting.

For the study period, 6,009 referrals resulted in 188 emergency initial review decisions and 3,551 stable initial review decisions with an eligible declaration (Table 2). The median time for emergency referral initial review decision was 5 hours, with an interquartile range (IQR) of 2 to 22 hours. Fourteen emergency initial review decisions (5.2%) were submitted by the VATC beyond the 48 hours mandated by policy. The median time for stable referral initial review decision was 3 business days (IQR 2-5 d) with 650 stable initial review decisions (12.5%) submitted beyond the 5 business days mandated by policy. In FY 2016, all 90 emergency referrals received an initial review decision within 48 hours, and all but 169 (8.6%) of stable referrals received an initial review decision within 5 business days, representing an improvement over FY 2014 and FY 2015.

Three thousand five hundred evaluations were performed in a median time of 27 calendar days (IQR 21-32 d) with 948 (27.1%) performed beyond the policy mandated 30 calendar days. Telehealth was used for 555 evaluations (15.9%), primarily for referrals located greater than 100 miles from the VATC. In FY 2016, 13.1% of the 1,321 completed evaluations were performed beyond 30 calendar days, representing an improvement from prior years; 45.7% beyond 30 calendar days in FY 2014 and 26.2% beyond 30 days in FY 2015.

Of the 6,009 referrals submitted in FY 2014 to FY 2016, 2,137 were waitlisted with UNOS. The median time from referral to waitlisting was 78 calendar days (IQR 43-148 d) for the entire study period, decreasing from 90 calendar days in FY 2014 to 70 calendar days in FY 2016.

For all organs and most organ types, the time from referral to initial review decision, evaluation, and

**TABLE 3** Outcomes of Veterans Waitlisted With UNOS for Fiscal Years 2014 to 2016

Distances, miles	Initial UNOS Listings  No. (%)	Mortality on UNOS List			Transplants			Removed	
		Count  No. (%)	Time From Listing to Mortality, d		Count  No. (%)	Time From Listing to Transplant, d		Overall  No. (%)	Failure to Meet Criteria  No.
			Median	IQR		Median	IQR		
<b>Heart</b>									
< 100	20 (15.2)	1 (5.0)	142	142-142	12 (60.0)	94	69-219	-	-
100 to 300	43 (32.6)	4 (9.3)	259	119-492	25 (58.1)	133	37-236	5 (11.6)	3
301 to 500	26 (19.7)	1 (3.8)	232	232-232	15 (57.7)	190	77-348	0	0
> 500	43 (32.6)	0	-	-	33 (76.7)	206	47-340	4 (9.3)	1
All distances	132	6 (4.5)	215	142-320	85 (64.4)	162	49-311	9 (6.8)	4
<b>Kidney</b>									
< 100	152 (10.9)	10 (6.6)	339	214-560	21 (13.8)	397	121-780	13 (8.6)	12
100 to 300	409 (29.4)	18 (4.4)	199	103-551	62 (15.2)	245	133-549	59 (14.4)	27
301 to 500	346 (24.8)	16 (4.6)	428	284-606	54 (15.6)	246	84-663	59 (17.1)	29
> 500	486 (34.9)	18 (3.7)	383	108-590	102 (21.0)	256	115-457	85 (17.5)	47
All distances	1,393	62 (4.5)	342	142-560	239 (17.2)	255	113-571	216 (15.5)	115
<b>Liver</b>									
< 100	146 (21.5)	14 (9.6)	44	21-326	83 (56.8)	123	29-353	25 (17.1)	22
100 to 300	246 (36.2)	28 (11.4)	123	56-243	139 (56.5)	126	22-245	36 (14.6)	28
301 to 500	125 (18.4)	15 (12.0)	208	96-322	59 (47.2)	129	27-279	21 (16.8)	16
> 500	162 (23.9)	15 (9.3)	323	36-517	78 (48.1)	80	15-200	27 (16.7)	23
All distances	679	72 (10.6)	139	43-323	359 (52.9)	113	24-263	109 (16.1)	89
<b>Lung</b>									
< 100	8 (13.1)	0	-	-	7 (87.5)	87	20-170	1 (12.5)	1
100 to 300	6 (9.8)	1 (16.7)	128	128-128	4 (66.7)	128	71-168	1 (16.7)	1
301 to 500	14 (23.0)	1 (7.1)	15	15-15	12 (85.7)	105	10-204	1 (7.1)	1
> 500	33 (54.1)	2 (6.1)	122	22-221	25 (75.8)	110	45-237	2 (6.1)	1
All distances	61	4 (6.6)	75	19-175	48 (78.7)	110	37-204	5 (8.2)	4
<b>All organs</b>									
< 100	326 (14.4)	25 (7.7)	183	37-396	123 (37.7)	165	38-397	39 (12.0)	35
100 to 300	704 (31.1)	51 (7.2)	142	77-298	230 (32.7)	150	38-291	101 (14.3)	59
301 to 500	511 (22.6)	33 (6.5)	294	118-445	140 (27.4)	178	42-401	81 (15.9)	46
> 500	724 (32.0)	35 (4.8)	326	83-555	238 (32.9)	154	49-308	118 (16.3)	72
All distances	2,265	144 (6.4)	227	81-407	731 (32.3)	157	42-333	339 (15.0)	212

Abbreviations: IQR, interquartile range; UNOS, United Network for Organ Sharing, VATC, Veterans Affairs Transplant Center.

From VATC Listing		Mortality for Patients Not Transplanted at a VATC	On the UNOS List at 3/31/17
Patient Choice	Mortality After TRACER Closure and Prior to 3/31/17		
No.	No. (%)	No. (%)	No. (%)
-	-	1 (5.0)	7 (35.0)
2	2 (40.0)	6 (14.0)	9 (20.9)
0	-	1 (3.8)	10 (38.5)
3	-	0 (0.0)	6 (14.0)
5	2 (22.2)	8 (6.1)	32 (24.2)
1	1 (7.7)	11 (7.2)	108 (71.1)
32	9 (15.3)	27 (6.6)	270 (66.0)
30	4 (6.8)	20 (5.8)	217 (62.7)
38	6 (7.1)	24 (4.9)	281 (57.8)
101	20 (9.3)	82 (5.9)	876 (62.9)
3	11 (44.0)	25 (17.1)	24 (16.4)
8	19 (52.8)	47 (19.1)	43 (17.5)
5	8 (38.1)	23 (18.4)	30 (24.0)
4	19 (70.4)	34 (21.0)	42 (25.9)
20	57 (52.3)	129 (19.0)	139 (20.5)
0	1 (100.0)	1 (12.5)	-
0	1 (100.0)	2 (33.3)	-
0	-	1 (7.1)	-
1	1 (50.0)	3 (9.1)	4 (12.1)
1	3 (60.0)	7 (11.5)	4 (6.6)
4	13 (33.3)	38 (11.7)	139 (42.6)
42	31 (30.7)	82 (11.6)	322 (45.7)
35	12 (14.8)	45 (8.8)	257 (50.3)
46	26 (22.0)	61 (8.4)	333 (46.0)
127	82 (24.2)	226 (10.0)	1,051 (46.4)

waitlisting was statistically less ( $P < .005$ ) for referrals received from VA medical facilities located less than 100 miles compared with referrals received from VA medical facilities at least 100 miles from the VATC. No statistical difference was found for emergency initial review decision for heart ( $P = .72$ ) and lung ( $P = .14$ ), time to evaluation for lung ( $P = .14$ ), and time to waitlisting for heart ( $P = .95$ ).

The waitlist cohort data are shown in Table 3. For FY 2014 to FY 2016, 2,265 veterans were waitlisted with UNOS of which 144 (6.4%) died on the waitlist and 731 (32.3%) underwent transplantation. The waitlist mortality rate varied by organ type: heart 4.5%, kidney 4.5%, liver 10.6%, and lung 6.6%. The transplant rate for this cohort varied by organ type: heart 64.4%, kidney 17.2%, liver 52.9%, and lung 78.7%. The median time from initial waitlisting to transplantation was 157 days for all organs and varied by organ type: heart 162 days, kidney 255 days, liver 113 days, and lung 110 days.

TRACER identified that 339 (15.0%) of the waitlist cohort were removed from the UNOS waitlist of which 212 (62.5%) were removed for failure to meet clinical criteria for transplantation, and 127 (37.5%) were removed for patient choice. Overall, 226 (10.0%) veterans died during the study period without receiving a transplant. Organ-specific mortality rates for veterans waitlisted but not transplanted at a VATC are as follows: heart 6.1%, kidney 5.9%, liver 19.0%, and lung 11.5%. As of March 31, 2017, 1,051 veterans were waitlisted with UNOS of which 876 (83.3%) were waitlisted for a kidney transplant.

The rate of mortality on the UNOS waitlist, the percentage of veterans transplanted, the time from waitlisting to transplantation, and the percentage of patients waitlisted at the end of the study period were not statistically different for referrals less than 100 miles compared with referrals at least 100 miles for all organs or kidney and liver separately ( $P \leq .05$ ). The relatively small numbers of veterans waitlisted for heart and lung transplants and nominal mortality events precluded making statements regarding significance for waitlist mortality.

The transplant cohort comprised 947 veterans receiving a solid organ transplant,

**TABLE 4** Timeliness of Referral Evaluation, Waitlisting, and Transplantation for Transplants Performed in Fiscal Years 2014 to 2016

Distances, miles	Transplants Performed, No. (%)	Median Referral to Evaluation, d (IQR)	Median Referral to Listing, d (IQR)	Median Referral to Transplant, d (IQR)
<b>Heart</b>				
< 100	18 (17.6)	2 (1-6)	4 (1-9)	327 (97-675)
100 to 300	31 (30.4)	19 (5-33)	63 (20-199)	352 (185-748)
301 to 500	18 (17.6)	20 (7-28)	60 (22-213)	405 (214-784)
> 500	35 (34.3)	20 (6-27)	50 (25-118)	263 (106-515)
All distances	102	16 (4-28)	50 (16-142)	301 (151-675)
<b>Kidney</b>				
< 100	44 (10.7)	41 (19-70)	77 (45-165)	1,113 (613-1,646)
100 to 300	109 (26.5)	85 (36-144)	169 (107-304)	915 (475-1,536)
301 to 500	86 (20.9)	103 (46-206)	200 (101-390)	947 (479-1,511)
> 500	172 (41.8)	85 (45-158)	177 (107-315)	839 (420-1,414)
All distances	411	81 (36-150)	169 (96-308)	914 (460-1,506)
<b>Liver</b>				
< 100	82 (21.4)	19 (5-35)	41 (15-86)	276 (72-550)
100 to 300	144 (37.6)	25 (12-34)	63 (31-126)	225 (99-394)
301 to 500	62 (16.2)	26 (15-33)	85 (36-142)	288 (120-547)
> 500	95 (24.8)	34 (23-54)	79 (51-165)	240 (89-522)
All distances	383	26 (14-39)	70 (32-131)	236 (91-500)
<b>Lung</b>				
< 100	9 (17.6)	5 (2-24)	26 (7-155)	229 (90-351)
100 to 300	4 (7.8)	62 (47-93)	317 (85-604)	426 (155-743)
301 to 500	15 (29.4)	39 (29-54)	87 (68-213)	279 (170-585)
> 500	23 (45.1)	30 (26-42)	117 (85-155)	205 (139-444)
All distances	51	31 (23-49)	99 (68-203)	246 (139-466)
<b>All organs</b>				
< 100	153 (16.2)	21 (5-41)	46 (15-105)	410 (99-851)
100 to 300	288 (30.4)	32 (20-81)	105 (43-204)	380 (185-956)
301 to 500	181 (19.1)	36 (24-114)	138 (69-259)	523 (239-1,109)
> 500	325 (34.3)	48 (27-104)	126 (71-237)	485 (205-1,045)
All distances	947	34 (21-85)	107 (48-218)	444 (190-994)

Abbreviation: IQR, interquartile range.

including 102 (10.8%) heart, 411 (43.4%) kidney, 383 (40.4%) liver, and 51 (5.4%) lung transplants (Table 4). The median time from referral to evaluation was 34 days (IQR 21-85 d), referral to waitlisting was 107 days (IQR 48-218 d), and referral to transplant was 444 days (IQR 190-994d). This cohort includes the 731 trans-

plants identified in the waitlist cohort plus 216 transplants performed on referrals waitlisted before October 1, 2013. These 216 transplants (17 heart, 172 kidney, 24 liver, and 3 lung) negatively influenced the timeliness of evaluations, waitlisting, and transplantation most notably with kidney transplantation. Time from referral to transplant was evaluated separately for all organs and each organ type separately, finding no statistical difference for referrals from VA medical facilities less than 100 miles from a VATC compared with referrals at least 100 miles in any category ( $P > .05$ ).

The transplant 30-day, 180-day, and 1-year survival rates are shown in Table 5. The 1-year survival rates for the VATP are as follows: heart 95.1%, kidney 97.4%, liver 91.7%, and lung 89.7%. These survival rates are on par or better than SRTR comparative estimates. Transplant survival rates were evaluated for each organ type separately, finding no statistical difference for referrals from VA medical facilities less than 100 miles compared with referrals at least 100 miles from a VATC in any category ( $P > .05$ ).

## DISCUSSION

This study shows that the VATP delivers timely, high-quality care and services even when the veteran's referring VA medical facility is located a considerable distance from the VATC. Three separate cohorts of veterans were examined for the FY 2014 to FY 2016 study period: those referred, those waitlisted, and those transplanted.

The referral cohort identified 6,009 referral submissions, performed 3,500 evaluations on veterans deemed to be potential candidates for solid organ transplantation, and placed 2,137 of these referrals on the UNOS waitlist. The median time from referral to initial review decision was 5 hours for emergency referrals and 3 business days

for stable referrals. The median time from referral to evaluation was 27 calendar days, and the median time from referral to UNOS waitlisting was 78 calendar days. Improvements in timeliness for referral initial review decision, evaluation completion, and waitlisting over the study period were reflective of VHA and NSO efforts to enhance access to services. In FY 2016, 100% of emergency referrals received an initial review decision within 48 hours, 91.4% of stable reviews received an initial review decision within 5 business days, and 86.9% of all referrals underwent evaluation within 30 calendar days.

Distance of less than 100 miles between the referring VA medical facility and the VATC was associated with statistically significant shorter times for initial review decision, evaluation, and UNOS waitlisting. Referrals from less than 100 miles were a minority (9.6%) of referrals and most often represented a direct referral from the VATC to its own program. Timeliness of referral initial review decision, evaluation, or UNOS waitlisting was similar for distance categories greater than 100 miles: 100 to 300 miles, 301 to 500 miles, or greater than 500 miles.

The waitlist cohort identified 2,265 veterans, of which 731 (32.3%) underwent transplantation and 226 (10.0%) died. All-cause mortality for veterans once waitlisted, whether or not maintained on the UNOS waitlist, varied among organs and was found to be 6.1% for heart, 5.9% for kidney, 19.0% for liver, and 11.5% for lung. Waitlist mortality and the time from referral to solid organ transplant was similar for all distance categories.

The transplant cohort identified 947 veterans receiving a solid organ transplant with a median time from referral to transplant that varied considerably by organ type; 301 days (10.0 mo) for heart transplants, 914 days (30.5 mo) for kidney transplants, 236 days (7.9 mo) for liver transplants, and 246 days (8.2 mo) for lung transplants. Time to transplant and post-transplant survival were similar in all distance categories. Moreover, the VATP 1-year survival rates compared favorably with published SRTR data.

Prior studies have shown that distance to a transplant center adversely impacts access to transplant services, mortality on the UNOS waitlist, and transplant outcomes.<sup>17-21</sup> Patients living in small towns and isolated rural regions were 8% to 15% less likely to be waitlisted and 10% to 20% less likely to undergo heart, kidney, and liver transplantation than were patients in urban environments.<sup>17</sup> This study found that a referral to the VATP from a VA medical facility located less than 100 miles from the VATC received an evaluation 5 to 7 days sooner and be placed on the UNOS waitlist 21 to 29 days sooner than a veteran referred to a VATC located at least 100 miles away. Contrary to prior studies, the distance from the VATC did not have an adverse impact on UNOS waitlist mortality, time to transplantation, or survival outcomes posttransplant.

The VHA offers a number of advantages to the veteran in need of transplant care and services. The VHA is the largest integrated health care system in the US designed specifically for veterans and their complex and specific needs with greater than 1,200 points of care and a single electronic health record optimizing coordinated services.<sup>22</sup> In addition, the VHA's use of telehealth to expedite evaluations and follow-up transplant care closer to home thereby obviating the need for travel. The VHA also has an electronic process to facilitate referral and tracking of timeliness of care (TRACER). Finally, VHA has policies that supports travel benefits, including lodging for the veteran, caregiver, and living donor if applicable for evaluations, transplant procedures, and follow-up care.<sup>4,23</sup>

The coordination of health care services in a single integrated health care system may be the most significant advantage.<sup>24</sup> Multiple studies have examined dual care, representing care and services provided across 2 separate health care systems, showing an association between dual care and an increased risk of hospitalization, duplication of tests, rates for prescribing potentially unsafe medications, and mortality.<sup>25-27</sup> Although no study to date is on point, it is reasonable to imply that dual care imposes unnecessary risks to the veteran receiving



**TABLE 5** Kaplan-Meier Survival Estimates by Distance Group for Transplants Performed in FY 2014 to FY 2016 Compared With SRTR Survival Estimates

Distances, miles	Transplants Performed, No. (%)	Mortalities, No.			Kaplan-Meier Survival Estimate, %		
		30 Days	180 Day	1 Year	30 Days	180 Days	1 Year
<b>Heart</b>							
< 100	18 (17.6)	0	0	1	100	100	94.4
100 to 300	31 (30.4)	1	2	2	96.8	93.5	93.5
301 to 500	18 (17.6)	0	0	0	100	100	-
> 500	35 (34.3)	0	2	2	100	94.3	94.3
All distances	102	1	4	5	99.0	96.1	95.1
SRTR National		-	-	-	96.1	-	90.5
<b>Kidney</b>							
< 100	44 (10.7)	0	0	0	100	100	-
100 to 300	109 (26.5)	0	2	3	100	98.2	97.0
301 to 500	86 (20.9)	0	1	3	100	98.8	96.4
> 500	172 (41.8)	1	2	4	99.4	98.8	97.6
All distances	411	1	5	10	99.8	98.8	97.4
SRTR National		-	-	-	99.5	-	97.3
<b>Liver</b>							
< 100	82 (21.4)	1	3	5	98.8	96.3	93.9
100 to 300	144 (37.6)	4	8	13	97.2	94.4	90.5
301 to 500	62 (16.2)	2	7	8	96.8	88.7	87.0
> 500	95 (24.8)	1	3	5	98.9	96.8	94.5
All distances	383	8	21	31	97.9	94.5	91.7
SRTR National		-	-	-	97.3	-	91.6
<b>Lung</b>							
< 100	9 (17.6)	0	0	0	100	100	100
100 to 300	4 (7.8)	0	0	0	100	100	100
301 to 500	15 (29.4)	0	2	3	100	86.7	78.0
> 500	23 (45.1)	0	2	2	100	91.3	91.3
All distances	51	0	4	5	100	92.2	89.7
SRTR National		-	-	-	97.2	-	87.6

Abbreviations: FY, fiscal year; SRTR, Scientific Registry for Transplant Recipients.

complex lifelong transplant care when the VATP is shown to provide timely and high-quality care.

**Limitations**

The retrospective design and limited study period represent limitations. Specifically, survival outcomes for veterans transplanted were limited to 1 year and do not rule out the possibility that distance to a VATC will impact

survival rates at 3 and 5 years posttransplant.

**CONCLUSION**

A referral distance of less than 100 miles from the VATC most often represents a direct referral and is a factor in timeliness of transplant initial review decision, evaluation, and placement of the veteran on the UNOS waitlist. Distance between the referring VA medical facility and the VATC, including distances of greater than 500 miles, was not found to impact the rate of mortality on the UNOS waitlist, time to transplantation, or post-transplant survival. Overall, the VHA provides timely solid organ transplant care and services with outcomes comparable to that of nationally reported SRTR estimates. Future studies should examine the timeliness of services, outcomes, and costs associated with those veterans authorized by the VHA for non-VA community care and those veterans who independently elect to receive transplant care and services by a non-VA transplant center and return to the VHA for dual care following transplantation.

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**Disclaimer**

The opinions expressed herein are those of the authors and do not necessarily reflect those of *Federal Practitioner*, Frontline Medical Communications Inc., the US Government, or any of its agencies.

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