

FINAL REPORT

**OPTN Histocompatibility Committee
Descriptive Data Request**

***Evaluation of Modification to OPTN Policy on
Using CPRA for Allocation of Deceased Donor Kidneys:
18 Month Data***

Prepared for:
Histocompatibility Committee Meeting
July 11-12, 2011

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Background/Purpose

The Histocompatibility Committee is interested in monitoring the second phase of CPRA implemented in UNetSM on October 1, 2009. Under the current policy, during allocation of deceased donor kidneys highly sensitized candidates are assigned 4 extra points. Prior to October 1, 2009 these points were assigned based on candidate's PRA value of 80% or greater. Starting October 1, 2009 points are assigned based on Calculated PRA (CPRA) value of 80% or greater.

At the January 17, 2011 conference call the committee reviewed the waiting list and transplant data 1 year before and after policy implementation. The data showed an increase in the number of unacceptable antigens reported on the waiting list and a drop in the number of positive crossmatches reported as a reason for organ refusal. After initial decline, transplant rates for non and low sensitized patients (0%/Not Reported and 1-20% PRA/CPRA) seemed to return to pre policy implementation level. Transplant rates for broadly sensitized patients (80%+ PRA/CPRA) significantly increased.

The committee requested an update of the analyses and several additional analyses to be presented during their July 2011 meeting.

Committee Annual Goal Addressed

Monitor implementation of CPRA in current kidney/pancreas allocation system.

Committee Request

The committee requested 18 month pre- and post- policy implementation data on:

- reporting of unacceptable antigens on the waiting list;
- PRA/CPRA distribution adult kidney alone registrations on the waiting list (overall, by ethnicity, by encrypted center, by encrypted center and gender, ethnicity and for registrations waiting for a re-transplant);
- comparison of CPRA values for kidney patients waiting at multiple centers and kidney patients transferred to a different center;
- the number of kidney offers refused due to the positive crossmatch by PRA/CPRA group;
- the number of deceased donor kidney transplants stratified by PRA/CPRA and HLA-ABDR mismatch level and transplant rates per 1,000 active patient years by PRA/CPRA group.

The committee also requested Kaplan-Meier graft survival rates by era stratified by PRA/CPRA.

Data and Methods

CPRA is the percentage of donors expected to have one or more of the HLA antigens listed as unacceptable on the waiting list for the candidate. CPRA defaults to zero if no unacceptable antigens are entered. HLA-C antigens are excluded from CPRA calculation. Some unacceptable antigens are rare and lead to CPRA value be rounded to zero.

Prior to October 1, 2009 allocation was based on the allocation PRA. Allocation PRA was defined as the current PRA if the waiting list record indicated that the current PRA is to be used, or peak PRA if peak was indicated. For comparison with CPRA, not reported and zero PRA values were combined into one group.

For Kaplan-Meier graft survival age was based on the age at the time of transplant. For all other analyses age group was determined based on the age at the time of listing.

Waiting list data for adult kidney alone registrations prior to October 1, 2009 were analyzed based on allocation PRA. Waiting list data for kidney registrations after October 1, 2009 were analyzed based on CPRA. A patient who is waiting at more than one center would have multiple registrations. Patients waiting for two or more organs were excluded from analysis.

For adult kidney alone registrations waiting in active status at more than one center on 03/31/2011 minimal and maximum CPRA values at different centers were compared. CPRA values were based on unacceptable antigens reported as of 03/31/2011.

For this report a transfer was counted if a patient was removed from the waiting lists for a transfer or other reason and listed at a different center for the same organ within 90 days before or after removal from the first center. If a patient was listed at more than one center after removal from the first center then the listing closest to the day of removal was selected. CPRA value at the time of removal from the first center was compared with the CPRA value at listing at the second center.

The number of positive crossmatches reported as a reason for organ refusal was limited to kidney offers for deceased donors with at least one kidney accepted for transplant. This number includes refusals for other reasons if the text field indicates that the organ was refused due to the positive crossmatch. For comparisons between eras the total number of offers was also calculated. Offers that could not be accepted for a registration (bypasses, direct donations, etc.) were excluded from the total offer count except for those refused due to the positive crossmatches. If the multiple matches were run for the same donor then the offer and refusal due to the positive crossmatch were counted only once per registration. The results were stratified by offer type (OABDR vs. non OABDR).

The number of deceased donor transplants was tabulated for adult kidney alone recipients. Multiple organ transplants were excluded. Number of transplants was stratified by HLA-ABDR mismatch level (OABDR vs. non OABDR mismatch transplants) and recipient's sensitization level. Number of OABDR mismatch transplants was affected by the allocation policy change. Mandatory non local sharing of OABDR mismatched kidneys was eliminated for adult 0-20% PRA candidates on January 21, 2009.

Transplant rates as expressed by transplants per 1,000 active patient-years were calculated by dividing the number of all deceased donor kidney transplants by the number of active years patients spent waiting, and then multiplying by 1,000. For each 18-month time interval only active waiting time within the interval analyzed was used for the patient-years calculation. Since some candidates may spend several months or years on the waiting list, a candidate may contribute waiting time to all eras, but a transplant is attributed only to the era in which it occurred. Transplant rates were computed for kidney alone patients added to the waiting list as adults. These rates were stratified by patient's PRA/CPRA value while waiting. If the same patient was actively waiting for kidney at more than one program with similar PRA/CPRA value, overlapping days of waiting time were counted only once.

The transplant rates were compared using the crude relative risk. It is a ratio of the transplant rate within the current era to that of the prior era (used as a baseline). If the ratio and 95% confidence limits are entirely above 1 then there was a statistically significant increase in the transplant rate in the current era compared to the baseline era.

Graft survival was calculated using the Kaplan-Meier method and compared using the log-rank test statistic. A significant p-value comparing all groups means that at least one of the groups is different from the others but it doesn't identify which group it is. For pair wise comparisons Scheffe's method was used to adjust for multiple comparisons.

All results are based on OPTN data as of June 3, 2011. Data are subject to change based on future data submission or correction.

Results

On 03/31/2008 (18 months prior to policy implementation), there were 256 programs with at least one kidney candidate listed. Thirteen of these programs didn't list unacceptable antigens for any of their kidney candidates. Most of these programs (11/13) had less than 15 kidney candidates listed at that time.

On 09/30/2009 (one day prior to policy implementation), 11 out of 255 programs didn't list unacceptable antigens for any of their kidney candidates.

Eighteen months later (03/31/2011) this number decreased to 8 out of 254. All programs that didn't list unacceptable antigens had 5 or fewer kidney candidates.

Table 1 shows percentiles for the number of unacceptable antigens entered for adult kidney alone registrations prior (03/31/2008 and 09/30/2009) and post (03/31/2011) policy implementation by allocation PRA/CPRA group:

- Overall number of antigens increased for sensitized registrations.
- Median number of unacceptable antigens for highly sensitized candidates (80%+ PRA/CPRA) increased from 22 to 35 antigens. Since CPRA is calculated based on unacceptable antigens entered on the waiting list this increase was expected.

Table 2 shows PRA/CPRA distribution of adult kidney alone registrations on the waiting list on 03/31/2008, 09/30/2009 and 03/31/2011 stratified by ethnicity:

- For all ethnicity groups the percentage of 0%/Not reported PRA/CPRA registrations substantially increased and the percentage of low sensitized registrations (1-20% PRA/CPRA) decreased.
- For all ethnicity groups the percentage of very broadly sensitized registrations (PRA/CPRA > 95%) increased. Overall percentage of these registrations increased from 8% on 03/31/2008 to 11% on 03/31/2011.

More than 60% (56,669) of adult kidney alone registrations waiting had 0% CPRA on 03/31/2011. Among those registrations 974 had antibodies to HLA-C antigens and 1,490 had antibodies to non HLA-C antigens. Some of these registrations (226) had antibodies to both HLA-C and non HLA-C antigens.

Table 3 compares CPRA distribution of female vs. male adult kidney alone registrations by date:

- Only 49% of female registrations are non sensitized (0% CPRA) compared to 72% for males.
- 25% of females are broadly sensitized (80%+ CPRA) compared to 11% males.
- After CPRA implementation the percentage of very broadly sensitized registrations (>95% CPRA) increased for both genders.

Table 4 compares CPRA distribution of adult kidney alone registrations waiting for a repeat transplant vs. their first transplant:

- Only 30% of primary transplant registrations are sensitized to any degree (>0% CPRA) compared to 77% for registrations with a previous graft failure.
- Only 9% of primary transplant registrations are broadly sensitized (80%+ CPRA) compared to 58% for re-transplant registrations.

- 18 months after CPRA implementation the percentage of very broadly sensitized registrations (>95% CPRA) increased by 16 percentage points for those waiting for a re-transplants compared to 18 months prior.

CPRA distribution of adult kidney alone registrations on 03/31/2011 is compared by center on **figures 1-3** (overall), **4-6** (for females), **7-9** (for males), **10-12** (White registrations), **13-15** (African American registrations), **16-18** (Hispanic registrations), **19-21** (Asian registrations), **20-24** (registrations with Other ethnicity) and **25-27** (registrations waiting for a re-transplant).

Figure 28 shows percentages of inactive adult kidney alone registrations for each allocation PRA/CPRA value on 03/31/2008, 09/30/2009 and 03/31/2011. For each allocation PRA/CPRA value approximately one third of registrations were inactive.

Figure 29 and **table 5** compare minimum and maximum CPRA values for adult kidney alone patients actively waiting at two or more centers on 03/31/2011:

- 60% of patients have the same CPRA value at all centers.
- 19% of those listed with 0% CPRA at one center had >20% CPRA at a different center.

Figure 30 and **table 6** compare CPRA values at removal from the first center and at listing at the second center for adult kidney alone registrations transferred to a different center:

- 61% of registrations had the same CPRA value at both centers.
- 29% of those listed with 0% CPRA had >20% CPRA at the time of removal from the first center.
- 90% of registrations were listed with 0% CPRA at the second center. Only 61% had 0% CPRA value at the time of removal from the first center.

Table 7 shows the number of kidney offers refused due to the positive crossmatch reported by offer type and era:

- During eighteen months following the policy implementation this number substantially decreased for all sensitization groups. The overall decrease was 66%.
- The percentage of offers decline due to positive crossmatches out of all offers made also decreased (from 1.8% to 0.7%).
- Even though the number of OABDR mismatch offers refused due to the positive crossmatch remained stable, the total number OABDR offers decreased in the 18 months after the policy change. This lead to the increase in percentage of OABDR offers refused due to the positive crossmatches from 1.6% to 3.0%. This increase was statistically significant.

Table 8 displays the number and percentage of deceased donor adult kidney alone transplants by era, recipient's sensitization level and OABDR mismatch:

- Following the policy implementation the percentage of transplants increased for 0/Not reported PRA/CPRA group and decreased for 1-20% PRA/CPRA group. These changes mirror the changes in the PRA/CPRA distribution of registrations on the waiting list.
- For broadly sensitized transplant recipients (80% PRA/CPRA) 19% of transplants are OABDR mismatched.

Table 9 shows transplant rates by 1,000 active patient-years for adult kidney alone patients ever on the waiting list during pre- and post- policy implementation stratified by era and sensitization level. **Figure 31** compares transplant rates in the two nine months intervals after the policy implementation (10/01/2009-06/30/2010 and 07/01/2011-03/31/2011) to the 9 months prior (01/01/2009-09/30/2009). And **figure 32** compares transplant rates in the two nine month intervals after the policy to 1 year prior (10/01/2008-09/30/2009)

- Comparing to 1 year prior, transplant rates for non sensitized group (0%/Not Reported) declined in the first 9 months and then returned to the pre policy level. Comparing to 9 months prior, transplant rates for this group weren't significantly different after the implementation.
- Transplant rates for low sensitized group (1-20% PRA/CPRA) significantly decreased after the policy implementation. Even after the decrease transplant rate for this group wasn't significantly different from rates for other groups post policy implementation.
- Transplant rate for moderately sensitized candidates (21-79%) didn't change significantly following the policy implementation.
- Comparing to 1 year prior, transplant rates for broadly sensitized group (80%+) significantly increased in the first 9 months and then returned to the pre policy level. Comparing to 9 months prior, transplant rates for this group weren't significantly different after the implementation.
- Even though the transplant rate for broadly sensitized group is the lowest among all four sensitization groups, in the second 9 months after the implementation (07/01/2010-03/31/2011) it wasn't significantly different from the rate for non and low sensitized groups.

Figure 33 compares 1 year Kaplan-Meier graft survival for adult kidney recipients transplanted in 2007-9/2009 vs. 10/2009-3/2010 by PRA/CPRA group:

- In the post policy period 1 year graft survival wasn't statistically different compared to the pre policy.

- In post policy period 1 year graft survival was similar across all CPRA groups.

Tables 10 through 13 compare Kaplan-Meier graft survival by era (2001-2003, 2004-2006, 2007-9/2009 and 10/2009-3/2010) by PRA/CPRA group. Within each PRA/CPRA group survival improved in the recent eras compared to the older era.

Summary

After the policy implementation on October 1, 2009:

- There was an increase in the number of unacceptable antigens that were reported on the waiting list and a substantial decrease in the number of kidney refusals due to the positive crossmatch.
- The percentage of non sensitized registrations (0%/Not reported PRA/CPRA) increased and the percentage of low sensitized registrations (1-20% PRA/CPRA) decreased. The percentage of very broadly sensitized registrations (>95% PRA/CPRA) also increased.
- Only 30% of primary transplant registrations are sensitized to any degree (>0% CPRA) compared to 77% for registrations with a previous graft failure.
- There is a variation in CPRA distribution by center.
- After initial decline for non sensitized and increase for broadly sensitized patients, transplant rates for these groups seem to return to pre policy implementation level. Even though transplant rate for low sensitized patients significantly decreased, the rate of transplantation for this group is not significantly different from other groups.

Table 1. Number of Unacceptable Antigens Listed for Adult Kidney Alone Registrations Prior and Post Policy Implementation by Allocation PRA/CPRA Group

Date	Allocation PRA/CPRA Group (%)	Percentile				
		5th	25th	50th	75th	95th
03/31/2008	0/Not Reported	0	0	0	0	0
	1 - 20	0	0	0	1	7
	21 - 79	0	0	4	11	28
	80+	0	6	22	40	67
09/30/2009	0/Not Reported	0	0	0	0	0
	1 - 20	0	0	0	2	7
	21 - 79	0	1	5	11	29
	80+	0	15	31	49	74
03/31/2011	0/Not Reported	0	0	0	0	0
	1 - 20	1	1	2	3	6
	21 - 79	1	3	5	9	19
	80+	8	21	35	53	77

*CPRA defaults to zero if no unacceptable antigens are entered.

Table 2. Allocation PRA/CPRA Distribution of Adult Kidney Alone Registrations on the Waiting List by Ethnicity and Date

Ethnicity	PRA/CPRA Group (%)	Date					
		03/31/2008		09/30/2009		03/31/2011	
		N	%	N	%	N	%
Total	0/Not Reported	43,621	57.1	46,500	55.7	56,669	62.7
	1 - 20	11,591	15.2	12,415	14.9	6,073	6.7
	21 - 50	5,683	7.4	6,560	7.9	6,472	7.2
	51 - 79	4,725	6.2	5,355	6.4	6,058	6.7
	80 - 95	4,820	6.3	5,376	6.4	4,830	5.3
	>95	5,984	7.8	7,236	8.7	10,286	11.4
	Total	76,424	100.0	83,442	100.0	90,388	100.0
White	0/Not Reported	17,087	58.1	18,225	56.9	22,124	64.1
	1 - 20	4,490	15.3	4,914	15.4	2,332	6.8
	21 - 50	2,038	6.9	2,330	7.3	2,276	6.6
	51 - 79	1,786	6.1	2,010	6.3	2,207	6.4
	80 - 95	1,784	6.1	1,933	6.0	1,803	5.2
	>95	2,248	7.6	2,601	8.1	3,756	10.9
	Total	29,433	100.0	32,013	100.0	34,498	100.0
African American	0/Not Reported	14,075	52.2	14,578	50.0	17,926	57.2
	1 - 20	4,186	15.5	4,612	15.8	2,255	7.2
	21 - 50	2,249	8.3	2,615	9.0	2,570	8.2
	51 - 79	1,864	6.9	2,038	7.0	2,361	7.5
	80 - 95	1,990	7.4	2,177	7.5	1,872	6.0
	>95	2,620	9.7	3,151	10.8	4,344	13.9
	Total	26,984	100.0	29,171	100.0	31,328	100.0
Hispanic	0/Not Reported	8,084	61.6	9,060	61.5	11,151	68.4
	1 - 20	1,909	14.5	1,898	12.9	928	5.7
	21 - 50	900	6.9	1,034	7.0	1,030	6.3
	51 - 79	736	5.6	877	6.0	958	5.9
	80 - 95	742	5.7	881	6.0	791	4.9
	>95	750	5.7	977	6.6	1,447	8.9
	Total	13,121	100.0	14,727	100.0	16,305	100.0
Asian	0/Not Reported	3,335	64.2	3,651	62.7	4,362	67.1
	1 - 20	773	14.9	762	13.1	432	6.6
	21 - 50	383	7.4	448	7.7	458	7.0
	51 - 79	252	4.8	323	5.5	410	6.3

Ethnicity	PRA/CPRA Group (%)	Date					
		03/31/2008		09/30/2009		03/31/2011	
		N	%	N	%	N	%
	80 - 95	215	4.1	275	4.7	288	4.4
	>95	238	4.6	361	6.2	549	8.4
	Total	5,196	100.0	5,820	100.0	6,499	100.0
	Other	0/Not Reported	1,040	61.5	986	57.6	1,106
	1 - 20	233	13.8	229	13.4	126	7.2
	21 - 50	113	6.7	133	7.8	138	7.8
	51 - 79	87	5.1	107	6.3	122	6.9
	80 - 95	89	5.3	110	6.4	76	4.3
	>95	128	7.6	146	8.5	190	10.8
	Total	1,690	100.0	1,711	100.0	1,758	100.0

Table 3. Allocation PRA/CPRA Distribution of Adult Kidney Alone Registrations on the Waiting List by Gender and Date

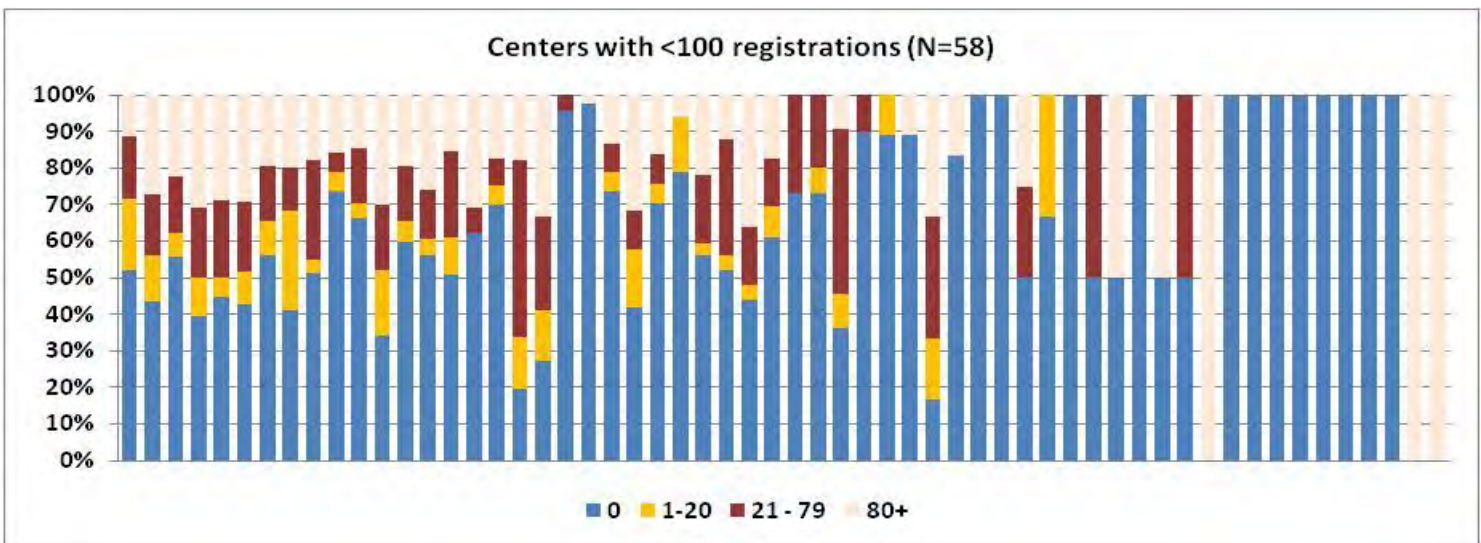
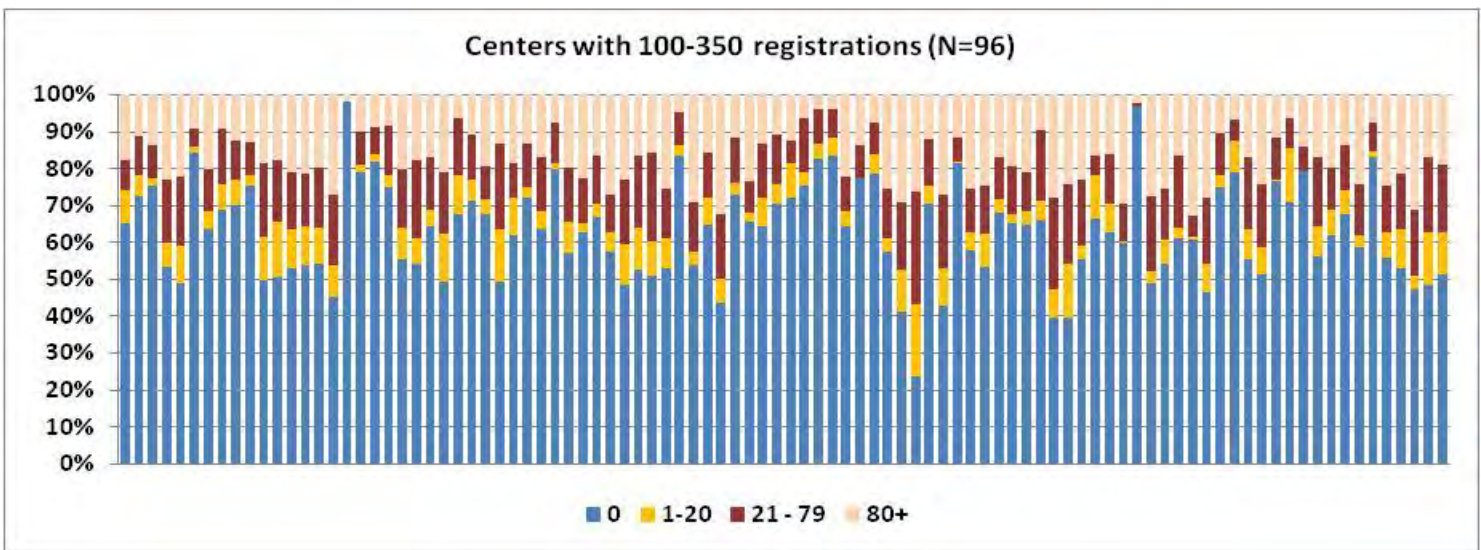
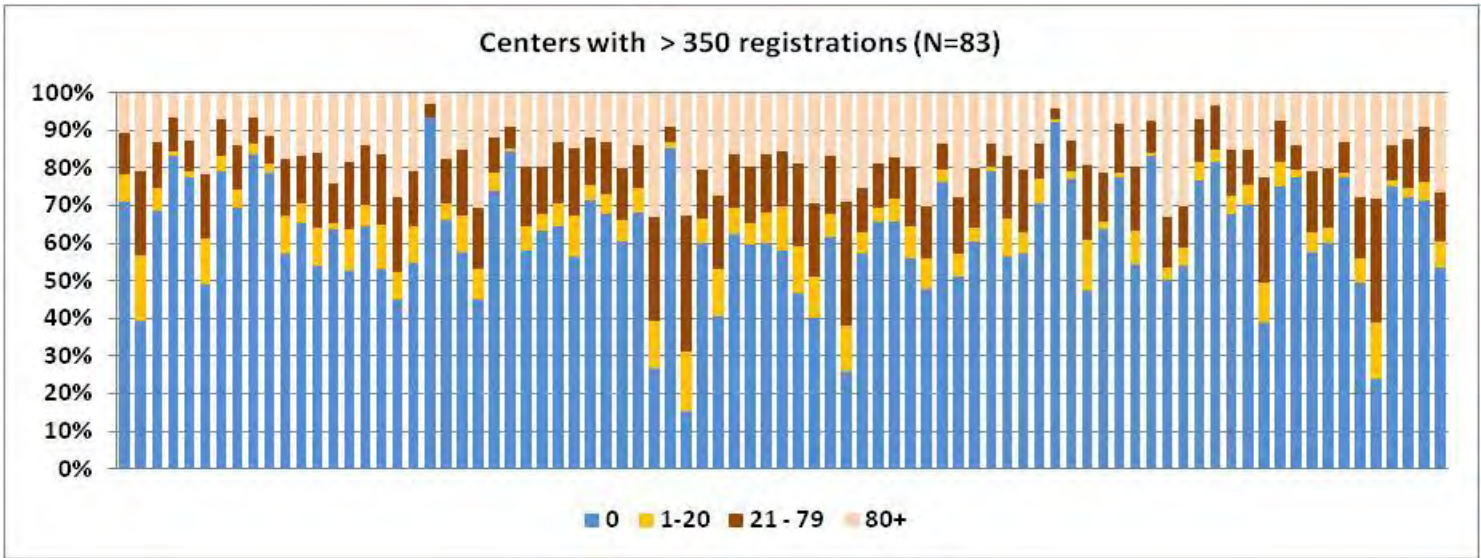
Gender	PRA/CPRA Group (%)	Date					
		03/31/2008		09/30/2009		03/31/2011	
		N	%	N	%	N	%
Female	0/Not Reported	14,523	45.1	15,097	43.3	18,372	49.4
	1 - 20	4,535	14.1	4,691	13.4	2,265	6.1
	21 - 50	3,276	10.2	3,662	10.5	3,309	8.9
	51 - 79	3,104	9.6	3,544	10.2	3,795	10.2
	80 - 95	3,107	9.7	3,510	10.1	3,233	8.7
	>95	3,635	11.3	4,376	12.5	6,232	16.7
	Total	32,180	100.0	34,880	100.0	37,206	100.0
Male	0/Not Reported	29,098	65.8	31,403	64.7	38,297	72.0
	1 - 20	7,056	15.9	7,724	15.9	3,808	7.2
	21 - 50	2,407	5.4	2,898	6.0	3,163	5.9
	51 - 79	1,621	3.7	1,811	3.7	2,263	4.3
	80 - 95	1,713	3.9	1,866	3.8	1,597	3.0
	>95	2,349	5.3	2,860	5.9	4,054	7.6
	Total	44,244	100.0	48,562	100.0	53,182	100.0

Table 4. Allocation PRA/CPRA Distribution of Adult Kidney Alone Registrations on the Waiting List Waiting for a Primary vs. Repeat Transplant by Date

Waiting for a repeat transplant?	PRA/CPRA Group (%)	Date					
		03/31/2008		09/30/2009		03/31/2011	
		N	%	N	%	N	%
No	0/Not Reported	40,632	64.0	43,607	62.6	53,353	70.1
	1 - 20	10,458	16.5	11,338	16.3	5,663	7.4
	21 - 50	4,412	6.9	5,398	7.7	5,626	7.4
	51 - 79	3,095	4.9	3,680	5.3	4,605	6.1
	80 - 95	2,501	3.9	2,872	4.1	2,853	3.7
	>95	2,413	3.8	2,811	4.0	3,982	5.2
	Total	63,511	100.0	69,706	100.0	76,082	100.0
Yes	0/Not Reported	2,989	23.1	2,893	21.1	3,316	23.2
	1 - 20	1,133	8.8	1,077	7.8	410	2.9
	21 - 50	1,271	9.8	1,162	8.5	846	5.9
	51 - 79	1,630	12.6	1,675	12.2	1,453	10.2
	80 - 95	2,319	18.0	2,504	18.2	1,977	13.8
	>95	3,571	27.7	4,425	32.2	6,304	44.1
	Total	12,913	100.0	13,736	100.0	14,306	100.0

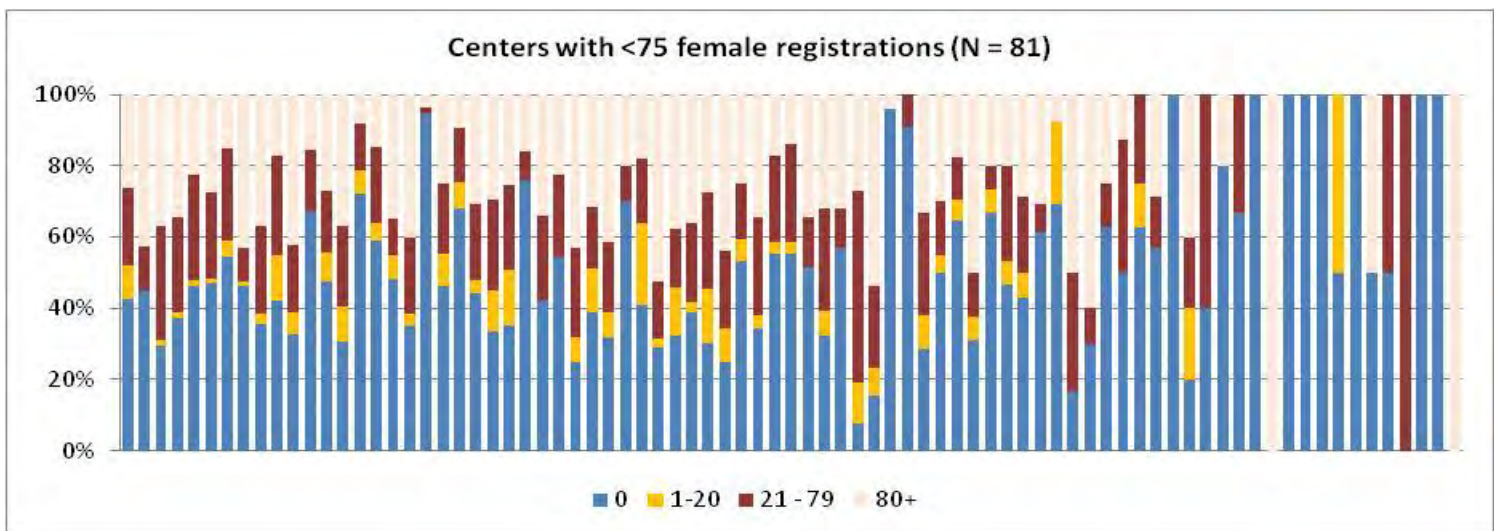
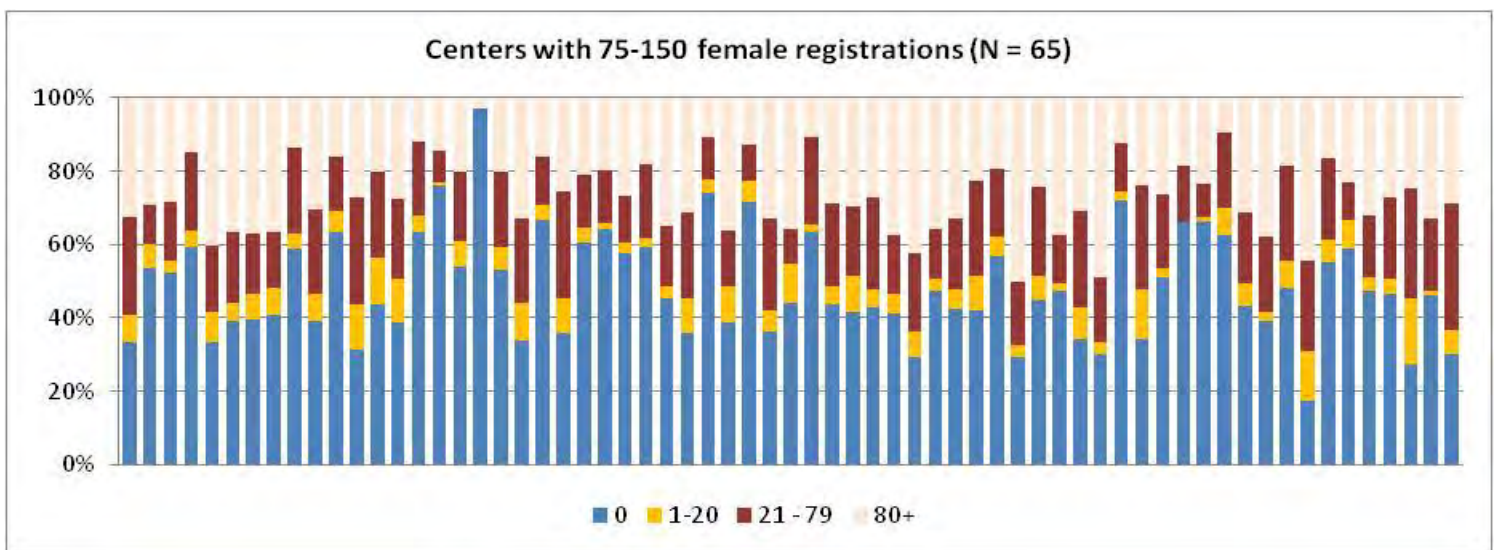
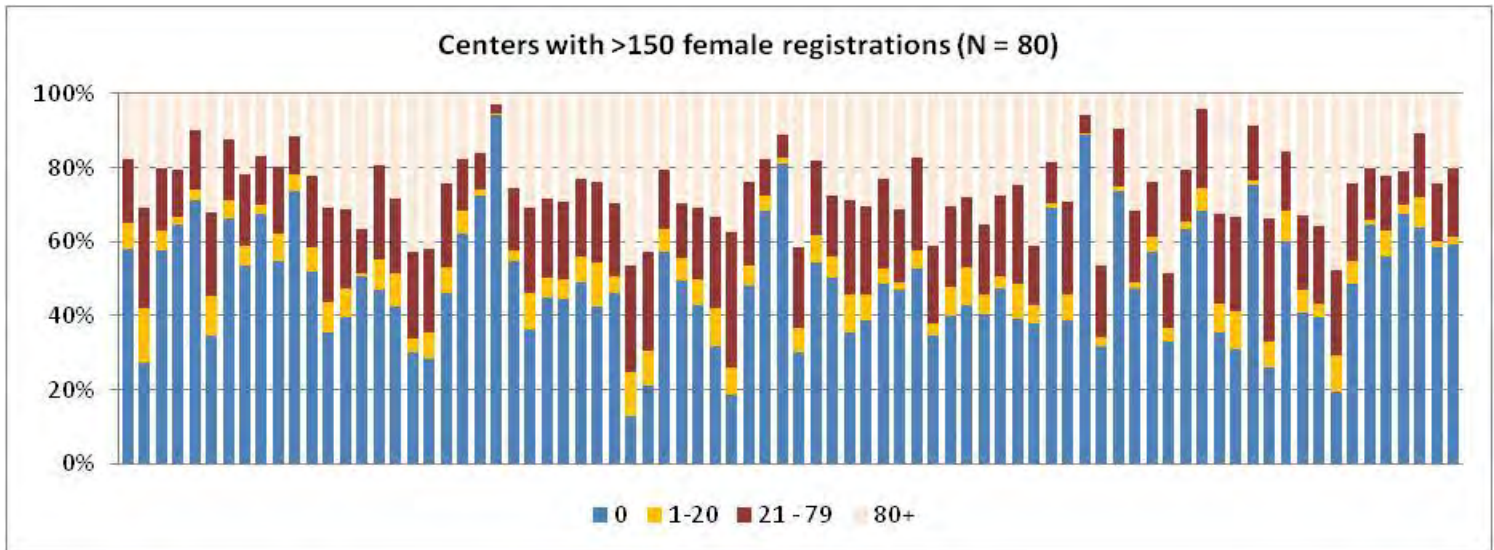
Figures 1-3. CPRA Distribution of Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of adult kidney alone registrations.



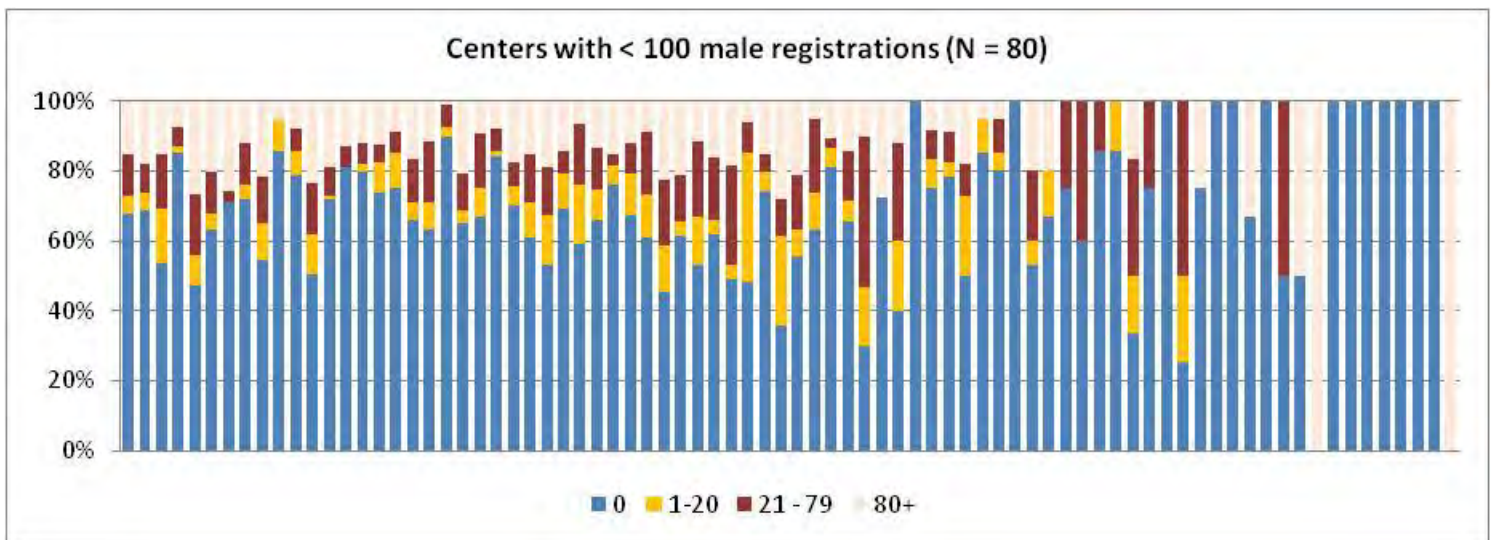
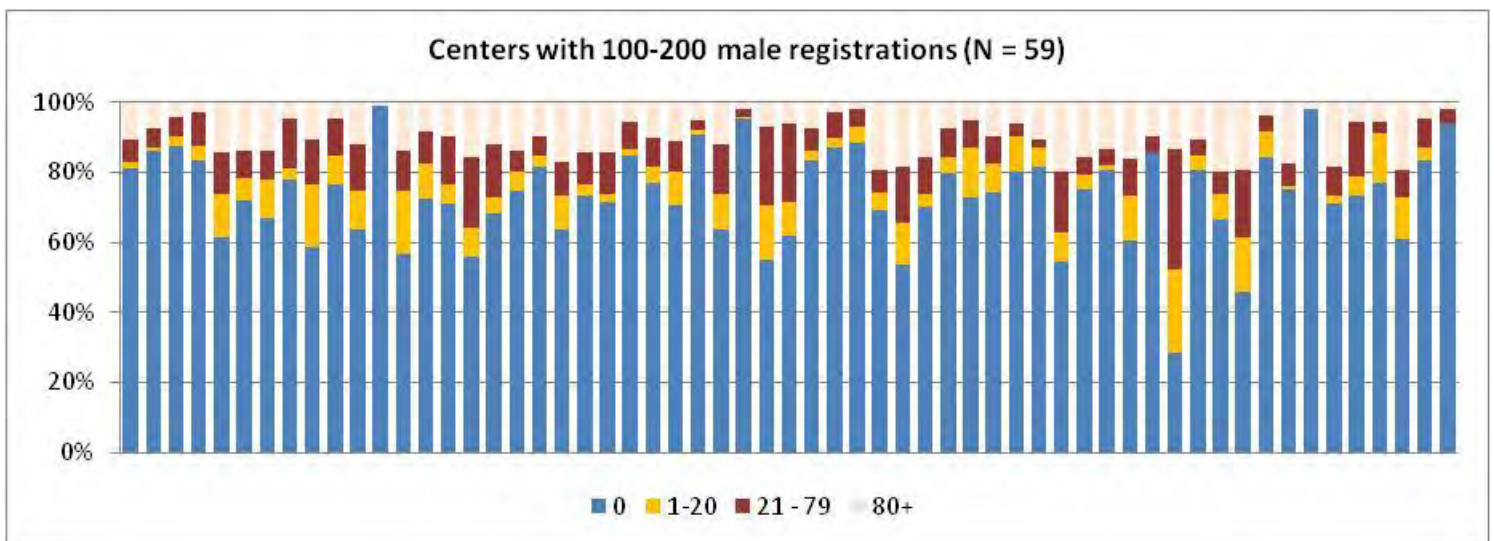
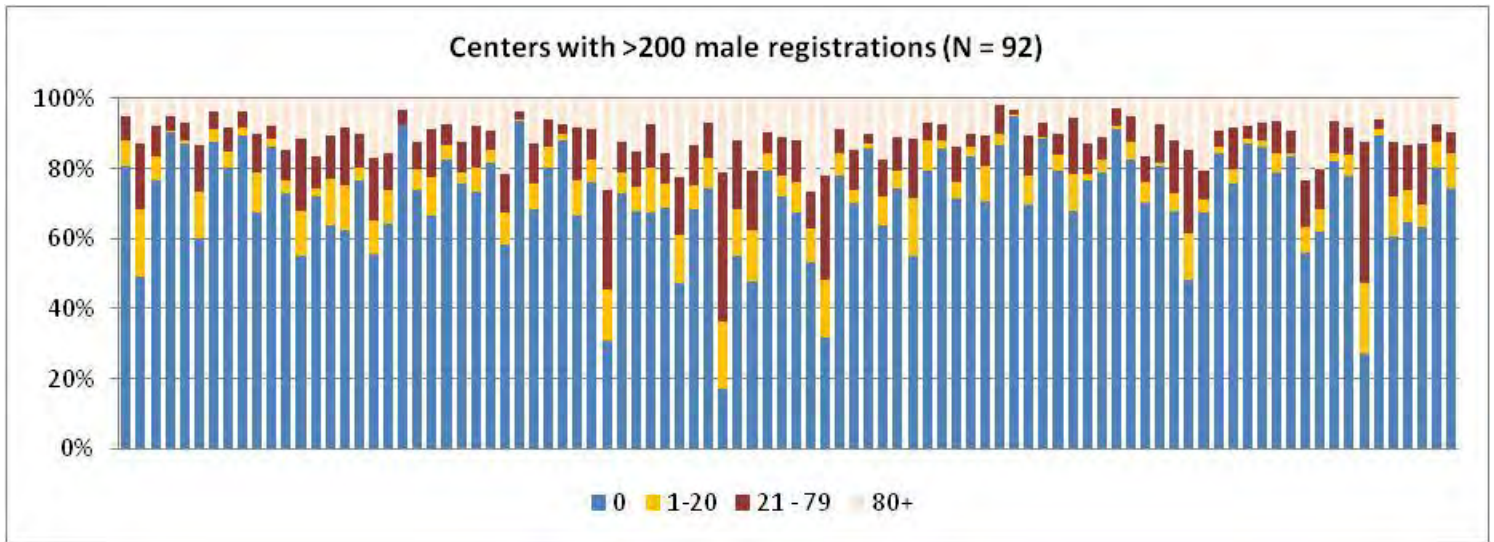
Figures 4-6. CPRA Distribution of Female Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of female adult kidney alone registrations.



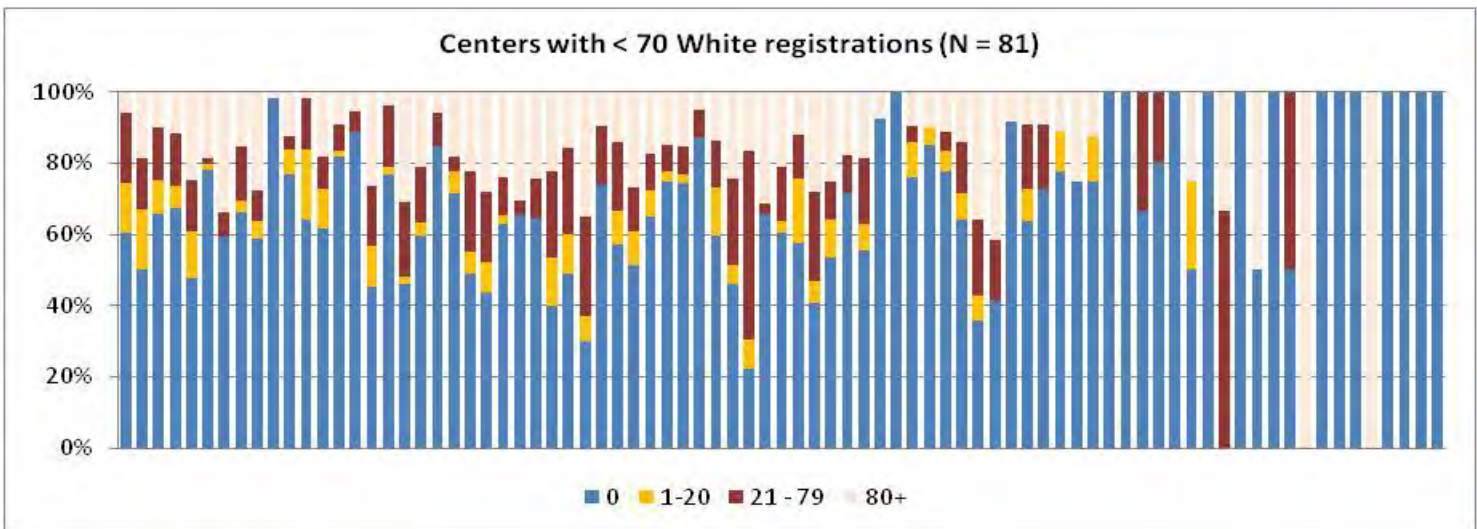
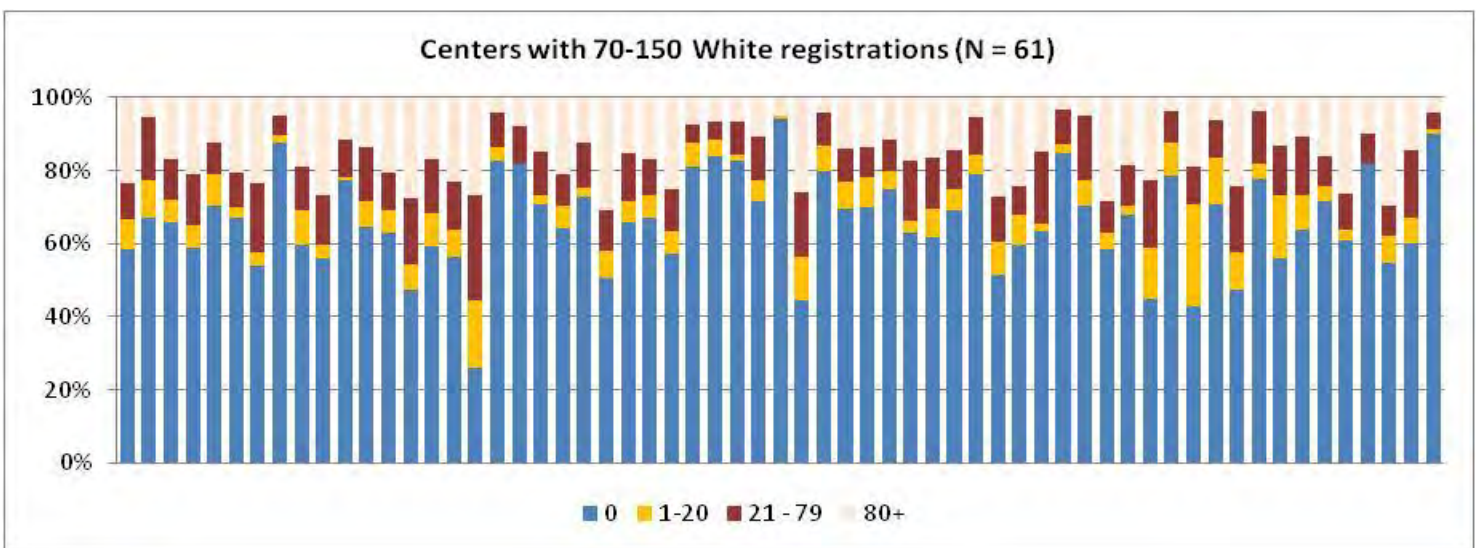
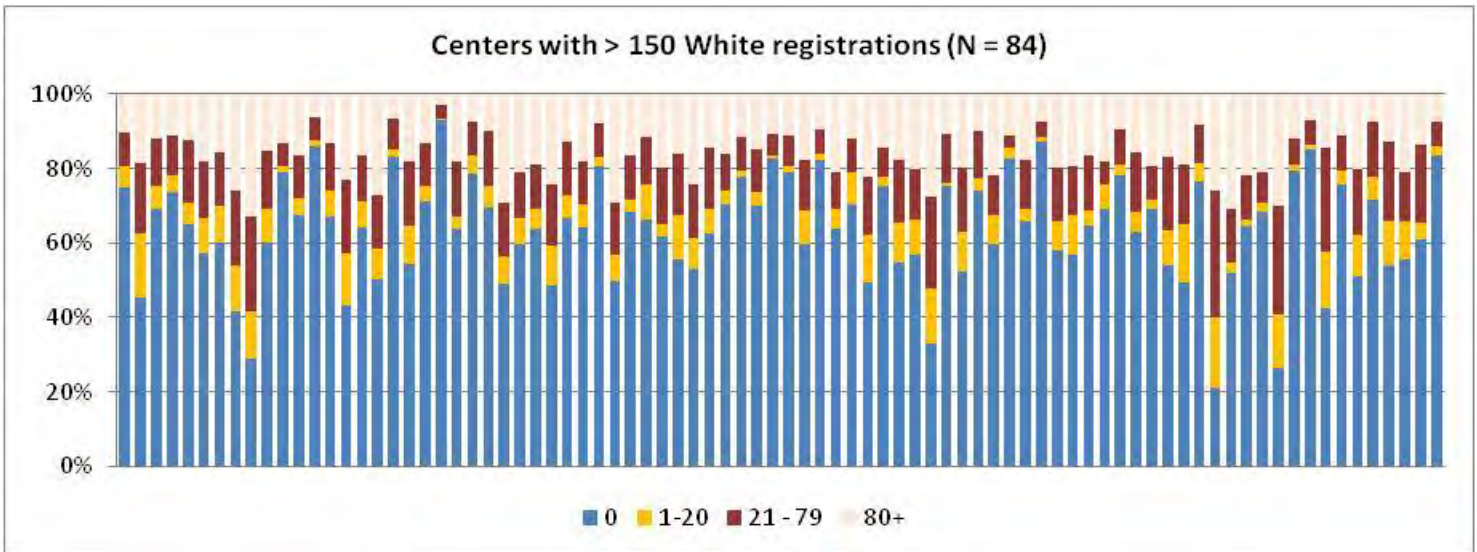
Figures 7-9. CPRA Distribution of Male Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of male adult kidney alone registrations.



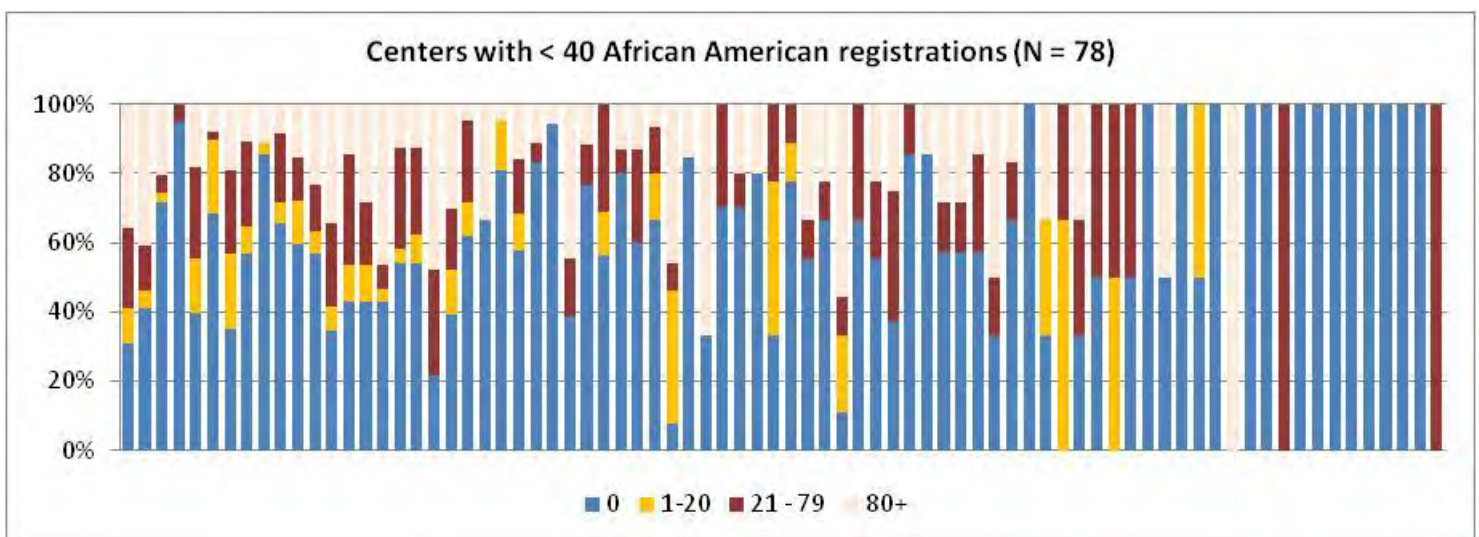
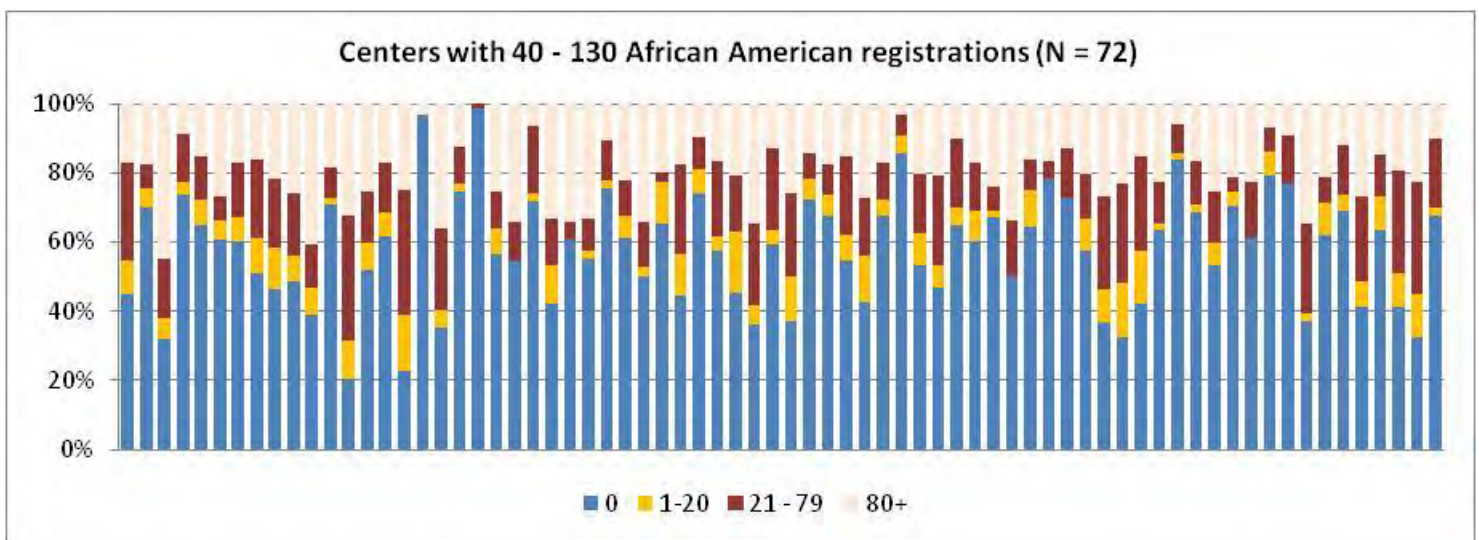
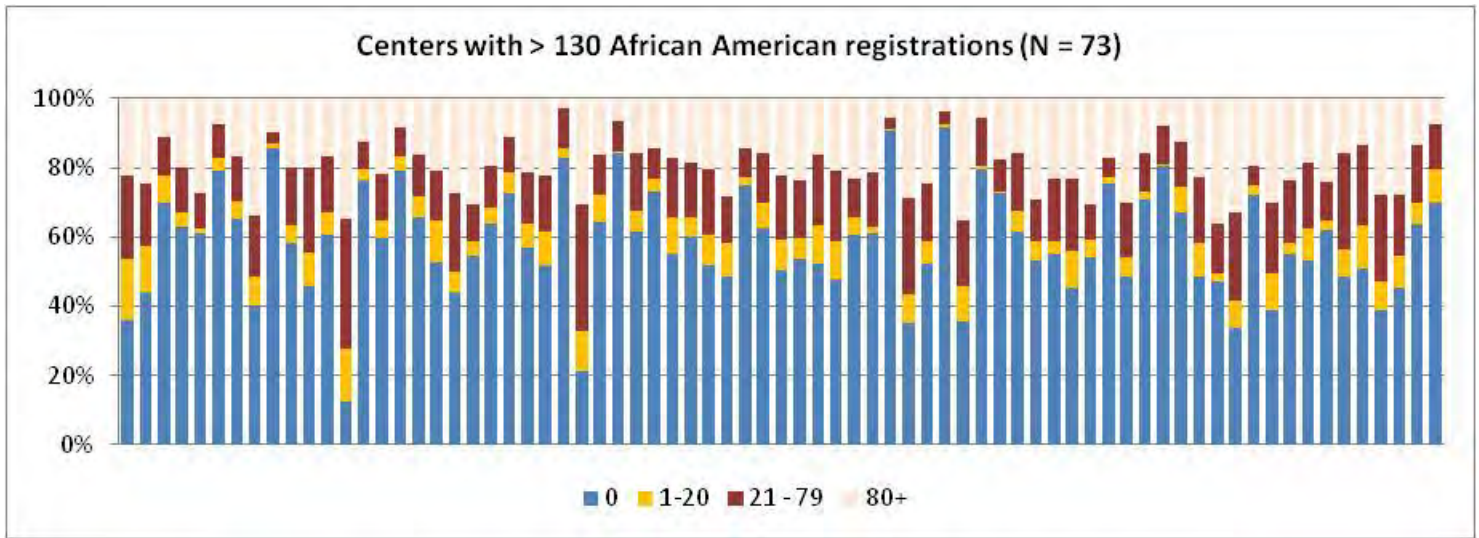
Figures 10-12. CPRA Distribution of White Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of White adult kidney alone registrations.



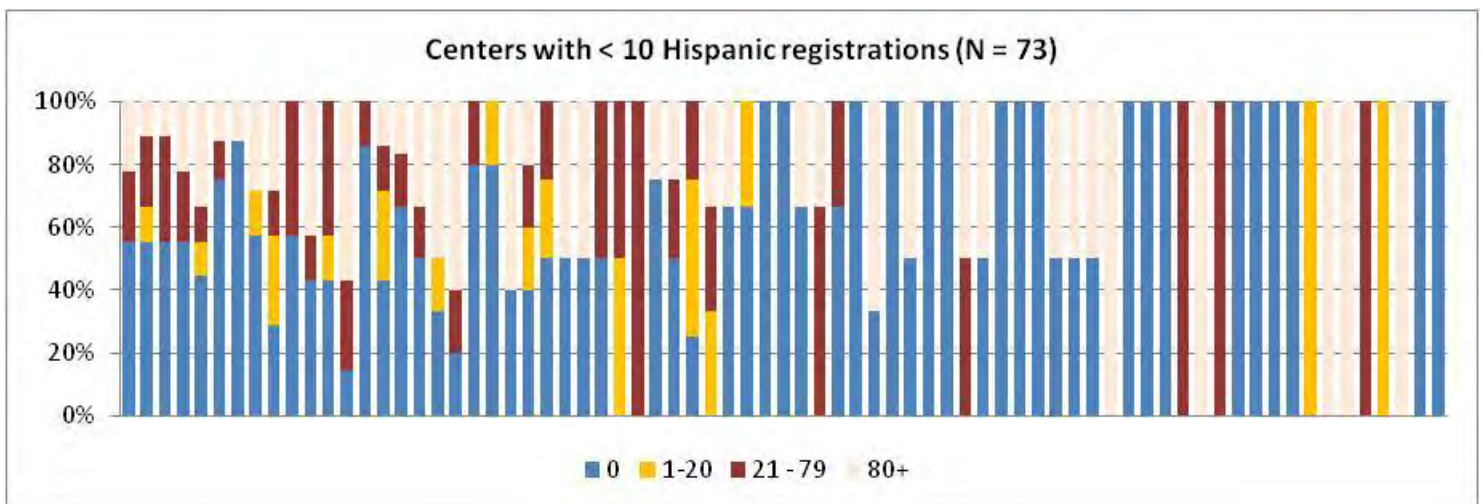
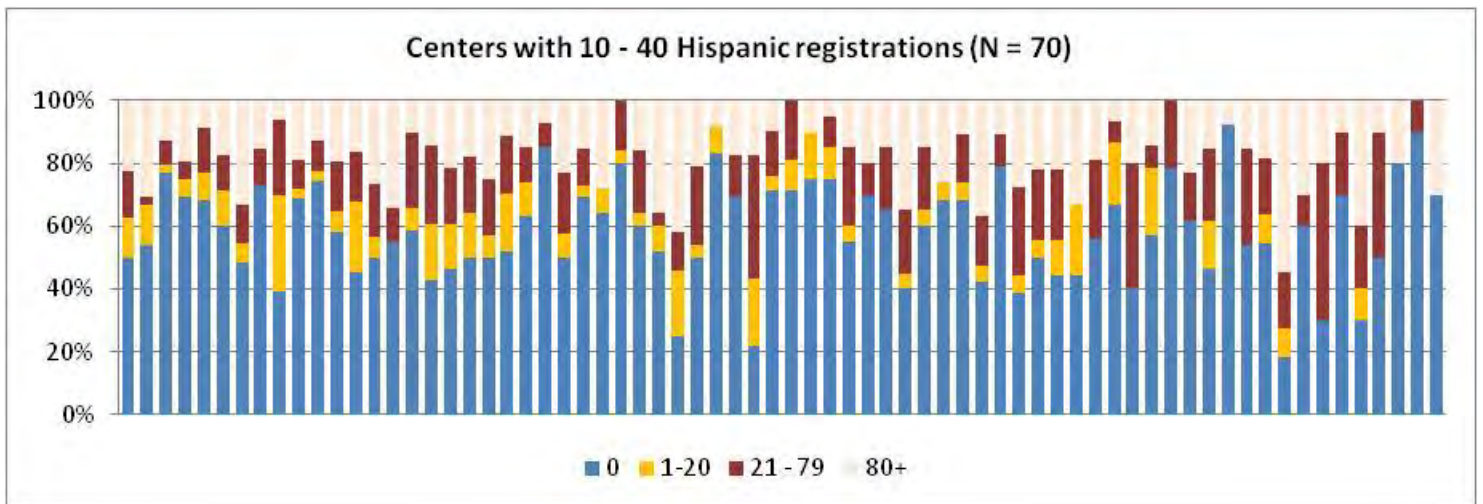
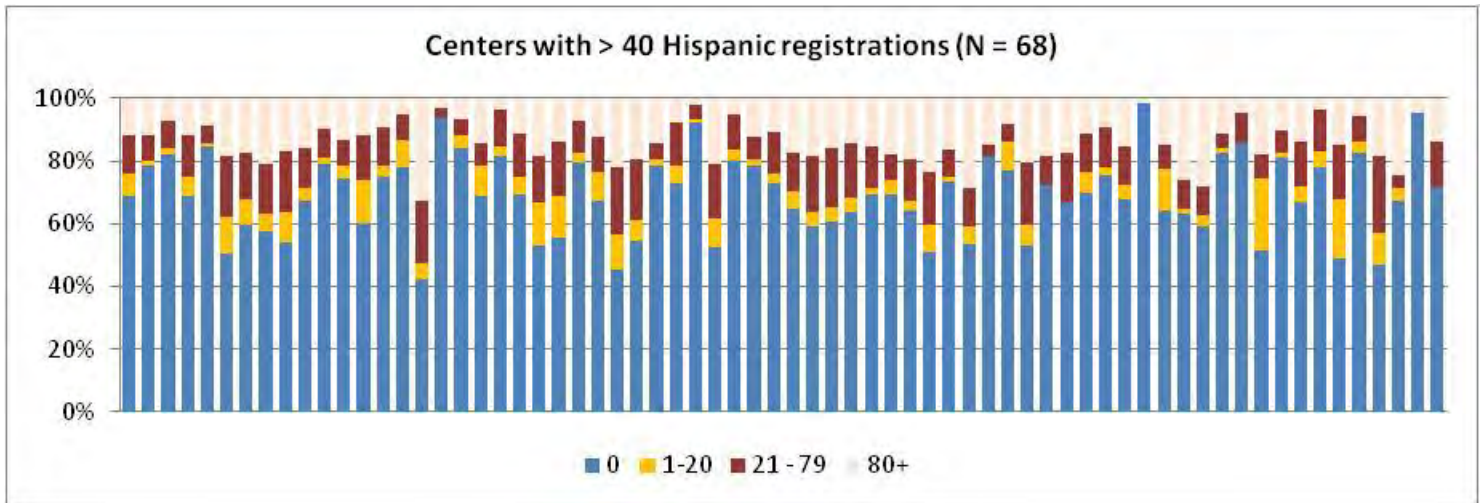
Figures 13-15. CPRA Distribution of African American Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of African American adult kidney alone registrations.



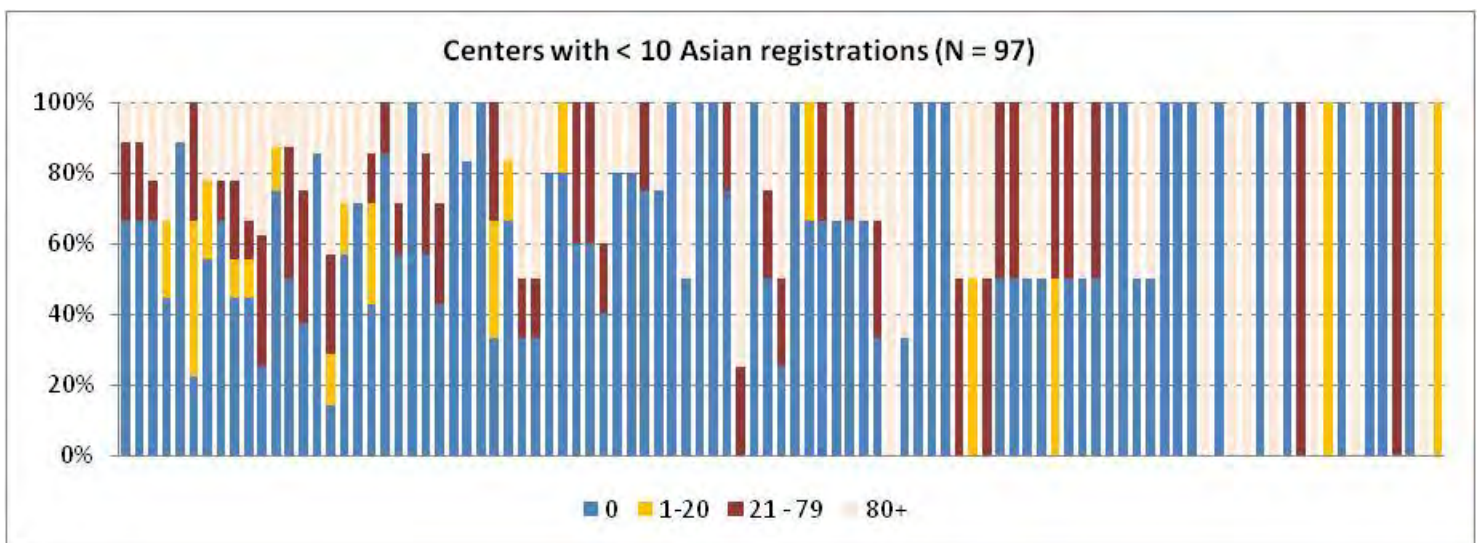
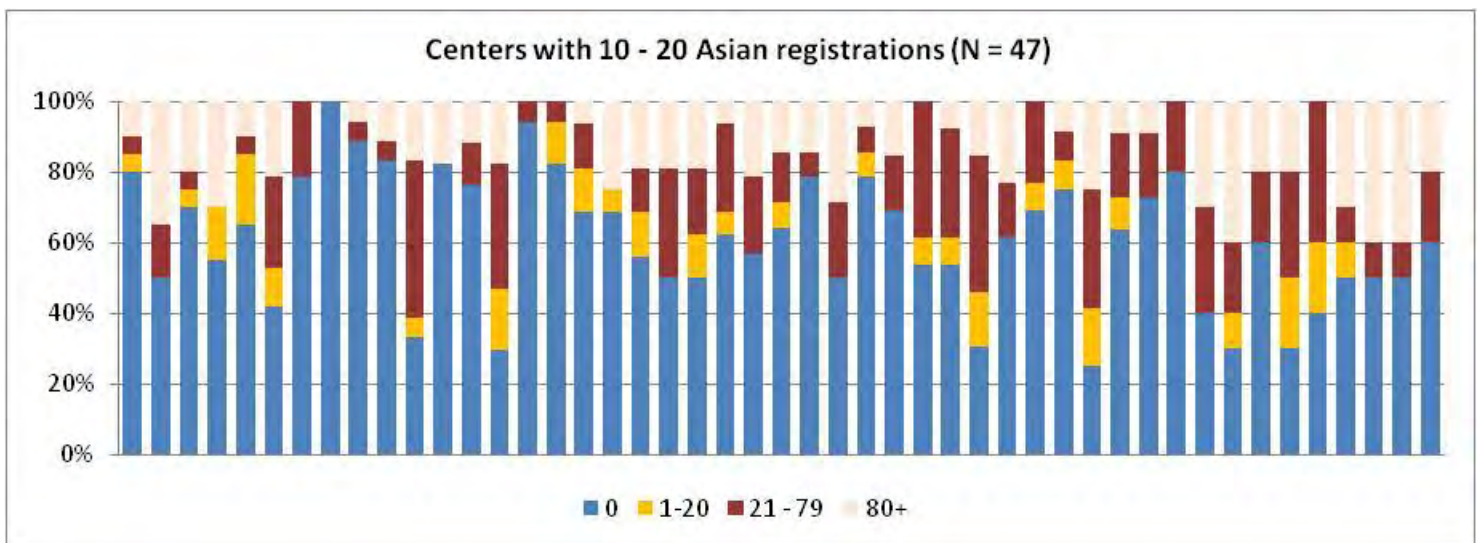
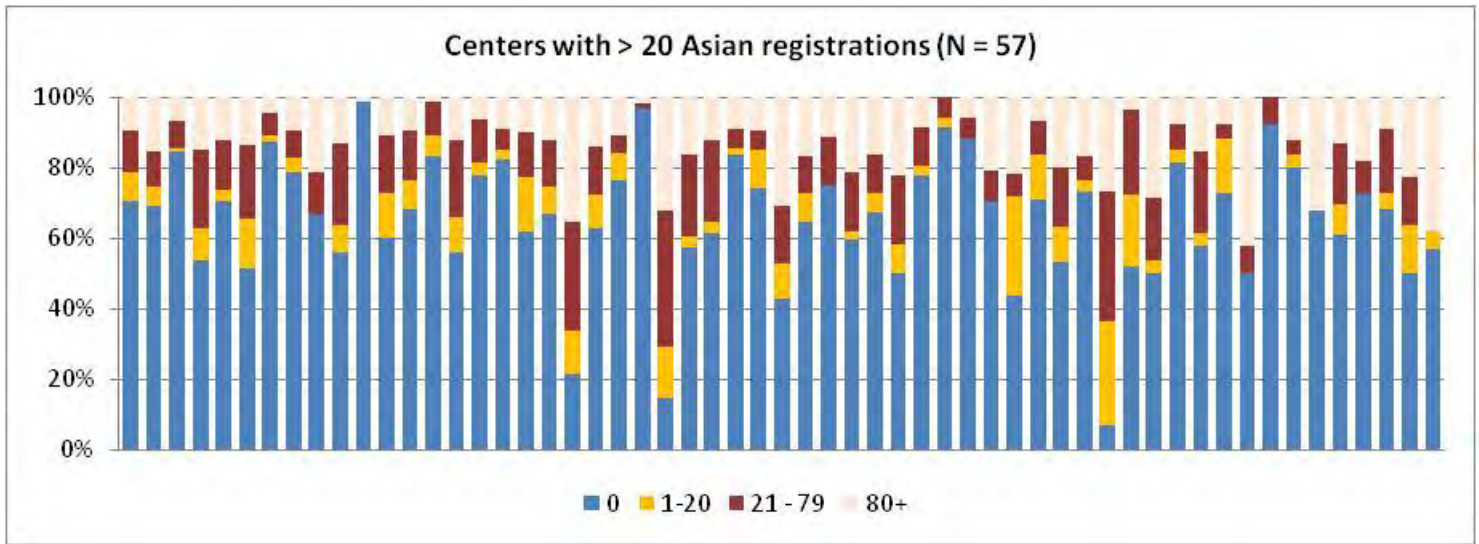
Figures 16-18. CPRA Distribution of Hispanic Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of Hispanic adult kidney alone registrations.



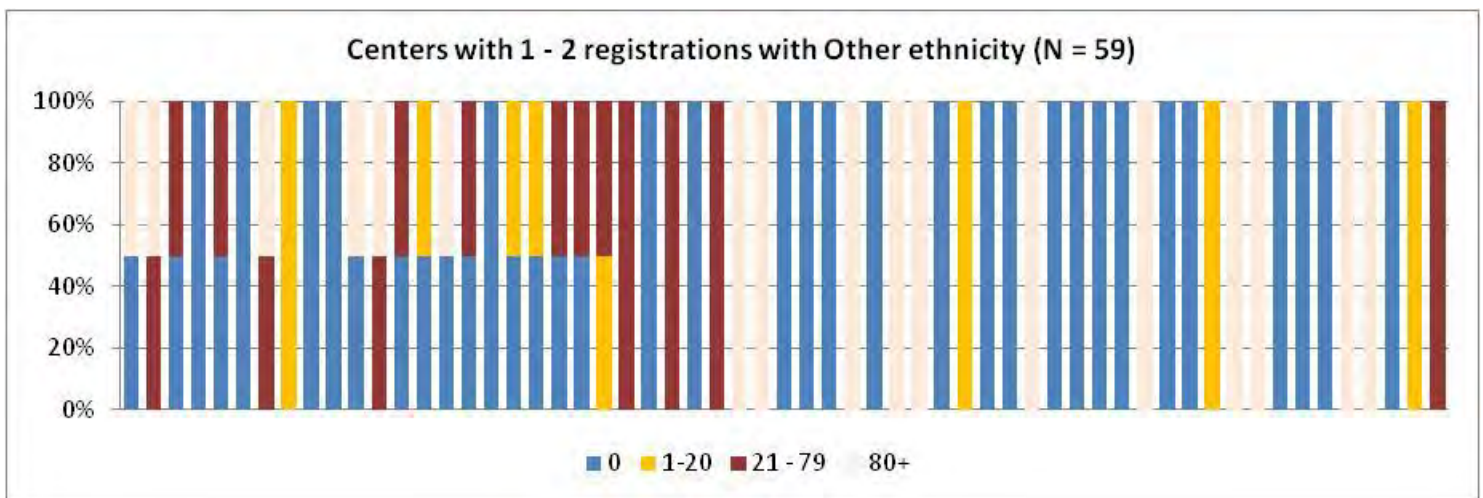
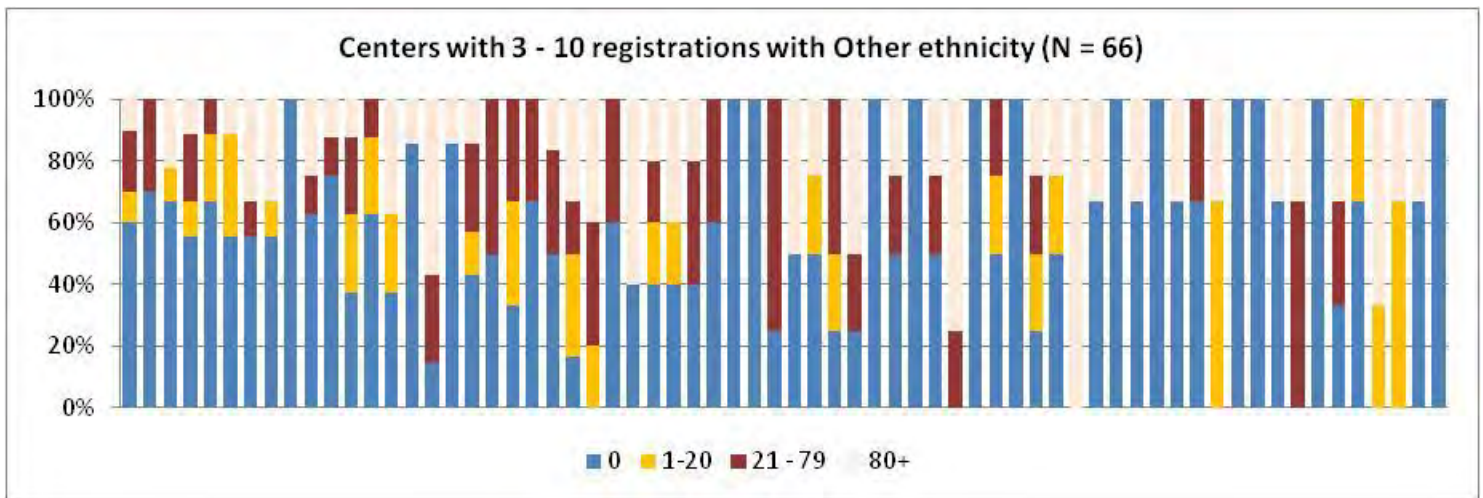
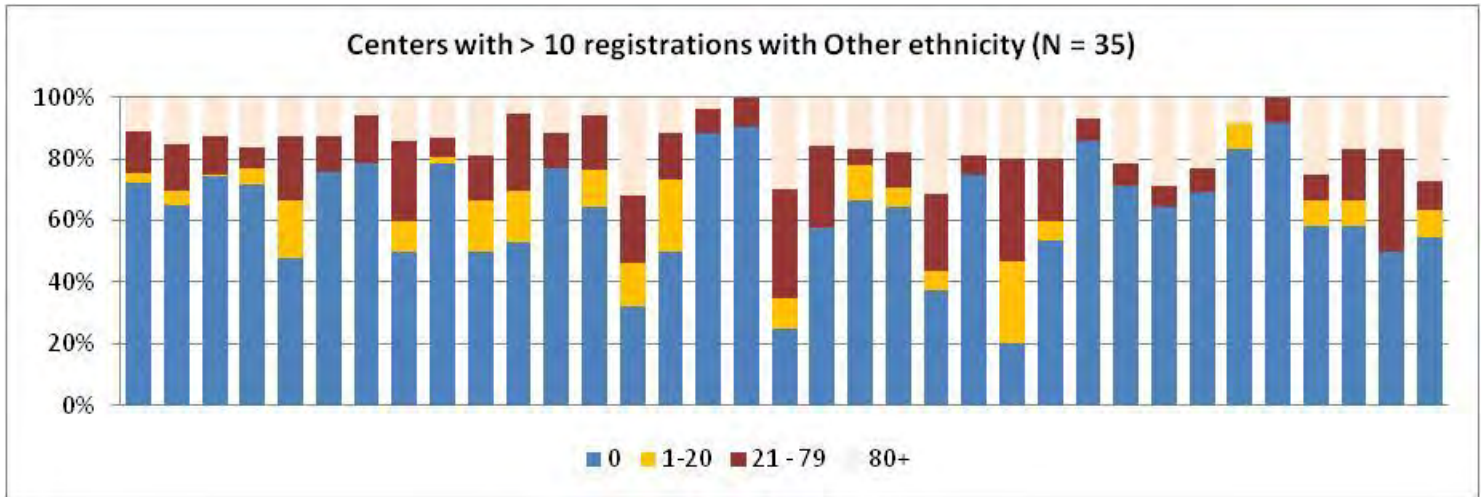
Figures 19-21. CPRA Distribution of Asian Adult Kidney Alone Registrations by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of Asian adult kidney alone registrations.



Figures 22-24. CPRA Distribution of Adult Kidney Alone Registrations with Other Ethnicity by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of adult kidney alone registrations with Other ethnicity.



Figures 25-27. CPRA Distribution of Adult Kidney Alone Registrations Waiting for a Re-Transplant by Center, 03/31/2011

Note: Centers are sorted in descending order by the total number of re-transplant kidney alone registrations.

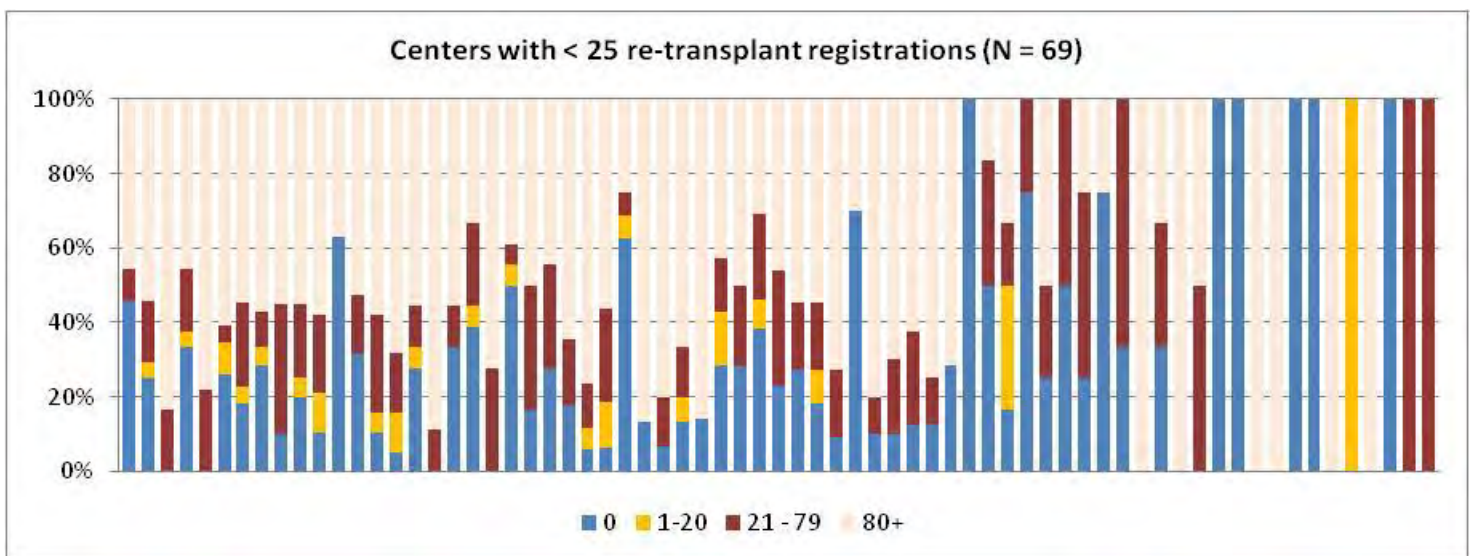
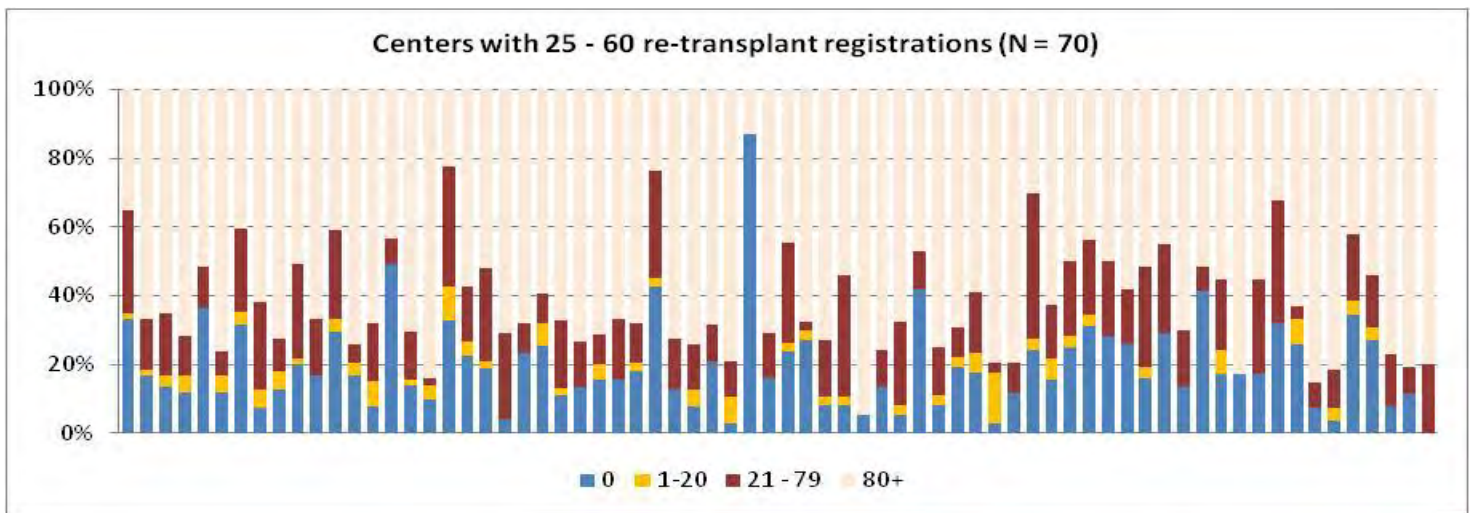
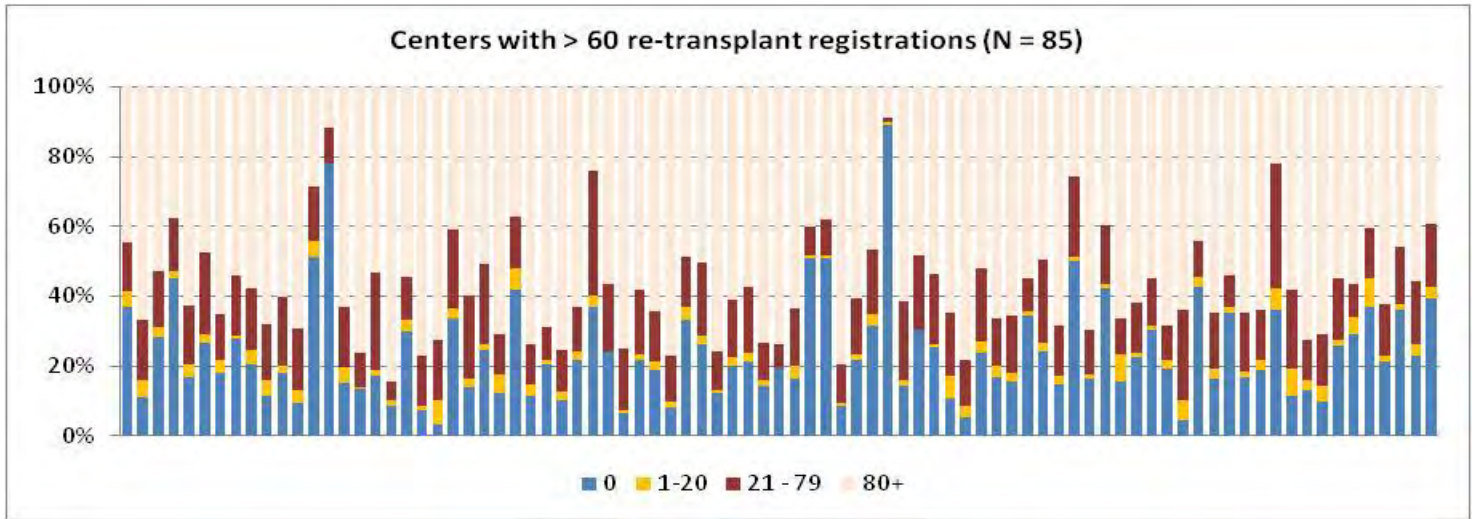
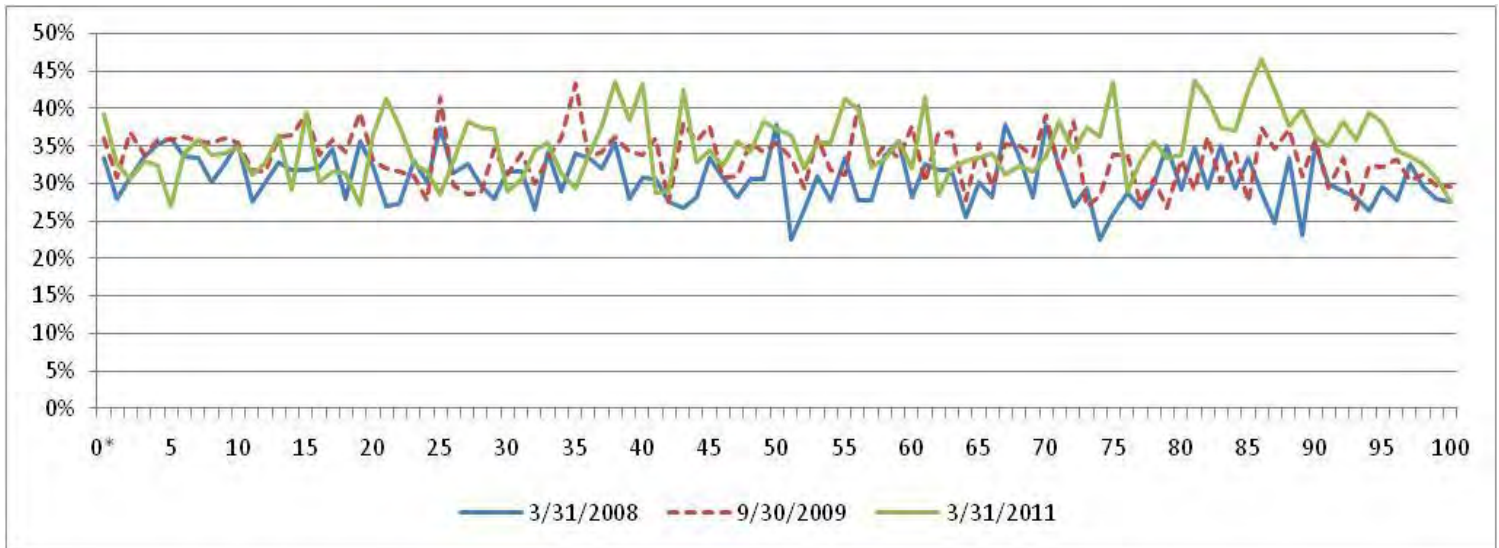
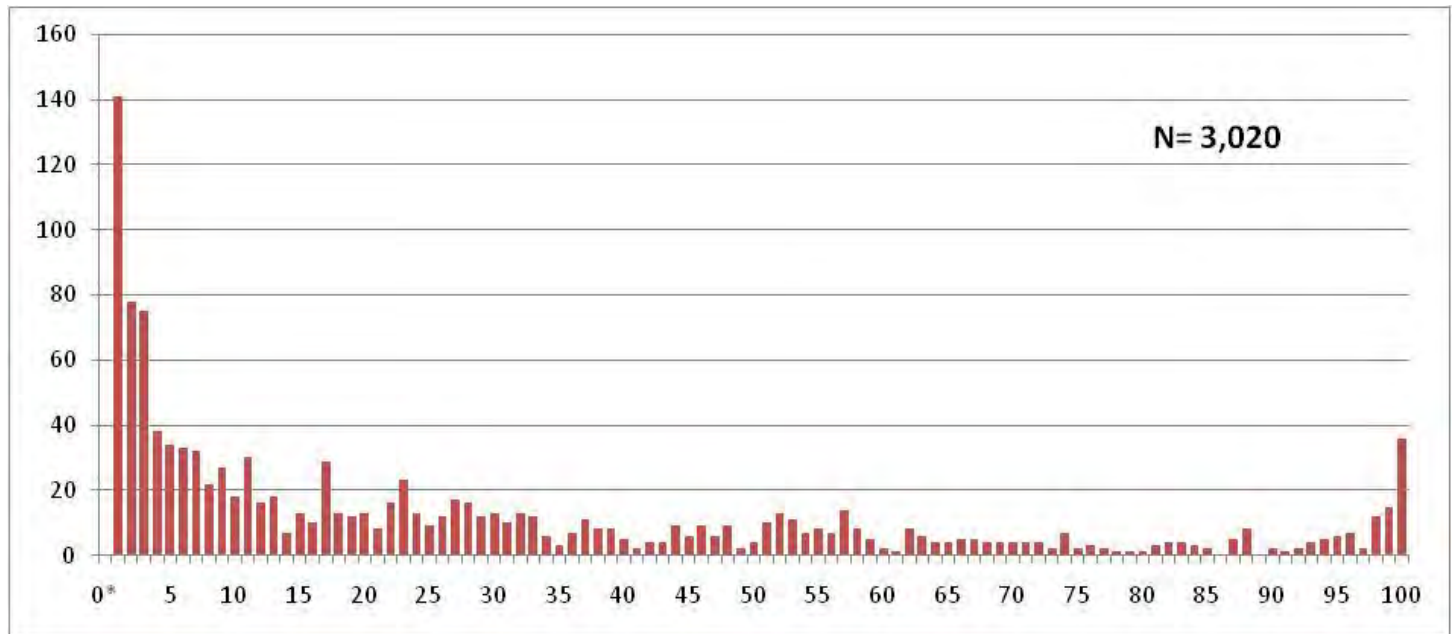


Figure 28. Percentage of Inactive Adult Kidney Alone Registrations by Allocation PRA/CPRA Value and Date



* Includes not reported for 03/31/2008 and 09/30/2009

Figure 29. Difference between Maximum and Minimal CPRA Values for Adult Kidney Alone Patients Waiting in Active Status at Two or More Centers on 03/31/2011



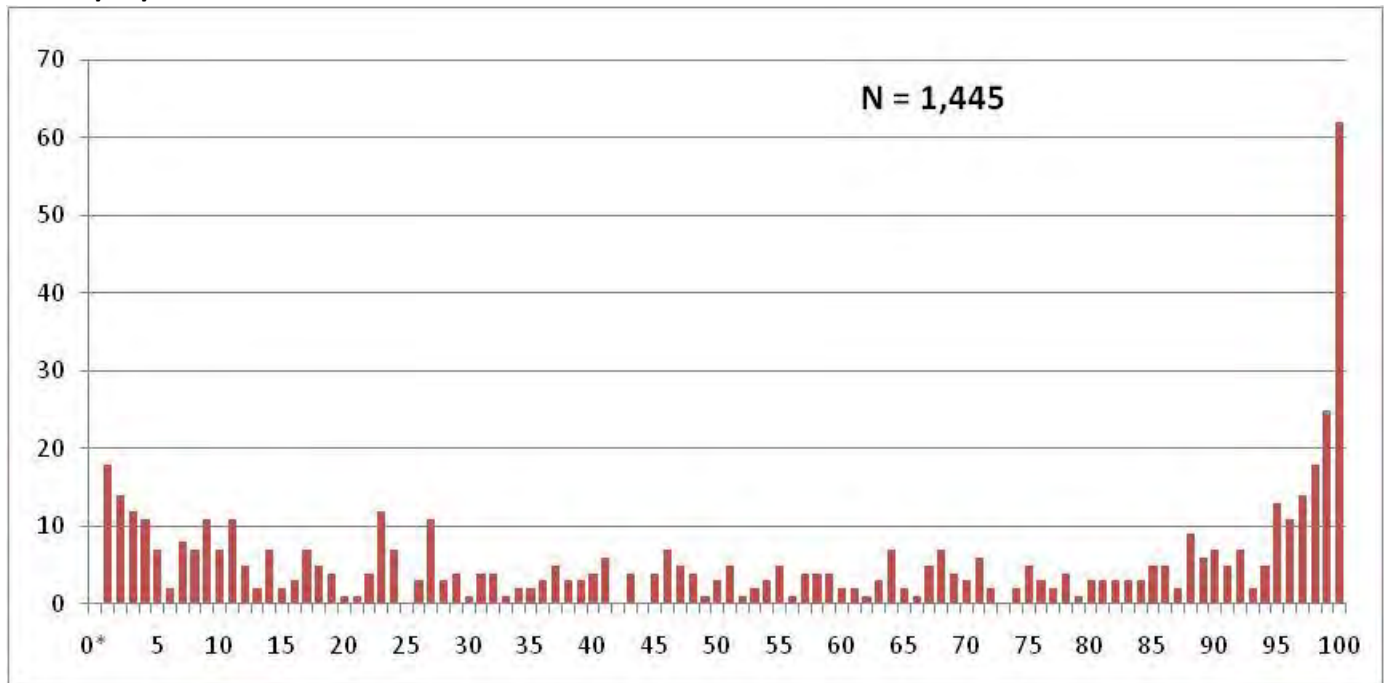
* for 1,806 patients the difference was 0.

Table 5. Difference between Maximum and Minimal CPRA Values for Adult Kidney Alone Patients Waiting in Active Status at Two or More Centers on 03/31/2011

Maximum CPRA Value	Minimum CPRA Value												Total		
	0		1 - 20		21 - 50		51 - 79		80 - 95		>95				
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
0	1,335	70.5	0	0	0	0	0	0	0	0	0	0	0	1,335	44.2
1 - 20	190	10.0	66	53.2	0	0	0	0	0	0	0	0	0	256	8.5
21 - 50	138	7.3	35	28.2	79	50.0	0	0	0	0	0	0	0	252	8.3
51 - 79	114	6.0	13	10.5	42	26.6	80	47.1	0	0	0	0	0	249	8.2
80 - 95	45	2.4	6	4.8	18	11.4	38	22.4	50	29.2	0	0	0	157	5.2
>95	71	3.8	4	3.2	19	12.0	52	30.6	121	70.8	504	100.0	771	25.5	
Total	1,893	100.0	124	100.0	158	100.0	170	100.0	171	100.0	504	100.0	3,020	100.0	

Figure 30. Absolute Difference between CPRA Values at Removal and at Listing for Adult Kidney Alone Registrations Transferred to a Different Center

For transfers with the removal from one center and listing at another center between 10/01/2009 and 03/31/2011.



* for 888 patients the difference was 0.

Table 6. Difference between CPRA Values at Removal and at Listing for Adult Kidney Alone Registrations Transferred to a Different Center

For transfers with the removal from one center and listing at another center between 10/01/2009 and 03/31/2011.

CPRA Value at Removal from the 1st Center	CPRA Value at Listing at the 2nd Center												Total	
	0		1 - 20		21 - 50		51 - 79		80 - 95		>95			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
0	858	65.7	10	52.6	11	42.3	4	16.7	2	5.1	0	0	885	61.2
1 - 20	72	5.5	6	31.6	3	11.5	0	0	1	2.6	0	0	82	5.7
21 - 50	83	6.4	2	10.5	9	34.6	3	12.5	5	12.8	0	0	102	7.1
51 - 79	83	6.4	1	5.3	1	3.8	9	37.5	2	5.1	2	6.3	98	6.8
80 - 95	79	6.1	0	0	1	3.8	5	20.8	16	41.0	5	15.6	106	7.3
>95	130	10.0	0	0	1	3.8	3	12.5	13	33.3	25	78.1	172	11.9
Total	1,305	100.0	19	100.0	26	100.0	24	100.0	39	100.0	32	100.0	1,445	100.0

Table 7. Number of Kidney Offers Refused for Adult Kidney Alone Registrations Because of the Positive Crossmatch by Offer Type and Era

Note: Limited to donors with at least one kidney accepted for transplant. Offers that could not be accepted for a registration were excluded from the total offer count except for those refused due to the positive crossmatch. Multiple offers for the same donor were counted only once per registration.

Offer Type	PRA/CPRA Group (%)	All Kidney Offers Made to Adult Kidney Alone Registrations		Offers Refused Due to the Positive Crossmatch			
				Number		% out of All Offers for the PRA/CPRA Group (%)	
				04/01/2008-09/30/2009	10/01/2009-03/31/2011	04/01/2008-09/30/2009	10/01/2009-03/31/2011
All Offers	0/Not Reported	1,021,589	887,927	9,119	3,513	0.9	0.4
	1 - 20	59,217	82,324	1,019	459	1.7	0.6
	21 - 79	102,915	105,415	5,315	1,507	5.2	1.4
	80+	30,529	22,537	6,776	2,049	22.2	9.1
	All	1,214,250	1,098,203	22,229	7,528	1.8	0.7
Non OABDR Mismatch Offers	0/Not Reported	1,017,548	887,219	9,102	3,505	0.9	0.4
	1 - 20	58,954	82,244	1,016	456	1.7	0.6
	21 - 79	101,811	104,134	5,292	1,490	5.2	1.4
	80+	29,230	21,226	6,711	1,975	23.0	9.3
	All	1,207,543	1,094,823	22,121	7,426	1.8	0.7
OABDR Mismatch Offers	0/Not Reported	4,041	708	17	8	0.4	1.1
	1 - 20	263	80	3	3	1.1	3.8
	21 - 79	1,104	1,281	23	17	2.1	1.3
	80+	1,299	1,311	65	74	5.0	5.6
	All	6,707	3,380	108	102	1.6	3.0

Table 8. Deceased Donor Adult Kidney Alone Transplants by Era, Recipient's Sensitization Level and OABDR Mismatch

HLA-ABDR Mismatch Level and PRA/CPRA Group		Era*							
		04/01/2008-12/31/2008		01/01/2009-09/30/2009		10/01/2009-06/30/2010		07/01/2010-03/31/2011	
		N	%	N	%	N	%	N	%
All Transplants	0/Not Reported	4,313	58.8	3,817	53.4	4,390	62.7	4,490	61.8
	1 - 20	1,324	18.0	1,272	17.8	440	6.3	532	7.3
	21 - 79	889	12.1	1,050	14.7	1,025	14.6	1,104	15.2
	80+	812	11.1	1,013	14.2	1,147	16.4	1,138	15.7
	Total	7,338	100.0	7,152	100.0	7,002	100.0	7,264	100.0
Non OABDR Mismatch	0/Not Reported	3,788	60.0	3,683	55.5	4,251	65.9	4,370	64.9
	1 - 20	1,194	18.9	1,242	18.7	425	6.6	523	7.8
	21 - 79	695	11.0	869	13.1	849	13.2	917	13.6
	80+	639	10.1	837	12.6	925	14.3	921	13.7
	Total	6,316	100.0	6,631	100.0	6,450	100.0	6,731	100.0
OABDR Mismatch	0/Not Reported	525	51.4	134	25.7	139	25.2	120	22.5
	1 - 20	130	12.7	30	5.8	15	2.7	9	1.7
	21 - 79	194	19.0	181	34.7	176	31.9	187	35.1
	80+	173	16.9	176	33.8	222	40.2	217	40.7
	Total	1,022	100.0	521	100.0	552	100.0	533	100.0

* Mandatory non local sharing of OABDR mismatched kidneys was eliminated for adult 0-20% PRA candidates on January 21, 2009.

Table 9. Transplant Rate per 1,000 Active Patient-Years for Adult Kidney Alone Patients on the Waiting List (WL) by Sensitization Level

Note: Transplant rate calculation takes into account CPRA changes during each era.

Era	PRA/CPRA Group (%)	Patients Ever Waited on WL	Active Years Waited	No. of Transplants	TX Rate per 1,000 Patient-Years
04/01/2008-12/31/2008	0/Not Reported	45,074	20,908	4,272	204.3
	1 - 20	14,275	5,889	1,311	222.6
	21 - 79	12,374	5,443	877	161.1
	80+	10,588	5,647	802	142.0
01/01/2009-09/30/2009	0/Not Reported	45,538	20,849	3,781	181.3
	1 - 20	14,155	5,765	1,256	217.9
	21 - 79	12,893	5,611	1,034	184.3
	80+	11,452	5,945	1,000	168.2
10/01/2009-06/30/2010	0/Not Reported	53,164	25,117	4,357	173.5
	1 - 20	5,825	2,297	438	190.7
	21 - 79	12,456	5,426	1,021	188.2
	80+	12,285	6,428	1,136	176.7
07/01/2010-03/31/2011	0/Not Reported	52,274	24,951	4,466	179.0
	1 - 20	7,091	2,873	532	185.2
	21 - 79	13,496	5,938	1,095	184.4
	80+	12,853	6,634	1,123	169.3

Figure 31. Crude Relative Risk of Transplant by Sensitization Level for Adult Kidney Alone Patients during Post- vs. Pre- CPRA Time Periods (Baseline is 01/01/2009-09/30/2009)

Note: Post 1 is 10/01/2009-06/30/2010; post 2 is 07/01/2010-03/31/2011. Squares represent crude relative risk, bars represent 95% confidence limits. If the relative risk and confidence limits are entirely above 1 then there was a statistically significant increase in the transplant rate in the current era compared to the baseline era.

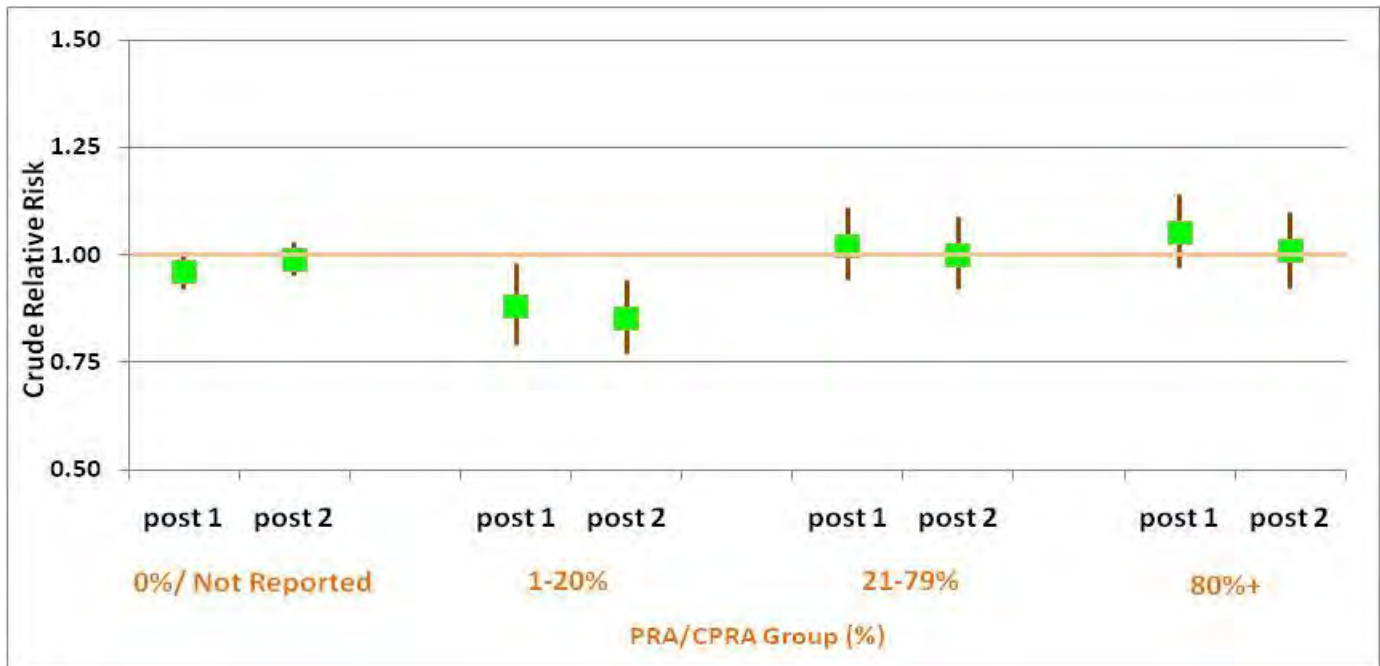


Figure 32. Crude Relative Risk of Transplant by Sensitization Level for Adult Kidney Alone Patients during Post- vs. Pre- CPRA Time Periods (Baseline is 10/01/2008-09/30/2009)

Note: Post 1 is 10/01/2009-06/30/2010; post 2 is 07/01/2010-03/31/2011.

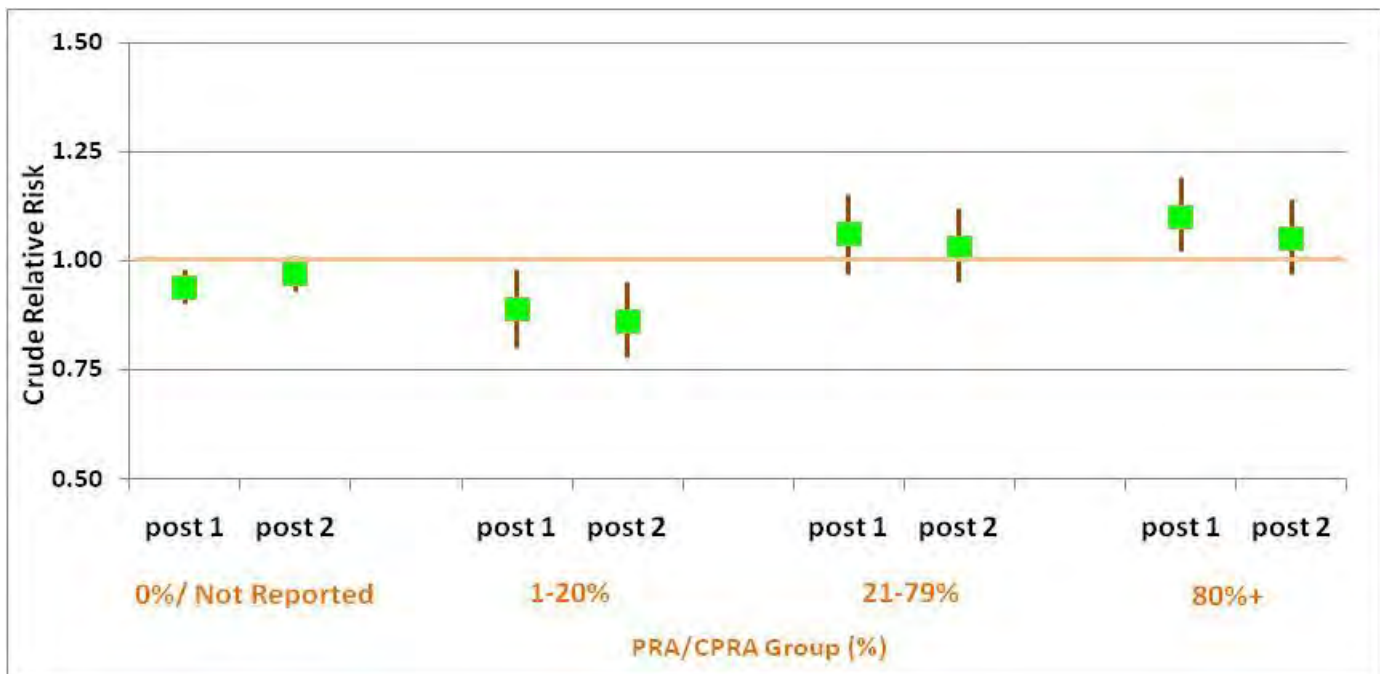


Figure 33. One Year Kaplan-Meier Graft Survival by PRA/CPRA Group and Era For Adult Kidney Alone Transplant Recipients

Note: p-value comparing all CPRA groups in for 10/2009-3/2010 era is 0.73. None of the pair wise comparisons comparing two eras for each PRA/CPRA group are significant at 0.05.

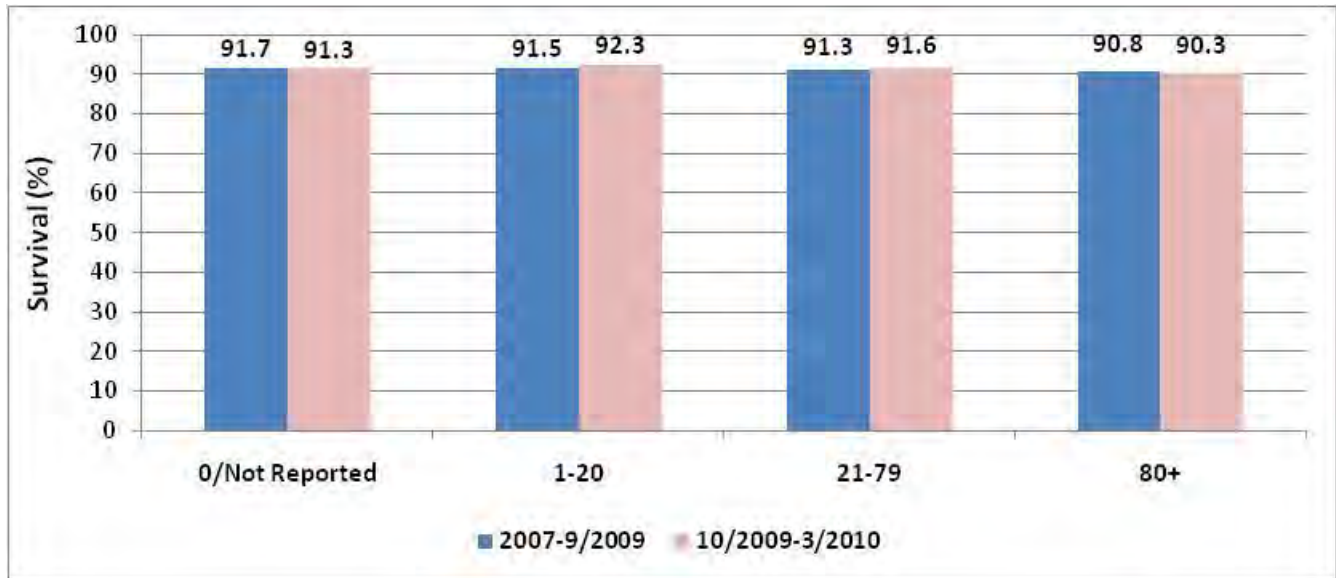


Table 10. Kaplan-Meier Graft Survival for 0/Not Reported PRA/CPRA Group by Era For Adult Kidney Alone Transplant Recipients

Note: p-value comparing all groups < 0.0001

Year	Era			
	2001-2003	2004-2006	2007-9/2009	10/2009-3/2010
0.5	92.1	93.2	94.2	94.4
1	89.1	90.4	91.7	91.3
2	83.7	85.4	87.1	.
3	78.7	80.6	.	.
4	73.6	75.9	.	.

Table 11. Kaplan-Meier Graft Survival for 1-20% PRA/CPRA Group by Era For Adult Kidney Alone Transplant Recipients

Note: p-value comparing all groups < 0.0001

Year	Era			
	2001-2003	2004-2006	2007-9/2009	10/2009-3/2010
0.5	91.7	92.5	94.1	95.0
1	88.9	89.4	91.5	92.3
2	84.0	84.0	86.8	.
3	79.4	79.0	.	.
4	73.3	74.1	.	.

**Table 12. Kaplan-Meier Graft Survival for 21-79% PRA/CPRA Group by Era
For Adult Kidney Alone Transplant Recipients**

Note: p-value comparing all groups = 0.0003

Year	Era			
	2001-2003	2004-2006	2007-9/2009	10/2009-3/2010
0.5	91.0	92.2	93.6	94.5
1	87.8	89.1	91.3	91.6
2	82.0	84.0	86.2	.
3	76.8	78.8	.	.
4	72.1	73.6	.	.

**Table 13. Kaplan-Meier Graft Survival for 80%+ PRA/CPRA Group by Era
For Adult Kidney Alone Transplant Recipients**

Note: p-value comparing all groups = 0.0001

Year	Era			
	2001-2003	2004-2006	2007-9/2009	10/2009-3/2010
0.5	91.2	91.9	93.6	92.5
1	87.5	89.2	90.8	90.3
2	80.6	83.5	85.8	.
3	75.0	78.7	.	.
4	70.0	72.9	.	.

**OPTN/UNOS Histocompatibility Subcommittee
Descriptive Data Request**

Final Report:

***Current vs. Recalculated CPRA Values for
Registrations on the Kidney Waiting List***

Prepared for:
HLA Frequencies Update Subcommittee of the Histocompatibility Committee
January 24, 2011

By:
Anna Kucheryavaya, M.S.
Research Department
United Network for Organ Sharing

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Background/Purpose

Calculated PRA (CPRA) is used for allocation of deceased donor kidneys since October 1, 2009. It is the percentage of donors expected to have one or more of the unacceptable antigens indicated on the waiting list for the candidate. The CPRA is determined using an established algorithm (1, 2) and HLA frequencies were derived and verified by an OPTN/UNOS Histocompatibility subcommittee for different ethnic groups. HLA frequencies currently used for CPRA calculation are based on the HLA phenotypes of deceased donors recovered from January 1, 2003 through December 31, 2004 (3). Ethnic frequencies are based on deceased donors recovered from January 1, 2006 through June 30, 2007.

The Histocompatibility Committee formed an HLA Frequency subcommittee to assess whether HLA and ethnic frequencies used in CPRA calculation need to be updated to better represent the comprehensive deceased donor population.

To determine a path forward the subcommittee had a conference call on December 10, 2010. The subcommittee has decided to look into using a more comprehensive cohort of deceased donors to potentially minimize the need for updates to the calculator and requested relevant data to be presented at their next conference call.

Committee Request

For kidney registrations on the waiting list the subcommittee requested to compare current CPRA which uses calculated HLA frequencies derived from deceased donors recovered from January 1, 2003 through December 31, 2004 with:

- CPRA calculated using HLA and ethnic frequencies based on deceased kidney donors recovered from January 1, 2007 through December 31, 2008. These HLA frequencies were recently estimated by Dr. Mary S. Leffell, the former chair of the Histocompatibility Committee.
- CPRA estimated using HLA data for deceased kidney donors recovered from January 1, 2001 through December 31, 2009.

To estimate whether ethnic frequencies have changed through the years, the subcommittee requested the number (and percent) of deceased kidney donors recovered from January 1, 2001 through December 31, 2009 stratified by ethnicity and year.

Committee Annual Goal Addressed

Monitor implementation of CPRA into current kidney allocation system.

Data and Methods

Calculated PRA (CPRA) is used for allocation of deceased donor kidneys since October 1, 2009. It is the percentage of donors expected to have one or more of the unacceptable antigens indicated on the waiting list for the candidate. The CPRA is determined using an established algorithm (1, 2) and HLA frequencies were derived and verified by an OPTN/UNOS Histocompatibility subcommittee for different ethnic groups. HLA frequencies currently used for CPRA calculation are based on the HLA phenotypes of deceased donors recovered from January 1, 2003 through December 31, 2004 (3). Ethnic frequencies are based on deceased donors recovered from January 1, 2006 through June 30, 2007.

For all kidney registrations on the kidney waiting list on November 30, 2010 current CPRA values were compared to recalculated CPRA and antigen frequency PRA. All the results are based on the current HLA-A, -B, -DR and -DQ unacceptable antigen equivalences listed in Appendix 3A to OPTN Policy 3. CW antigens weren't included into calculation.

CPRA values were recalculated with updated HLA and ethnic frequencies based on the algorithm currently used for CPRA calculation. Updated HLA and ethnic frequencies were derived from deceased kidney donors recovered from January 1, 2007 through December 31, 2008. These HLA frequencies were recently derived by the maximum likelihood estimation algorithm using the Arlequin computer program by Dr. Mary S. Leffell, the former chair of the Histocompatibility Committee.

Antigen frequency PRA was calculated using HLA data for deceased kidney donors recovered from January 1, 2001 through December 31, 2009. Only donors with reported HLA-A, -B, -DR and -DQ antigens were included. Bw4 and Bw6 values were cleaned up based on reported B antigens. Antigen frequency PRA value is the percentage of donors that had one or more of the HLA antigens indicated as unacceptable on the waiting list for the registration.

To estimate whether ethnic frequencies have changed through the years, the number of all deceased kidney donors recovered from January 1, 2001 through December 31, 2009 was stratified by ethnicity and year.

All results are based on OPTN data as of December 24, 2010. Data are subject to change based on future data submission or correction.

Results

Table 1 shows recalculated CPRA and antigen frequency PRA to the current CPRA comparison for kidney registrations on the waiting list on November 30, 2010:

- For most registrations recalculated CPRA and antigen frequency PRA values and were equal to the current CPRA.
- For 82% of registrations recalculated CPRA was equal to the current CPRA value. And only for 3% of registrations recalculated CPRA was more than 10% higher or lower than the current CPRA.
- Antigen frequency PRA values were even more similar to the current CPRA. Ninety one percent of registrations had the same values. And for only 1% of registrations antigen frequency PRA was more than 10% higher or lower than the current CPRA.

Table 2 shows comparison of the current CPRA to the recalculated CPRA:

- For most registrations current and recalculated CPRA values are in the same CPRA group.
- Under the current policy during allocation of deceased donor kidneys highly sensitized registrations (80%+ CPRA) are assigned 4 extra points. For 498 registrations (5 pediatric and 493 adult) current CPRA is less than 80% but recalculated CPRA is 80%+. Twenty registrations with current CPRA greater or equal to 80% had recalculated CPRA less than 80%.
- Under the current policy there is no mandatory non-local sharing of zero antigen mismatched deceased donor kidneys for adult non sensitized registrations (CPRA less or equal to 20%). Ninety three adult registrations have current CPRA less or equal to 20% and recalculated CPRA more than 20%. And 23 adult registrations have current CPRA greater than 20% and recalculated CPRA less or equal to 20%.

Table 3 shows comparison of the current CPRA to antigen frequency PRA values:

- For most registrations current CPRA and antigen frequency PRA values are in the same sensitization group.
- If the antigen frequency PRA was used for allocation, 45 registrations currently not eligible for 4 additional sensitization points would become eligible and 28 registrations would lose 4 additional points.
- Thirty six adult registrations have current CPRA less or equal to 20% and antigen frequency PRA more than 20%. And 12 adult registrations have current CPRA more than 20% and antigen frequency PRA less or equal to 20%.

Table 4 shows the difference between the current CPRA and recalculated CPRA/antigen frequency PRA values:

- Antigen frequency PRA values are more similar to the current CPRA than recalculated CPRA values.
- Recalculated CPRA value is more likely to be higher than the current CPRA than lower.
- For 1,891 registrations there was a substantial difference between recalculated CPRA and the current CPRA (absolute difference > 5). Fifty five percent of these registrations had antibodies to DQ 7. Eighty six percent had antibodies to DQ 6 and/or DQ 7. Almost all (97%) had antibodies to DQ 4, 5, 6, 7, 8 and/or 9. Reporting of these antigens for deceased kidney donors increased in the past decade. DQ 4, 5, 6, 7, 8 and/or 9 was reported for 61% of deceased kidney donors recovered in 2001 and for 90% of donors recovered in 2009.

Table 5 shows all deceased kidney donors recovered from January 1, 2001 through December 31, 2009 stratified by ethnicity and year:

- Percentage of White donors decreased from 74% in 2001 to 68% in 2009.
- Percentages of African American donors increased from 11% in 2001 to 15% in 2009.
- Percentage of Hispanic donors increased from 12% in 2001 to 14% in 2009.

Summary

- Most of the registrations have the same current, recalculated CPRA and antigen frequency PRA values.
- Antigen frequency PRA values are more similar to the current CPRA than recalculated CPRA values.
- Almost all registrations with substantial differences (absolute difference > 5) between recalculated and current CPRA values had antibodies to DQ 4, 5, 6, 7, 8 and/or 9 antigens. Reporting of these antigens for deceased kidney donors increased in the past decade.

**Table 1. Recalculated CPRA and Antigen Frequency PRA to the Current CPRA Comparison
Kidney Registrations on the Waiting List on November 30, 2010**

Difference	Recalculated CPRA vs. Current CPRA		Antigen Frequency PRA vs. Current CPRA	
	N	%	N	%
Same Values (CPRA = 0)	59,354	63.8	59,292	63.7
Same Values (CPRA >0)	17,422	18.7	24,949	26.8
More than 10% lower than the current CPRA	626	0.7	440	0.5
Within 10% of the current CPRA	13,459	14.5	8,073	8.7
More than 10% higher than the current CPRA	2,209	2.4	316	0.3
Total	93,070	100.0	93,070	100.0

**Table 2. Current CPRA vs. Recalculated CPRA
All Kidney Registrations on the Waiting List on November 30, 2010**

Age Group	Current CPRA	Recalculated CPRA								Total	
		0		1 - 20		21 - 79		80+			
		N	%	N	%	N	%	N	%	N	%
All Age Groups	0	59,354	100.0	2	0.0	0	0	0	0	59,356	100.0
	1 - 20	1	0.0	5,943	98.4	93	1.5	0	0	6,037	100.0
	21 - 79	0	0	23	0.2	12,368	96.0	498	3.9	12,889	100.0
	80+	0	0	0	0	20	0.1	14,768	99.9	14,788	100.0
	Total	59,355	63.8	5,968	6.4	12,481	13.4	15,266	16.4	93,070	100.0
Pediatric	0	519	100.0	0	0	0	0	0	0	519	100.0
	1 - 20	0	0	40	100.0	0	0	0	0	40	100.0
	21 - 79	0	0	0	0	77	93.9	5	6.1	82	100.0
	80+	0	0	0	0	0	0	136	100.0	136	100.0
	Total	519	66.8	40	5.1	77	9.9	141	18.1	777	100.0
Adult	0	58,835	100.0	2	0.0	0	0	0	0	58,837	100.0
	1 - 20	1	0.0	5,903	98.4	93	1.6	0	0	5,997	100.0
	21 - 79	0	0	23	0.2	12,291	96.0	493	3.8	12,807	100.0
	80+	0	0	0	0	20	0.1	14,632	99.9	14,652	100.0
	Total	58,836	63.7	5,928	6.4	12,404	13.4	15,125	16.4	92,293	100.0

Table 3. Current CPRA vs. Antigen Frequency PRA
All Kidney Registrations on the Waiting List on November 30, 2010

Age Group	Current CPRA	Antigen Frequency PRA								Total	
		0		1 - 20		21 - 79		80+			
		N	%	N	%	N	%	N	%	N	%
All Age Groups	0	59,292	99.9	64	0.1	0	0	0	0	59,356	100.0
	1 - 20	20	0.3	5,981	99.1	36	0.6	0	0	6,037	100.0
	21 - 79	0	0	12	0.1	12,832	99.6	45	0.3	12,889	100.0
	80+	0	0	0	0	28	0.2	14,760	99.8	14,788	100.0
	Total	59,312	63.7	6,057	6.5	12,896	13.9	14,805	15.9	93,070	100.0
Pediatric	0	519	100.0	0	0	0	0	0	0	519	100.0
	1 - 20	0	0	40	100.0	0	0	0	0	40	100.0
	21 - 79	0	0	0	0	82	100.0	0	0	82	100.0
	80+	0	0	0	0	0	0	136	100.0	136	100.0
	Total	519	66.8	40	5.1	82	10.6	136	17.5	777	100.0
Adult	0	58,773	99.9	64	0.1	0	0	0	0	58,837	100.0
	1 - 20	20	0.3	5,941	99.1	36	0.6	0	0	5,997	100.0
	21 - 79	0	0	12	0.1	12,750	99.6	45	0.4	12,807	100.0
	80+	0	0	0	0	28	0.2	14,624	99.8	14,652	100.0
	Total	58,793	63.7	6,017	6.5	12,814	13.9	14,669	15.9	92,293	100.0

**Table 4. Difference between Current CPRA and Recalculated CPRA/Antigen Frequency PRA
For All Kidney Registrations on the Waiting List on November 30, 2010**

Difference	For Recalculated CPRA		For Antigen Frequency PRA	
	N	%	N	%
-17	5	0.0	0	0
-16	30	0.0	0	0
-15	33	0.0	0	0
-14	130	0.1	0	0
-13	65	0.1	0	0
-12	43	0.0	0	0
-11	206	0.2	0	0
-10	133	0.1	0	0
-9	159	0.2	0	0
-8	236	0.3	0	0
-7	305	0.3	0	0
-6	544	0.6	0	0
-5	465	0.5	0	0
-4	471	0.5	2	0.0
-3	962	1.0	217	0.2
-2	1,775	1.9	456	0.5
-1	6,918	7.4	3,582	3.8
0	76,776	82.5	84,241	90.5
1	3,573	3.8	4,541	4.9
2	177	0.2	28	0.0
3	38	0.0	1	0.0
4	19	0.0	2	0.0
5	5	0.0	0	0
6	2	0.0	0	0
Total	93,070	100.0	93,070	100.0

**Table 5. Deceased Kidney Donors Recovered January 1, 2001 – December 31, 2009
by Year of Donor Recovery and Ethnicity**

Year	Donor Ethnicity												All	
	White		African American		Hispanic		Asian		Other		Not Reported			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2001	4,092	74.0	621	11.2	637	11.5	122	2.2	56	1.0	0	0	5,528	100.0
2002	4,116	73.0	685	12.1	662	11.7	99	1.8	75	1.3	1	0.0	5,638	100.0
2003	4,081	70.9	713	12.4	738	12.8	121	2.1	84	1.5	16	0.3	5,753	100.0
2004	4,455	70.4	799	12.6	844	13.3	142	2.2	85	1.3	0	0	6,325	100.0
2005	4,630	69.1	923	13.8	925	13.8	134	2.0	88	1.3	0	0	6,700	100.0
2006	4,916	68.5	1,035	14.4	996	13.9	157	2.2	74	1.0	0	0	7,178	100.0
2007	4,923	68.0	1,034	14.3	1,032	14.3	161	2.2	90	1.2	0	0	7,240	100.0
2008	4,888	68.0	1,067	14.8	1,005	14.0	172	2.4	56	0.8	0	0	7,188	100.0
2009	4,918	67.9	1,100	15.2	998	13.8	173	2.4	59	0.8	0	0	7,248	100.0

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1. Zachary AA and Braun WE. Calculation of a predictive value for transplantation. *Transplantation* 1985;39:316-8.
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**OPTN/UNOS Histocompatibility Subcommittee
Descriptive Data Request**

Final Report:

***Current vs. Recalculated CPRA Values for
Kidney Registrations on the Waiting List
with Antibodies to HLA-C***

Prepared for:
HLA Frequencies Subcommittee of the Histocompatibility Committee
March 17, 2011

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Background/Purpose

Calculated PRA (CPRA) is used for allocation of deceased donor kidneys since October 1, 2009. It is the percentage of donors expected to have one or more of the unacceptable antigens indicated on the waiting list for the candidate. The CPRA is determined using an established algorithm (1, 2) and HLA frequencies were derived and verified by an OPTN/UNOS Histocompatibility subcommittee for different ethnic groups. HLA frequencies currently used for CPRA calculation (HLA-A, -B, -DR and -DQ) are based on the HLA phenotypes of deceased kidney donors recovered from January 1, 2003 through December 31, 2004 (3). Ethnic frequencies are based on deceased kidney donors recovered from January 1, 2006 through June 30, 2007.

The Histocompatibility Committee formed an HLA Frequency Subcommittee to assess whether using HLA frequencies based on a more recent cohort of donors can improve CPRA accuracy. At the January 24, 2011 call the subcommittee reviewed previously requested data. CPRA was recalculated based on HLA and ethnic frequencies derived from a more recent cohort of deceased kidney donors (2007-2008). Reporting of HLA-DQ 4, 5, 6, 7, 8, and 9 antigens increased in the past decade leading to a substantial CPRA increase for some kidney registrations. If recalculated CPRA was used for allocation of deceased donor kidneys, almost 500 kidney registrations with current CPRA of less than 80 would become eligible for 4 sensitization points.

At the July 13-14, 2010 meeting the Histocompatibility Committee voted to propose the inclusion of HLA-C frequencies into CPRA calculation. At the January 24, 2011 call the HLA Frequencies Subcommittee discussed the data needed to support this proposal. The subcommittee requested recalculated CPRA based on HLA-A, -B, -DR, -DQ and -C frequencies for a subgroup of kidney registrations on the waiting list with antibodies to HLA-C antigens. Since currently CPRA is calculated as a percentage rounded to the nearest integer, the subcommittee decided that for this data request recalculated CPRA values can be estimated without 5 point Haplotype frequencies (HLA-A;B;DR;DQ;C). The subcommittee requested these data to be presented at their March conference call.

Committee Annual Goal Addressed

Monitor implementation of CPRA into current kidney allocation system.

Committee Request

For kidney registrations on the waiting list with antibodies to HLA-C antigens and 0% CPRA or 50-79% CPRA, the subcommittee requested to compare current CPRA values with:

- CPRA recalculated using ethnic and HLA frequencies (HLA-A, -B, -DR, -DQ, and -C) derived from a more recent cohort of deceased kidney donors (2007-2008). Recalculated CPRA values will be estimated without 5 point Haplotype frequencies (HLA-A;B;DR;DQ;C). HLA frequencies for deceased kidney donors recovered in 2007-2008 were recently derived by the maximum likelihood estimation algorithm using the Arlequin computer program by Dr. Mary S. Leffell, the former chair of the Histocompatibility Committee.

Data and Methods

Calculated PRA (CPRA) is used for allocation of deceased donor kidneys since October 1, 2009. It is the percentage of donors expected to have one or more of the unacceptable antigens indicated on the waiting list for the candidate. The CPRA is determined using an established algorithm (1, 2) and HLA frequencies were derived and verified by an OPTN/UNOS Histocompatibility subcommittee for different ethnic groups. HLA frequencies currently used for CPRA calculation are based on the HLA phenotypes of deceased donors recovered from January 1, 2003 through December 31, 2004 (3). Ethnic frequencies are based on deceased donors recovered from January 1, 2006 through June 30, 2007.

Current CPRA values were compared to recalculated CPRA for all kidney registrations on the kidney waiting list with antibodies to HLA-C antigens and 0% CPRA or 50-79% CPRA on February 28, 2011. All the results are based on the HLA-A, -B, -DR, -DQ and -C unacceptable antigen equivalences listed in Appendix 3A to OPTN Policy 3 as of March 10, 2011.

CPRA values were recalculated with updated HLA and ethnic frequencies based on the algorithm currently used for CPRA calculation with addition of HLA-C frequencies. Recalculated CPRA values were estimated without 5 point Haplotype frequencies (HLA-A;B;DR;DQ;C). Updated HLA and ethnic frequencies were derived from deceased kidney donors recovered from January 1, 2007 through December 31, 2008. These HLA frequencies were recently derived by the maximum likelihood estimation algorithm using the Arlequin computer program by Dr. Mary S. Leffell, the former chair of the Histocompatibility Committee.

All results are based on OPTN data as of March 4, 2011. Data are subject to change based on future data submission or correction.

Results

On February 28, 2011 there were 93,711 kidney registrations on the waiting list. Eleven percent (10,569) of these registrations had at least one unacceptable HLA-C antigen reported on the waiting list. Among all kidney registrations with unacceptable HLA-C antigens, 7% (728) only had antibodies to HLA-C antigens.

Table 1 shows CPRA distribution of kidney registrations on the waiting list with reported antibodies to HLA-C antigens.

- Inclusion of HLA-C frequencies into CPRA calculation would result in a higher CPRA value for most of these registrations.
- Sixty three percent of these registrations already have CPRA greater or equal to 80% and are currently eligible for extra 4 sensitization points during allocation of deceased donor kidneys.

Table 2 provides the distribution of the number of unacceptable HLA-C antigens entered on the waiting list for kidney registrations with antibodies to HLA-C.

- Most of these registrations (58%) have three or less unacceptable HLA-C antigens.
- Eleven percent (1,114 registrations) has 10 or more unacceptable HLA-C antigens.

Figure 1 and **Table 3** show the difference between recalculated and current CPRA values for kidney registrations on the waiting list with antibodies to HLA-C antigens and 0% current CPRA:

- Thirty one percent of these registrations have the difference of more than 20.
- Fifteen registrations have the difference of more than 80, indicating that their recalculated CPRA is above 80%.

Figure 2 and **Table 3** show the difference between recalculated and current CPRA values for kidney registrations on the waiting list with antibodies to HLA-C antigens and 50-79% current CPRA:

- Addition of HLA-C frequencies to CPRA calculation would increase CPRA values for almost all of these candidates.
- For almost half of these registrations (524 or 47%) recalculated CPRA is 80% or higher.

Summary

- Eleven percent of kidney registrations on the waiting list have antibodies to HLA-C antigens. Only 63% of these registrations have current CPRA of 80% or higher and eligible for 4 additional sensitization points during allocation of deceased donor kidneys.
- Inclusion of HLA-C frequencies into CPRA calculation can benefit some of kidney registrations with antibodies to HLA-C. Almost half of kidney registrations with 50-79% current CPRA would be eligible for 4 extra sensitization points if CPRA was calculated based on a more recent set of HLA frequencies with inclusion of HLA-C.

Table 1. Current CPRA for Kidney Registrations on the Waiting List with Antibodies to HLA-C Antigens February 28, 2011

CPRA Group (%)	N	%
0	946	9.0
1 - 20	889	8.4
21 - 49	951	9.0
50 - 79	1,114	10.5
80+	6,669	63.1
Total	10,569	100.0

Table 2. Number of Unacceptable HLA-C Antigens for Kidney Registrations on the Waiting List with Antibodies to HLA-C Antigens, February 28, 2011

Number of Unacceptable HLA-C Antigens	N	%
1	3,213	30.4
2	1,743	16.5
3	1,171	11.1
4	693	6.6
5	523	4.9
6	557	5.3
7	643	6.1
8	519	4.9
9	393	3.7
10	307	2.9
11	232	2.2
12	222	2.1
13	141	1.3
14	146	1.4
15	62	0.6
16	4	0.0
Total	10,569	100.0

Figure 1. Difference between Recalculated and Current CPRA for Kidney Registrations with Antibodies to HLA-C and 0% Current CPRA, February 28, 2011

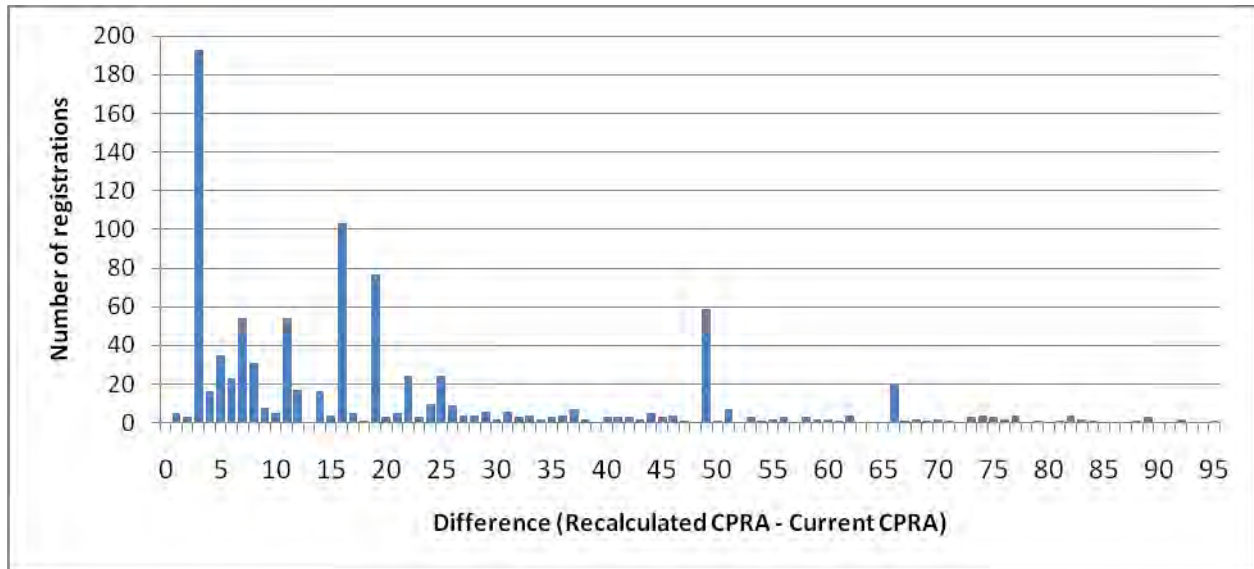


Figure 2. Difference between Recalculated and Current CPRA for Kidney Registrations with Antibodies to HLA-C and 50-79% Current CPRA, February 28, 2011

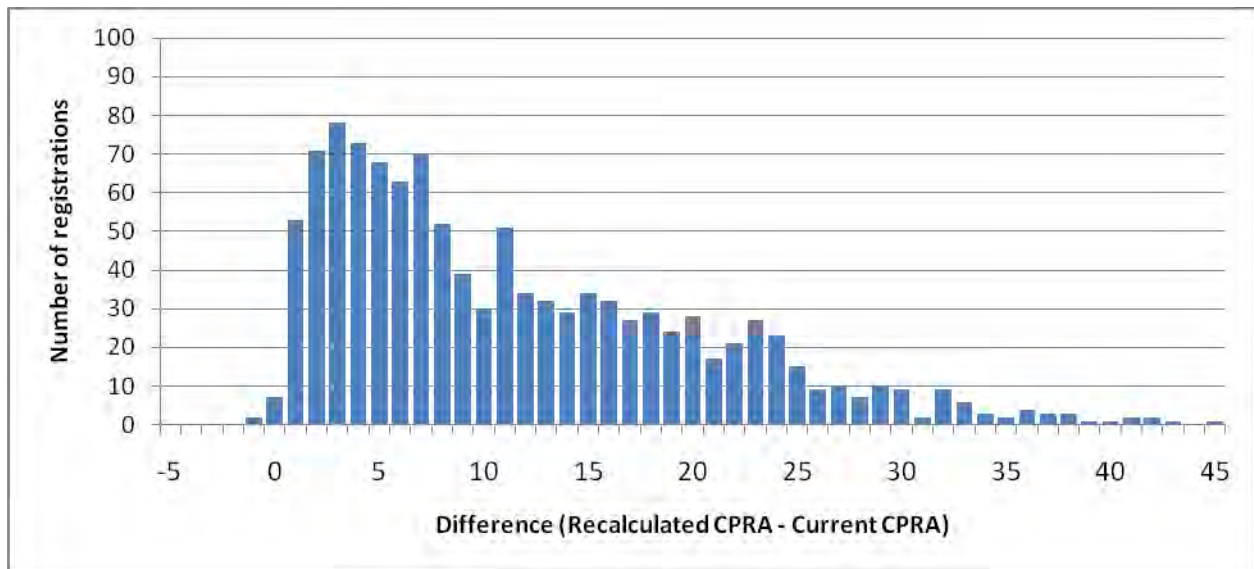


Table 3. Difference between Recalculated and Current CPRA for Kidney Registrations with Antibodies to HLA-C and 0% or 59-79% Current CPRA, February 28, 2011

Difference	Current CPRA Group (%)			
	0		50 - 79	
	N	%	N	%
-1	0	0	2	0.2
0	0	0	7	0.6
1	5	0.5	53	4.8
2	3	0.3	71	6.4
3	193	20.4	78	7.0
4	16	1.7	73	6.6
5	35	3.7	68	6.1
6	23	2.4	63	5.7
7	54	5.7	70	6.3
8	31	3.3	52	4.7
9	8	0.8	39	3.5
10	5	0.5	30	2.7
11	54	5.7	51	4.6
12	17	1.8	34	3.1
13	0	0	32	2.9
14	16	1.7	29	2.6
15	4	0.4	34	3.1
16	103	10.9	32	2.9
17	5	0.5	27	2.4
18	1	0.1	29	2.6
19	77	8.1	24	2.2
20	3	0.3	28	2.5
21	5	0.5	17	1.5
22	24	2.5	21	1.9
23	3	0.3	27	2.4
24	10	1.1	23	2.1
25	24	2.5	15	1.3
26	9	1.0	9	0.8
27	4	0.4	10	0.9
28	4	0.4	7	0.6
29	6	0.6	10	0.9
30	2	0.2	9	0.8

Difference	Current CPRA Group (%)			
	0		50 - 79	
	N	%	N	%
31	6	0.6	2	0.2
32	3	0.3	9	0.8
33	4	0.4	6	0.5
34	2	0.2	3	0.3
35	3	0.3	2	0.2
36	4	0.4	4	0.4
37	7	0.7	3	0.3
38	2	0.2	3	0.3
39	0	0	1	0.1
40	3	0.3	1	0.1
41	3	0.3	2	0.2
42	3	0.3	2	0.2
43	2	0.2	1	0.1
44	5	0.5	0	0
45	3	0.3	1	0.1
46	4	0.4	0	0
47	1	0.1	0	0
49	59	6.2	0	0
50	1	0.1	0	0
51	7	0.7	0	0
53	3	0.3	0	0
54	1	0.1	0	0
55	2	0.2	0	0
56	3	0.3	0	0
58	3	0.3	0	0
59	2	0.2	0	0
60	2	0.2	0	0
61	1	0.1	0	0
62	4	0.4	0	0
66	20	2.1	0	0
67	1	0.1	0	0
68	2	0.2	0	0
69	1	0.1	0	0
70	2	0.2	0	0

Difference	Current CPRA Group (%)			
	0		50 - 79	
	N	%	N	%
71	1	0.1	0	0
73	3	0.3	0	0
74	4	0.4	0	0
75	3	0.3	0	0
76	2	0.2	0	0
77	4	0.4	0	0
79	1	0.1	0	0
81	1	0.1	0	0
82	4	0.4	0	0
83	2	0.2	0	0
84	1	0.1	0	0
88	1	0.1	0	0
89	3	0.3	0	0
92	2	0.2	0	0
95	1	0.1	0	0
Total	946	100.0	1,114	100.0

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1. Zachary AA and Braun WE. Calculation of a predictive value for transplantation. *Transplantation* 1985;39:316-8.
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