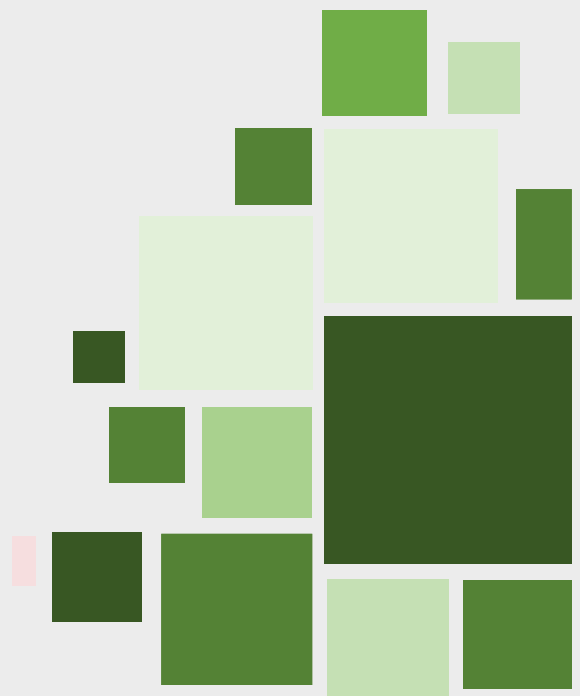
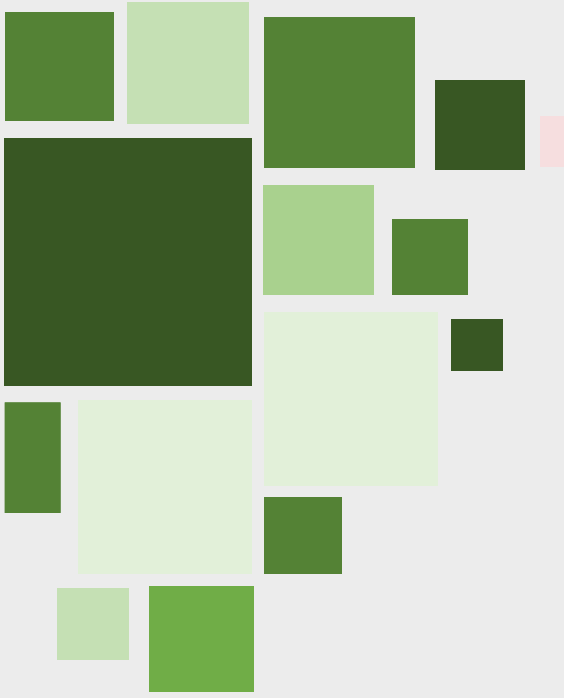


2. Organ Transplantation in the Kingdom of Saudi Arabia

Contents:

- 2.1 kidney
- 2.2 liver
- 2.3 Heart
- 2.4 Lung
- 2.5 Pancreas
- 2.6.1 and 2.6.2 Corneas and Bones
- 2.7 Intestine
- 2.8 Organ Sharing between KSA and GCC





2.1 Kidney Transplantation



In the year 2023, 1,439 kidneys were transplanted inside the kingdom of Saudi Arabia with **1,258** kidneys transplanted from living donors and **181** were transplanted from deceased donors. (Details of the living and deceased kidney transplantation are shown in Table 2.1.1)

It is worth mentioning that a total of **17,833** kidneys were transplanted inside the kingdom from 1979-2023; of these **12,627 (71%)** were from living related, **3,876 (22%)** were from deceased donors and **1,330 (7%)** from transplanted unrelated kidney donor. Illustration of the cumulative living and deceased kidney transplantation is shown in figure 2.1.1.

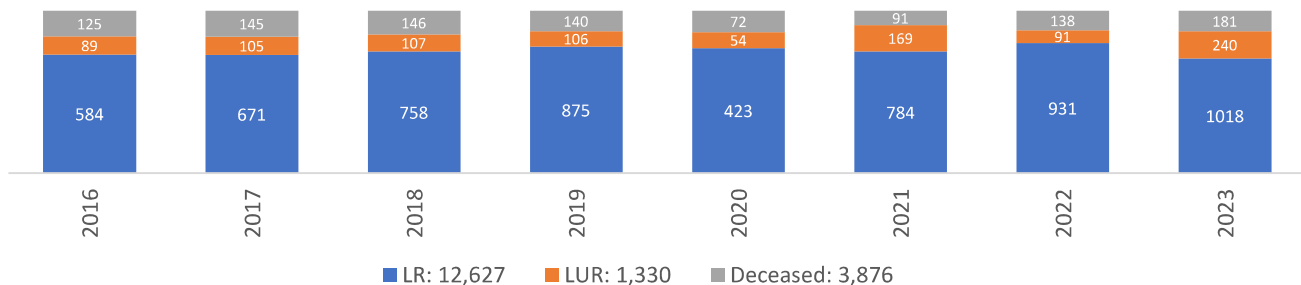
Table 2.1.1: Living and deceased kidney transplantation

Transplant Centers	Total transplanted kidneys	LR	LUR	Deceased
King Faisal Specialist Hospital Riyadh	463	284	112	67
King Faisal Specialist Hospital Jeddah	232	184	28	20
King Abdulaziz Medical City and National Guard Hospital, Riyadh	176	110	37	29
King Fahad Specialist Hospital, Dammam	206	165	12	29
Prince Sultan Military Medical City, Riyadh	83	58	10	15
King Fahad Armed Forces Hospital, Jeddah	83	62	10	11
King Fahad Military Hospital, Khamis Mushayt	53	39	9	5
King Salman Military Hospital, Tabuk	20	12	6	2
Al Hada Armed Forces Hospital, Taif	39	30	6	3
King Abdulaziz Medical City and National Guard Hospital, Jeddah	12	6	6	NA
Dr. Suleiman Al Fakeeh Hospital, Jeddah	14	14	0	NA
King Abdullah Medical City, Makkah	19	14	4	NA
King Fahad Hospital, Madinah	0	0	0	NA
Dr. Suleiman Al Habib Suweidi, Riyadh	39	39	0	NA
TOTAL	1439	1018	240	181

Transplant centers performing living and deceased kidney transplantation in 2023

Figure 2.1.1

Cumulative living and deceased kidney transplantation



Details of living and deceased kidney transplantation in the Kingdom of Saudi Arabia during 1979-2023

Total number of kidneys transplantation(1979-2023) 17,833

2.1.1 Deceased Kidney Donation

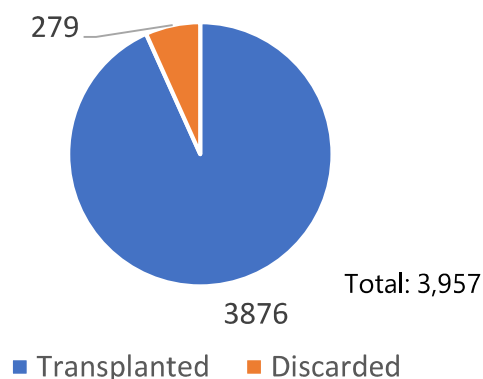
In 2023, 201 donors were consented for organ donation. Wherein, 131 donors (122 in KSA and 9 in UAE) or (262 kidneys) were offered to KSA of which 99 donors were recovered but only 93 were utilized. From donors in KSA: 194 kidneys were recovered of which 177 were transplanted and 17 were discarded, while 25 donors (50 kidneys) were non-recovered. In donors from UAE, 9 donor's kidneys were offered in KSA of which, 2 donors were recovered from whom 4 kidneys were transplanted, while 7 donors or 14 kidneys were non-recovered (See details of utilized kidney donor characteristics inside the kingdom are listed in table 2.1.1.2 and the details of the deceased kidney donation are listed in tables 2.1.1.1 & figure 2.1.1.1 cumulative).

Table 2.1.1.1: Deceased kidney donation 2023

Kidneys from deceased donors	N	%
Transplanted in KSA	181	45
Not recovered kidneys	64	16
Discarded kidneys	17	4
Kidneys for GCC*	138	34
Not Consented	2	0
Total	201 Donors/ 402 kidneys	100%

*Kidneys for GCC- other donor organs (e.g. liver, heart, lungs) were offered or shared to KSA except the kidneys.

Figure 2.1.1.1: Recovered Deceased Kidneys 1986-2023



2.1.1.1 Kidney Donor Risk Index (KDRI)

KDRI for utilized kidney from 93 deceased donors were ranging from 0.54 to 3.54 with mean KDRI 1.02; of which 57 (61%) of the cases had a KDRI <1, 26 (28%) are between 1-1.5 and 10 (11%) had KDRI of 1.5 above.

Table 2.1.1.2: Deceased kidney donor characteristics

Characteristics of utilized deceased kidney donors in KSA 2023

Characteristic	N	%
Age		
0-10	5	5%
11-20	3	3%
21-30	11	12%
31-40	25	27%
41-50	33	35%
51-60	12	13%
61-70	4	4%
Blood Group		
A	30	32%
B	27	29%
AB	10	11%
O	26	28%
Gender		
Male	82	88%
Female	11	12%
Donor Type		
SCD	73	78%
ECD	21	22%
Cause of Death		
Anoxia	16	15%
CVA	47	56%
Head trauma	28	28%
CNS tumor	2	1%
Cirumstance of Death		
MVA	18	19%
Non-MVA	75	81%

2.1.2 Deceased Kidney Transplantation

262 deceased kidneys were consented and offered for transplantation of which a total of 181 kidneys were transplanted to 177 recipients including 4 en-bloc kidney transplant. Kidneys transplanted from KSA were 177 kidneys while, 2 donors from UAE were recovered from whom 4 kidneys were transplanted, Transplantation was performed by 9 currently active deceased kidney transplant centers all over the Kingdom. (See table 2.1.2.1). Illustration of the cumulative deceased kidney transplantation is shown in figure 2.1.2.1.

Table 2.1.2.1: Deceased kidney transplantation 2023

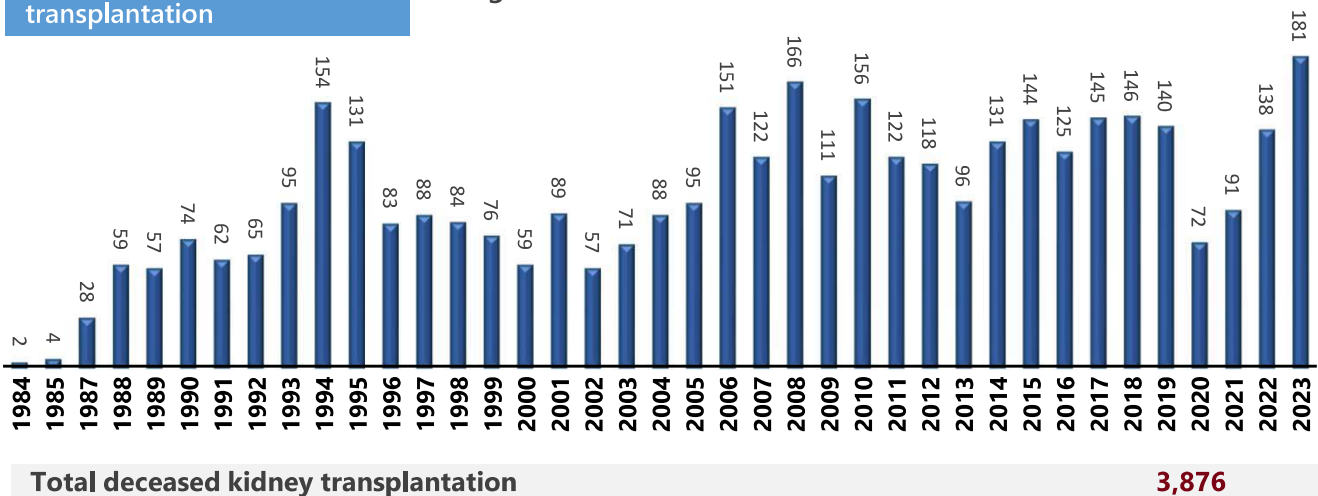
Transplant Centers	Deceased
King Faisal Specialist Hospital Riyadh	*67 kidney/64 recipients
King Faisal Specialist Hospital Jeddah	20
King Abdulaziz Medical City and National Guard Hospital, Riyadh	29
King Fahad Specialist Hospital, Dammam	29/28 recipients
Prince Sultan Military Medical City, Riyadh	15
King Fahad Armed Forces Hospital, Jeddah	11
King Fahad Military Hospital, Khamis Mushayt	5
King Salman Military Hospital, Tabuk	2
Al Hada Armed Forces Hospital, Taif	3
TOTAL	181 kidneys/177 recipients

Performance of deceased kidney transplantation in currently active national kidney transplant centers in 2023.

*4 En-bloc kidney transplants

Cumulative deceased kidney transplantation

Figure 2.1.2.1



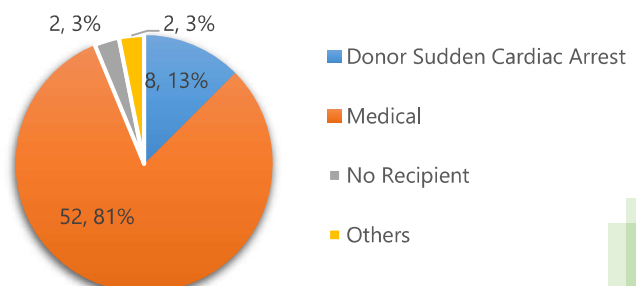
2.1.2.1 Non-recovered deceased kidneys

262 kidneys were consented for transplantation of which 174 deceased kidneys were offered to KSA; wherein, 64 kidneys were not recovered including 14 kidneys from UAE (See table 2.1.2.2 for non-recovered kidneys inside the kingdom). The major causes of non-recovered kidneys are shown in Figure 2.1.2.2.

Table 2.1.2.2: Reasons of non-recovered deceased kidneys in 2023

Reasons of Non-Recovery	N	%
Diseased Kidneys	16	25%
Donor Medical History	12	19%
Infection	10	16%
Donor Sudden Cardiac Arrest	8	13%
Poor Organ Function	6	9%
Biopsy Finding (Tumors, nodules)	4	6%
Kidney Anatomical Abnormalities	4	6%
No Recipient Located (No ABO Compatible Recipient)	2	3%
Others: Police case	2	3%
Total	64	100%

Figure 2.1.2.2: Major Causes of non-recovered deceased kidneys 2023



2.1.2.2 Discarded deceased kidneys

262 deceased kidneys were consented and offered for kidney transplantation in KSA wherein 17 kidneys were discarded by KSA (see table 2.1.2.4 discarded kidneys inside Kingdom). Causes of discarded deceased kidneys from 1986-2023 are listed in table 2.1.2.3.

Table 2.1.2.3: Causes of discarded deceased kidneys

Reason of Discard	N	%
Biopsy Findings: (<i>Malignancy, Glomerulosclerosis, Thrombosis</i>)	103	37%
Vascular Damage (<i>Traumatic renal injury, poor perfusion, black discoloration</i>)	50	18%
Anatomical Abnormalities (<i>Small, atrophied left kidneys</i>)	42	15%
Diseased Organ: (<i>CKD, Renal stones, kidney cyst</i>)	32	11%
Infection: (<i>TB, Sepsis, Pyelonephritis</i>)	21	8%
No recipient Located	18	6%
Others: (<i>Police case, Transport</i>)	12	4%
Ureteral Damage: (<i>Skeletonized Ureter</i>)	1	0%
Total	279	100%

Discarded kidneys among actual deceased donors during 1986-2023

2.1.2.4 Adult and pediatric deceased kidney transplantation 2023

181 deceased kidneys were transplanted in KSA. Of which, 177 were transplanted with 4 en-bloc transplants. Kidneys were transplanted to 31 pediatric recipients ≤ 14 years and 150 kidneys were transplanted to 146 adults with 8 kidneys transplanted as en-bloc (see table 2.1.2.5).

Table 2.1.2.5: Adult and pediatric deceased kidney transplantation 2023

Transplant Center	Pediatric	Adult	T: Kidneys
King Faisal Specialist Hospital & Research Center-Riyadh	14	*53K/50R	67K/64R
Prince Sultan Military Medical City-Riyadh	4	11	15
King Abdul-Aziz Medical City & National Guard-Riyadh	2	27	29
King Fahd Specialist Hospital-Dammam	9	*20K/19R	29K/28R
King Salman Military Hospital-Tabuk	0	2	2
King Faisal Specialist Hospital & Research Center-Jeddah	1	19	20
King Fahd Armed Forces Hospital-Jeddah	1	10	11
Al Hada Military Hospital-Taif	0	3	3
King Faisal Military Hospital-Khamis Mushayt	0	5	5
Total	31	150K/146R	181K/177R

*En-bloc transplantation (4 en-bloc transplantation was done in 2023)
K- Kidney R: Recipients

Table 2.1.2.4: Reasons of discarded deceased kidneys 2023

Reason of Discard	N	%
Biopsy Findings: (<i>Sclerosis, carcinoma, Glomerulosclerosis, Infarction</i>)	12	71%
Vascular Damage: (<i>Poor kidney perfusion in life port machine</i>)	2	12%
Infection: (<i>Blood Culture Positive</i>)		
Ureteral Damage: (<i>Skeletonized Ureter</i>)	1	5%
Anatomical Abnormalities (<i>Small, atrophied left kidneys</i>)	2	12%
Total	17	100%

2.1.2.3 Cold ischemia time (CIT)

181 Kidney were transplanted to 177 recipients. The cold Ischemia Time (CIT) for locally transplanted deceased kidneys were ranging from 01:57 to 26:27 hours with a mean CIT of 08 hrs. and 39 minutes. Wherein, 142 (80%) of the deceased kidneys were transplanted with CIT of <12 hrs; 34, (19%) were transplanted with CIT ranging from ≥ 12 -24 hours and 1 (1%) kidneys were transplanted between >24-25 hrs.

2.1.2.5 SCD & ECD kidney transplantation

In 2023, 93 donors the kidneys were utilized from which 181 deceased kidneys were transplanted to 177 recipients out of which 31 (18%) kidneys were transplanted to pediatric recipients (≤ 14 years old) and 146 kidneys were transplanted to adults (82%). On kidney criteria: 141 SCD and 40 ECD kidneys were transplanted. Of the SCD kidneys 30 SCD and 1 ECD kidneys were transplanted to pediatric recipients.

Table 2.1.2.6: Transplanted deceased ECD kidneys in 2023

Characteristics	Donors	Utilized Kidneys
Age ≥ 60 years	5	10 (25%)
Age 50-59 years and having 2 of the following:	6	12 (30%)
<ul style="list-style-type: none"> CVA Hypertension SCr. ≥ 133 $\mu\text{mol/L}$ (1.5 mg/dl) 		
CVA, Hypertension and SCr. result doubled during admission and before retrieval	9	18 (45%)
TOTAL	20	40 (100%)

2.1.2.6 Deceased donor–recipient matching

Matching gender was done in 66% of cases while matching blood group for kidney transplantation between deceased donors and recipients were done in 97% of the cases. Age distribution between deceased kidney donor and recipient is shown in table 2.1.2.7.

Table 2.1.2.7: Age distribution between deceased kidney donor and recipients 2023

Donor Age (yrs.)	Recipient Age (yrs.)						K:Kidney R: Recipient
	<5	5-15	16-29	30-50	51-65	>65	
<5	2	4	2K/1R	2K/1R	0	0	10K/8R
5-15	0	0	0	0	0	0	0
16-29	1	7	7	6	3	1	25/25
30-50	0	16	29K/28R	50	13	6	114K/113R
51-65	0	1	4	12	10	3	30K/30R
>65	0	0	0	0	0	2K/1R	2K/1R
Total	3	28	42K/40R	70K/69R	26	12K/11R	181/177

2.1.3 Living Kidney Transplantation

In 2023, 1,258 kidneys were transplanted from living donors out of which 1,018 kidneys were from Living Related (LR) donors transplants (81%) and 240 were from Living Unrelated (LUR) donors transplants. Living donor transplant is being performed by 14 accredited transplantation in the kingdom from both governmental and private hospital. (see table 2.1.3.1).

Table 2.1.3.1: Living kidney transplantation 2023

Transplant Centers	LR	LUR	Total
King Faisal Specialist Hospital Riyadh	284	112	396
King Faisal Specialist Hospital Jeddah	184	28	212
King Abdulaziz Medical City and National Guard Hospital, Riyadh	110	37	147
King Fahad Specialist Hospital, Dammam	165	12	177
Prince Sultan Military Medical City, Riyadh	58	10	68
King Fahad Armed Forces Hospital, Jeddah	62	10	72
King Fahad Military Hospital, Khamis Mushayt	39	9	48
King Salman Military Hospital, Tabuk	12	6	18
Al Hada Armed Forces Hospital, Taif	30	6	36
King Abdulaziz Medical City and National Guard Hospital, Jeddah	6	6	12
Dr. Suleiman Al Fakeeh Hospital, Jeddah	14	0	14
King Abdullah Medical City, Makkah	15	4	19
King Fahad Hospital, Madinah	0	0	0
Dr. Suleiman Al Habib Suweidi, Riyadh	39	0	39
TOTAL	1018	240	1258

Performance of living kidney transplantation in currently active national kidney transplant centers in 2023

2.1.4 Kidney donation and transplantation outcome 2023

A total of 1,439 kidneys from living and deceased donors were transplanted this year and the top performing kidney transplant centers were KFSH Riyadh with 463 kidneys, KFSH Jeddah 232 kidneys, KFSH Dammam 206 kidneys and KAMC NGH 176 Kidneys transplanted. (see table 2.1.4.1 Living and Deceased Kidney Transplantation Outcome 2023).

Table: 2.1.4.1: Living and Deceased Kidney Transplantation Outcome 2023

Transplant Centers	Total transplanted kidneys/Recipients	Type of Transplant	Total Kidneys	SAUDI	NON-SAUDI	Pediatric ≤14	Adult	Graft loss	Mortality	PKD tx.	Average SCr. (μmol)
King Faisal Specialist Hospital Riyadh	463	D	67	64	0	14	53K/50R	4	3	0	173.2
		LR	284	284	0	34	250	4	1	91	103.4
		LUR	112	110	2	8	104	2	1		
King Faisal Specialist Hospital Jeddah	232	D	20	20	0	1	19	1	1	0	90
		LR	184	184	0	7	177	5	1	2	75
		LUR	28	28	0	0	28	1	1		
King Abdulaziz Medical City and National Guard Hospital, Riyadh	176	D	29	29	0	2	27	0	0	0	105
		LR	110	110	0	3	107	0	0	6	92
		LUR	37	37	0	2	35	0	0		
King Fahad Specialist Hospital, Dammam	206	D	29	29	0	9	20K/19R	0	1	0	100
		LR	165	151	14	21	144	1	0	12	90
		LUR	12	12	0	2	10	0	0		
Prince Sultan Military Medical City, Riyadh	83	D	15	15	0	4	11	0	0	0	132
		LR	58	49	9	3	55	0	0	0	98
		LUR	10	10	0	0	10	0	0		
King Fahad Armed Forces Hospital, Jeddah	83	D	11	11	0	1	10	0	0	0	130-150
		LR	62	62	0	1	61	2	0	0	100
		LUR	10	10	0	0	10	0	0	0	
King Fahad Military Hospital, Khamis Mushayt	53	D	5	5	0	0	5	0	0	0	80-130
		LR	39	39	0	3	36	0	1	NA	60-130
		LUR	9	9	0	1	8	0	1		
King Salman Military Hospital, Tabuk	20	D	2	2	0	0	2	0	0	0	98
		LR	12	12	0	0	12	0	0	0	92.8
		LUR	6	6	0	0	6	0	0		
Al Hada Armed Forces Hospital, Taif	39	D	3	3	0	0	3	0	0	0	107
		LR	30	30	0	0	30	0	0		102
		LUR	6	6	0	0	6	0	0		
King Abdulaziz Medical City and National Guard Hospital, Jeddah	12	LR	6	6	0	0	6	0	0	0	96.33
		LUR	6	6	0	0	6	0	0		
Dr. Suleiman Al Fakeeh Hospital, Jeddah	14	LR	14	1	13	0	14	0	0	0	85
		LUR	0	0	0	0	0	0	0		
King Abdullah Medical City, Makkah	19	LR	15	15	0	0	15	0	0	0	109.6
		LUR	4	4	0	0	4	0	0		
King Fahad Hospital, Madinah	0	LR	0	0	0	0	0	0	0	0	0
		LUR	0	0	0	0	0	0	0		
Dr. Suleiman Al Habib Suweidi, Riyadh	39	LR	39	0	40	0	40	0	0		
Total kidneys	1439 Kidneys 1435 Recipients	D	181	178	0	31	150K/146R	5	5	111	
		LR	1018	943	76	72	947	12	3		
		LUR	240	238	2	13	227	3	3		

Legend:

- D:** Deceased
- LR:** Living Related
- LUR:** Lung Unrelated
- NA:** Not available data



2.2 Liver Transplantation





In the year 2023, 499 livers were transplanted inside the kingdom of Saudi Arabia of which, 404 livers were transplanted from living and 95 transplanted from deceased donors including 4 split liver transplantation. Details of the living and deceased liver transplantation 2023 is shown in table. It is worth mentioning that a total of 4,416 livers were transplanted inside the kingdom from 1990 to 2023 of these livers, 1,413 (32%) were transplanted from deceased donors, 2,688 (61%) from living related donors and 315 (7%) were from living unrelated donors. Illustration of cumulative living and deceased liver transplantation is shown in (figure 2.2.1).

2.2.1 Deceased Liver Donation

In 2023, 201 donors were consented for organ donation. Wherein, 133 donors (122 in KSA, 10 in UAE and 1 in Oman) livers were consented and offered to KSA from which 109 donors were recovered but only 91 were utilized wherein, 95 livers were transplanted with 4 split liver transplants performed. From donors in KSA: 87 recovered and transplanted to 91 recipients (4 split liver) transplanted, 14 were discarded, while 21 donors were non recovered. From donors in GCC, 11 donor's livers were offered in KSA of which, 8 donors were recovered from whom 4 livers were transplanted, 4 discarded and 3 were non-recovered. The details of utilized liver donor characteristics are listed in table 2.2.1.1. Details of the cumulative deceased liver donation are listed in table 2.2.1.2.

Table 2.2.1.1. Deceased liver donor characteristics

Characteristic	N	%
Age		
0-10	4	4
11-20	3	3
21-30	8	9
31-40	22	24
41-50	34	37
51-60	14	15
61-70	6	7
Blood Group		
A	28	31
B	25	27
AB	13	14
O	25	27
Gender		
Male	78	86
Female	13	14
Cause of Death		
Anoxia	15	16
CVA	46	51
Head trauma	27	30
CNS tumor	3	3
Others		
Circumstance of Death		
MVA	17	19
Non-MVA	74	81

Characteristics of utilized deceased liver donors in 2023

Table 2.2.1.2 Deceased liver donation 2023

Livers from deceased donors	N	%
Transplanted in KSA	91 (95*)	45%
Not recovered livers	24	12%
Discarded livers	18	9%
Liver for GCC countries	67	33%
Not consented	1	1%
Total	201	100%

91 livers were recovered and transplanted to 95* recipients via (4 Split Liver Transplantation)

Cumulative living and deceased liver transplantation in KSA

■ Deceased: 1,1413 ■ Living Related: 2,688 ■ Living Unrelated: 315

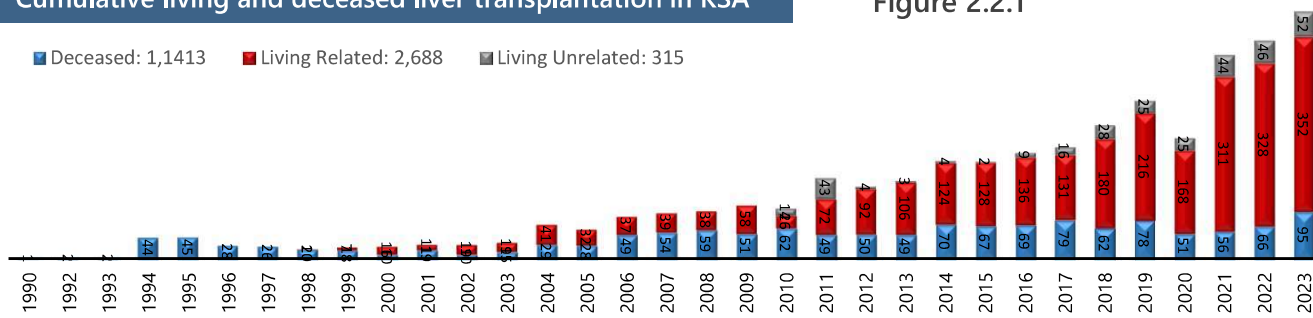


Figure 2.2.1

2.2.2.1 Deceased Liver Transplantation 2023

201 deceased liver donors were consented for organ donation of these, 133 liver donors were consented and offered to KSA wherein, 91 livers were recovered and transplanted to 95 recipients including the 4 split liver transplants. Of the transplanted livers 87 liver were from KSA and transplanted to 91 recipients (4 split liver) and 4 were from UAE. The deceased liver transplantations this year were performed in 4 currently active liver transplant centers in the kingdom (see table 2.2.2.1).

2.2.2.2 Non-recovered deceased livers

133 deceased liver donors were consented/offered for donation of which 95 livers were transplanted including 4 split liver transplants. Of the livers offered, 24 livers were not recovered which includes 21 livers from KSA and 3 livers from GCC. (see table 2.2.2.4). The major causes of non-recovered deceased livers are mainly due to donor Medical reasons. Major causes of non-recovered deceased livers in 2023 are listed in Figure 2.2.2.1. Illustration of the cumulative major cause non-recovered deceased liver transplantation from 1994 is shown in Figure 2.2.2.2.

2.1.2.3 Discarded deceased livers

133 deceased livers were consented for transplantation, of which 109 livers were recovered for the purposed of transplantation. From the recovered livers, 18 livers were discarded which includes 14 livers from KSA and 4 livers from UAE. (see table 2.2.2.1). Causes of discarded deceased livers from 1994-2019 are listed in (table 2.2.2.7).

Table 2.2.2.1: Deceased liver transplantation

Hospital Name	Liver/Recipients
King Faisal Specialist Hospital, Riyadh	44/48*
King Abdulaziz National Guard, Riyadh	24
King Fahad Specialist Hospital Dammam	12
Prince Sultan Military Medical City, Riyadh	11
Total	91/95*

Performance of deceased liver transplantation in currently active national liver transplant centers in 2023
91 Livers were transplanted to 95* recipients via split liver transplantation.

Table 2.2.2.2. Reasons of non-recovered deceased livers

Reasons of Non-Recovery	N	%
Donor Sudden Cardiac Arrest	4	
Donor Medical History	1	
▪ ITP, immune disease		
Infection	9	
▪ Sepsis, fungal infection, culture positive		
No Recipient Located	3	
▪ No ABO recipient, Size and weight mismatched		
Micro/Macroscopic findings (upon opening the body)	4	
▪ Liver fibrosis/cirrhosis, Mass on the colon		
Logistics Issues		
▪ No available MEDEVAC	1	
Others:		
▪ Police case	1	
▪ Team need more investigations	1	
Total	24	

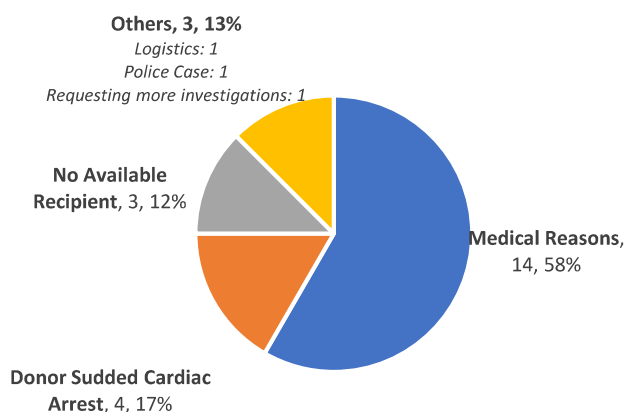
Reasons of non-recovery of livers among eligible donors consented for liver donation in 2023

Table 2.2.2.3: Reasons of discarded deceased livers 2023

Reason of Discard	N	%
Microscopic findings	12	67%
▪ Steatosis, hepatic necrosis, nodular fibrosis, multiple thrombus in hepatic artery		
▪ Lung nodule, malignancy		
Macroscopic findings	2	11%
▪ Fatty liver, hepatomegaly, liver trauma,		
Infection	1	5.5%
▪ MDRO		
Others:		
▪ Recipient had sudden cardiac arrest	1	5.5%
▪ Long Cold Ischemic Time	2	11%
Total	18	100%

Discarded livers among actual deceased liver donors in 2023

Figure 2.2.2.1: Major causes of non-recovered deceased livers 2023



2.2.2.3 Adult and pediatric deceased liver transplantation

A total of 91 livers were recovered and transplanted to 95 recipients (4 livers transplanted via Split Transplantation). Recipients of these liver were composed of 61 (92%) livers transplanted to adult and 5 (8%) livers transplanted to pediatric recipients aged ≤ 14 years old (see table 2.2.2.4).

Table 2.2.2.4: Adult and pediatric deceased liver transplantation

Liver Transplant Center	Adult	Pediatric ≤ 14 yrs	Total
King Faisal Specialist Hospital & Research Center-Riyadh	42	6	44/48*
King Abdul-Aziz Medical City and National Guard-Riyadh	24	0	24
King Fahd Specialist Hospital-Dammam	12	0	12
Prince Sultan Military Medical City	10	1	11
Total	88	7	91/95*

Pediatric and adult deceased liver transplanted in currently active national liver transplant centers in 2023 (*4 Livers Transplanted as split)

2.2.2.4 Deceased donor-recipient matching

Matching sex was done in 41 (62%) of the cases and matching blood group for liver transplantation between deceased donors and recipients was done in 61 (92%) of the cases. Age distribution between deceased kidney donor and recipient is shown in table 2.2.2.5.

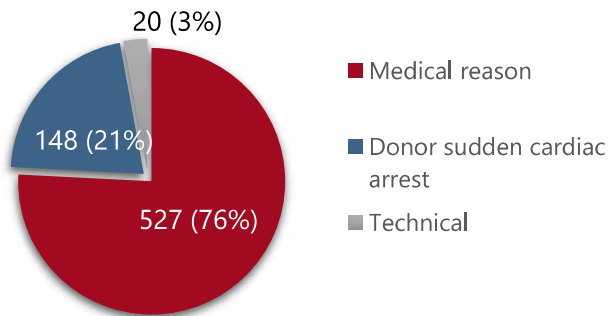
Table 2.2.2.5: Age distribution between deceased liver donor and recipients; *performed as split liver transplantation 2023

Donor Age (yrs.)	Recipient Age (yrs.)						Livers/Recipients
	<5	5-15	16-29	30-50	51-65	>65	
<5	0	3	0	1	0	0	4
5-15	0	0	0	0	0	0	0
16-29	1*	0	2	3	4	1	10L/11R
30-50	1*	2*	7	19	27	4	57L/60R
51-65	0	1	1	3	13	0	18
66-71	0	0	0	1	0	1	2
Total	2	6	10	27	44	6	91/95*

2.2.2.5 Cold ischemia time (CIT)

The Cold Ischemic time of transplanted livers to 95 recipients (4 split livers) ranges from 00:30 minutes to 12 hours 30 minutes. With a mean CIT of 6 hours 13 minutes. Breakdown of CIT of liver transplantation are as follows: <6 hours: 41 recipients (44%), $\geq 6 - 8$ hours: 24 recipients (25%), and $\geq 8 - 12$ hours: 28 recipients (29%), >12 Hours: 2 (2%)

Figure 2.2.2.2 Major causes of non-recovered deceased livers 1994-2023



Major causes of non-recovered deceased livers among eligible donors consented for liver donation

Table 2.2.2.7 Causes of discarded deceased livers 1994-2023

Major Causes	N	%
Micro/Macroscopic Findings:	213	72%
Macro/Microstasis, Steatosis (fatty Changes)	142	
Granulomatous Changes/Fibrosis/Atherosclerosis/Necrosis	57	
Hepatitis (B,C) Changes	6	
Cholestasis, ductopenia, Artery thrombosis	8	
Infection:	23	8%
Sepsis: Positive Blood Cultures: (Acinobacter Baumannii)	14	
Infectious Disease (TB, Bilharziasis, Schistosomiasis, COVID, Others)	9	
Tumour/Malignancy:	11	4%
Neoplastic	9	
Suspicious Malignancy from other organs found	2	
Post Retrieval Issues	27	9%
Ischemia/Long CIT	25	
Poor liver perfusion	2	
Donor/Recipient:	20	7%
Cardiac Arrest (Donor/Recipient)	8	
Traumatic Liver Injury	9	
Congenital/Vascular Abnormalities	3	
Total	294	100%

Discarded livers among actual deceased donors consented for liver donation 1994-2023

2.2.3 Living Liver Transplantation

A total of 404 living liver transplants were performed this year; of which, 352 (87%) livers were transplanted from living related donors (LR) and 52 (13%) from living unrelated liver donors (LUR). The total living liver transplantations this year were performed in 4 liver transplant centers in the Kingdom (see table 2.2.3.1).

Table 2.2.3.1: Living liver transplantation

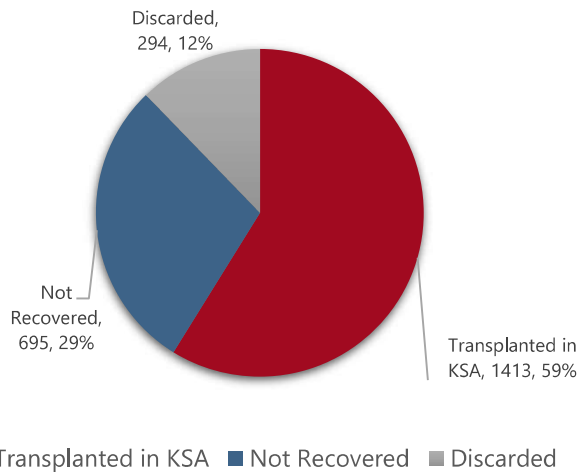
Transplant Center	Living Related	Living Unrelated	Total
King Faisal Specialist Hospital, Riyadh	229	37	266
King Fahad Specialist Hospital Dammam	54	8	62
King Abdulaziz Medical City National Guard, Riyadh	40	6	46
Prince Sultan Military Medical City, Riyadh	29	1	30
Total	352	52	404

Table 2.2.3.2: Living and deceased liver transplantation

Transplant Center	Living		Deceased	T
	Related	Unrelated		
King Faisal Specialist Hospital, Riyadh	229	37	48	314
King Fahad Specialist Hospital Dammam	54	8	12	74
King Abdulaziz Medical City National Guard, Riyadh	40	6	24	70
Prince Sultan Military Medical City, Riyadh	29	1	11	41
Total	352	52	95	499

Transplant centers performing living and deceased liver transplantation in 2023

Table 2.2.2.8: Livers from deceased donors 1994-2023



2.2.4 Liver donation and transplantation Outcome 2023

A total 499 living and deceased livers were transplanted this year, and the top performing liver transplant center is the KFSH Riyadh with 314 livers transplanted. (see table 2.2.4.1 Living and Deceased Liver Transplantation Outcome 2023).

Table: 2.2.4.1: Living and Deceased Liver Transplantation Outcome 2023

Transplant Centers	Total transplanted Livers	Type of Transplant	Total	SAUDI	NON-SAUDI	Pediatric ≤14	Adult	Graft loss	Mortality
King Faisal Specialist Hospital Riyadh	314	D	48	48	0	6	42	6	11
		LR	229	211	18	63	166	9	8
		LUR	37	37	0	16	21	2	2
King Abdulaziz Medical City and National Guard Hospital, Riyadh	70	D	24	24	0	0	24	0	0
		LR	40	40	0	12	28	0	2
		LUR	6	6	0	3	3	0	0
King Fahad Specialist Hospital, Dammam	74	D	12	12	0	0	12	2	4
		LR	54	37	17	23	31	1	2
		LUR	8	6	2	3	5	1	2
Prince Sultan Military Medical City, Riyadh	41	D	11	11	0	1	10	0	3
		LR	29	27	2	1	28	0	4
		LUR	1	1	0	0	1	0	0
Total	499	D	95	95	0	7	88	8	18
		LR	352	315	37	99	253	10	16
		LUR	52	50	2	22	30	3	4

Legend:

- D:** Deceased
- LR:** Living Related
- LUR:** Lung Unrelated
- NA:** Not available data



2.3 Heart Transplantation



In the year 2023, 68 hearts were recovered of which 55 hearts were transplanted and 9 hearts were recovered as source of valves by the kingdom of Saudi Arabia. It is worth mentioning that a total of 621 hearts has been transplanted from 1986-2023 in addition, 767 hearts recovered as sources of valves since 1993. Illustration of the cumulative deceased heart transplantation and recovered hearts as source of valves in Saudi Arabia is shown in figure 2.3.1.

2.3.1 Deceased Heart Donation 2023

201 deceased donors were consented for the purpose of organ donation(see table 2.3.1.3). Of the consented deceased donors, 185 hearts were consented and offered to KSA from which 120 were from KSA and 65 from UAE. From the consented heart donors in KSA (120): 44 were recovered of which 38 were transplanted, 5 recovered as HFV, 1 discarded, and 76 non recovered. GCC donors (65): 21 were recovered of which 17 were transplanted, 4 recovered as HFV, and 44 non recovered. The characteristics of the transplanted utilized deceased heart donor by the KSA are listed in table 2.3.1.1. Illustration of the cumulative deceased heart donation from 1986 is shown in table 2.3.1.2.

Table 2.3.1.1: Characteristics of Utilized Heart Donors

Characteristic	N	%
Age		
0-10	5	9%
11-20	2	4%
21-30	11	20%
31-40	21	38%
41-50	16	29%
51-60	0	0
Blood Group		
A	19	35%
B	8	15%
AB	2	4%
O	26	47%
Gender		
Male	44	80%
Female	11	20%
Cause of Death		
Anoxia	9	16%
Cerebrovascular/Stroke	26	47%
Head trauma	19	35%
CNS Tumor	1	2%
Circumstance of Death		
MVA	11	20%
Non-MVA	44	80%

Characteristics of utilized deceased heart donors in 2023

Table 2.3.1.2: Deceased heart donation 1986-2023

Hearts from deceased donors	N	%
Consented for Heart Donation	2,439	90%
As source of valves	767	
Not recovered	1,029	
Transplanted	621	
Discarded	2	
For GCC	20	
Not consented	237	10%
Total	2,676	100%

Table 2.3.1.3: Deceased heart donation 2023

Hearts from deceased donors	N	%
Consented Deceased Donors	201	100%
•Not recovered	120	
•Transplanted whole heart	55	
•Recovered as source of valves	9	
•Discarded	1	
•Heart for GCC*	13	
•Not consented	3	
Total	201	100%

*Heart for GCC- other donor organs (e.g. liver, lungs) were offered or shared to KSA except the heart.

2.3.2 Deceased Heart Transplantation

201 deceased donors were consented for organ donation of which 185 heart donation donors were consented and/or offered in KSA of which heart donors in KSA: 44 were recovered of which 38 were transplanted, 5 recovered as HFV, 1 discarded, and 76 non recovered. From GCC donors (65): 21 were recovered of which 17 were transplanted, 4 recovered as HFV, and 44 non recovered. (See table 2.3.2.2) For transplanted hearts (See table 2.3.2.1) Heart as source for valves.

Table 2.3.2.1: Heart for valve recovery and utilization 2023

Total Collected Heart for HFV			9
HFV Utilization	Aortic valve	Pulmonary valve	
Total Collected	9	9	
Used	0	3	
To be used	1	1	
Discarded	8	5	

Recovered heart as source of valves from eligible deceased hearts in 2023 (KFSH Riyadh)

2.3.2.1 Non-recovered deceased hearts

185 deceased hearts were consented/offered to KSA for heart Transplantation; out of which 120 were not recovered; 76 from KSA and 44 from GCC (see table 2.3.2.3). The major causes of non-recovered deceased hearts are mainly due to determined unsuitable heart donor, poor heart function and no available suitable recipients. This year 1 heart was also discarded due to long ischemic time.

2.3.2.2 Cold ischemia time (CIT)

CIT for the 55 deceased hearts transplanted was ranging from 00:10 to 8:18 hours with a mean CIT of 3 hrs. 16 minutes, of these 36 hearts were transplanted with CIT of ≤ 4 hours, 10 with CIT ≤ 5 hours, and 9 with CIT of > 5 hours.

2.3.2.3 Adult and pediatric heart transplantation

55 hearts were transplanted inside the kingdom of which 17 (31%) hearts were transplanted to pediatric recipients with age of ≤ 14 years and 38 (69%) hearts were utilized for adult recipients see table 2.3.2.4.

Table 2.3.2.2: Deceased hearts transplantation 2023

Transplant Center	Transplanted Deceased Hearts
King Faisal Specialist Hospital & Research Center-Riyadh	27
King Abdulaziz Cardiac Center National Guard	21
Prince Sultan Cardiac Center-Riyadh	7
Total	55

Performance of deceased heart transplantation in currently active national heart transplant centers in 2023

Table 2.3.2.3: Reasons of non-recovered deceased hearts

Reasons of Non-Recovery	N	%
Organ Assessment (Findings during offering)	45	36
▪ CAD, LVH, Cardiac cath findings		
Donor Medical History	26	22
▪ Heart surgeries, OLD age with multiple co-morbidities (HTN, DM), CAD, STEMI		
Poor Organ Function	11	9
▪ Poor Echo result, low EF, poor heart contractility, Hypokinesia		
No Recipient	10	8
▪ No ABO compatible recipient	4	
▪ Crossmatched Positive	3	2
▪ No Available suitable recipients (Age, size, blood group mismatched)	3	
Infection	6	5
▪ Septicemia (Blood infection), Hepatitis, PCR CSF positive		
Donor Instability	6	5
Donor Sudden Cardiac Arrest	3	2
Tumor/Malignancy	1	1
▪ Neoplastic Tumor in pancreas		
Logistics	6	5
▪ No available MEDEVAC bad weather	3	
▪ Machine can't fit in the MEDEVAC	1	
▪ No available Helicopter	1	
▪ Need to bring the donor in Riyadh	1	
Others:	6	5
▪ Cardiac cath not available		
Total	120	100%

Reasons of non-recovered deceased hearts among eligible donors consented for heart donation in 2023

Table 2.3.2.4 Adult and paediatric deceased heart transplantation

Heart Transplant Center	Adult ≥ 15 years	Pediatric ≤ 14 years	Total
King Faisal Specialist Hospital & Research Center Riyadh	16	11	27
King Abdulaziz Cardiac Center National Guard	15	6	21
Prince Sultan Military Medical City Riyadh	7	0	7
Total	38	17	55

Adult and pediatric deceased heart transplantation 2023

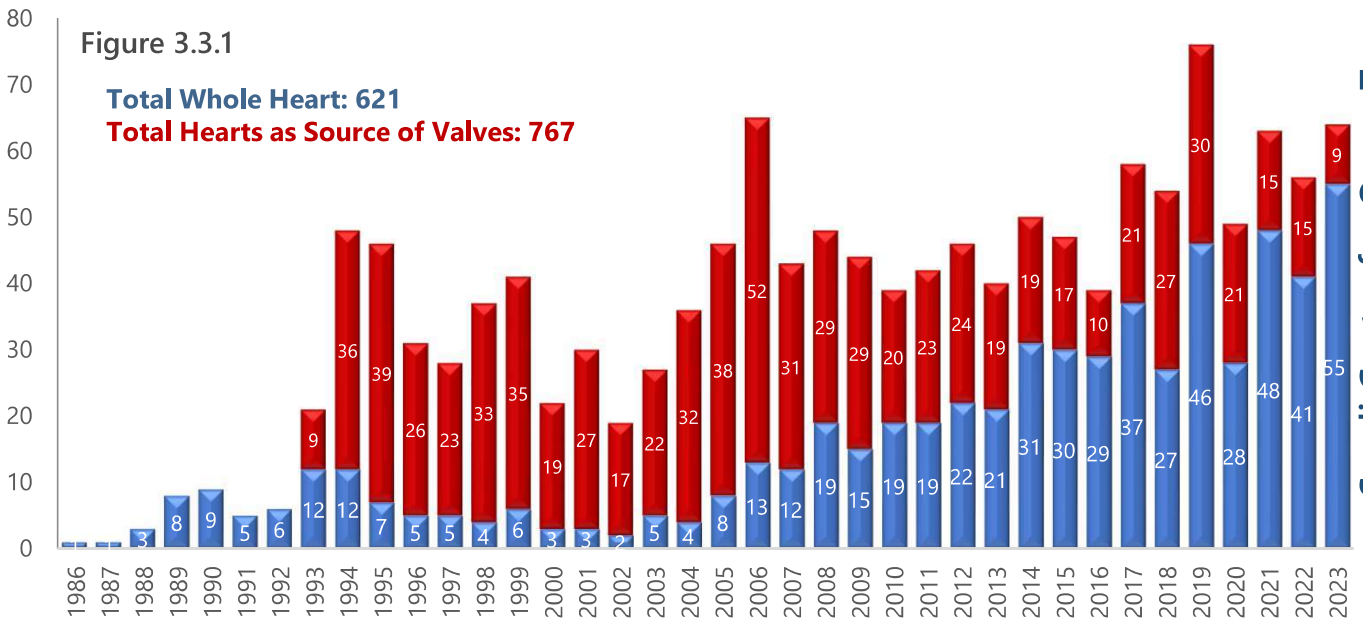
2.3.2.4 Deceased donor-recipient matching 2023

Matching sex was done in 36 donor-recipient (65%) of the cases, and matching blood group for heart transplantation between deceased donors and recipients was done in 51 (93%) of the cases. Age distribution between deceased heart donors and recipients are shown in table 2.3.2.5.

Table 2.3.2.5: Age distribution between deceased heart donor and recipients 2023

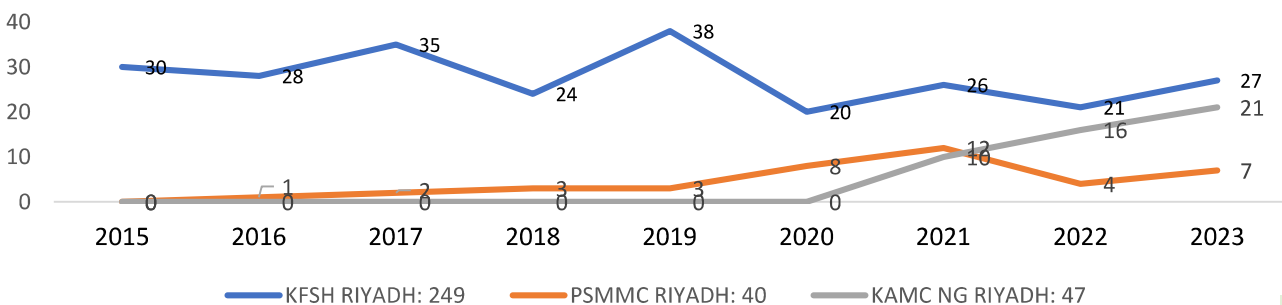
Donor Age (yrs.)	Recipient Age (yrs.)						Total
	<5	5-15	16-29	30-50	51-65	>65	
<5	4	0	0	0	0	0	4
5-15	0	1	0	0	0	0	1
16-29	0	5	4	2	1	0	12
30-50	1	6	7	20	4	0	38
Total	5	12	11	22	5	0	55

Cumulative deceased heart transplantation and recovered hearts as source of valves in Saudi Arabia 1986-2023



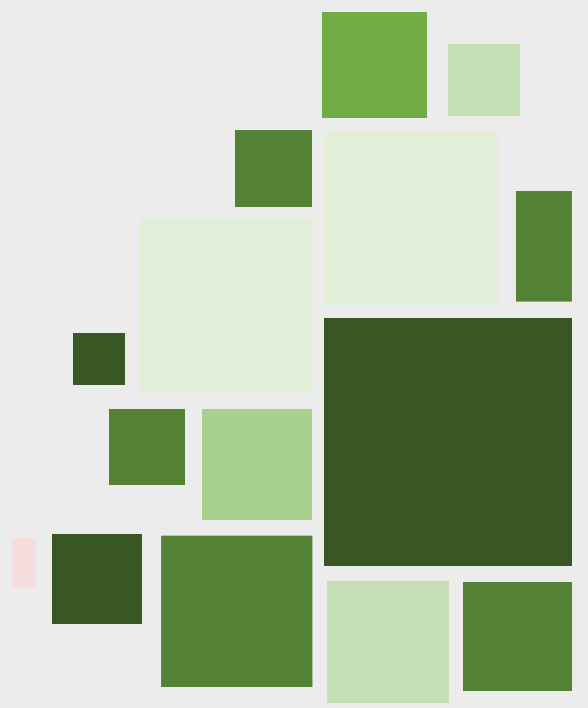
Saudi Center for Organ Transplantation

Heart Transplantation Activity by Transplant Center 2015-2023





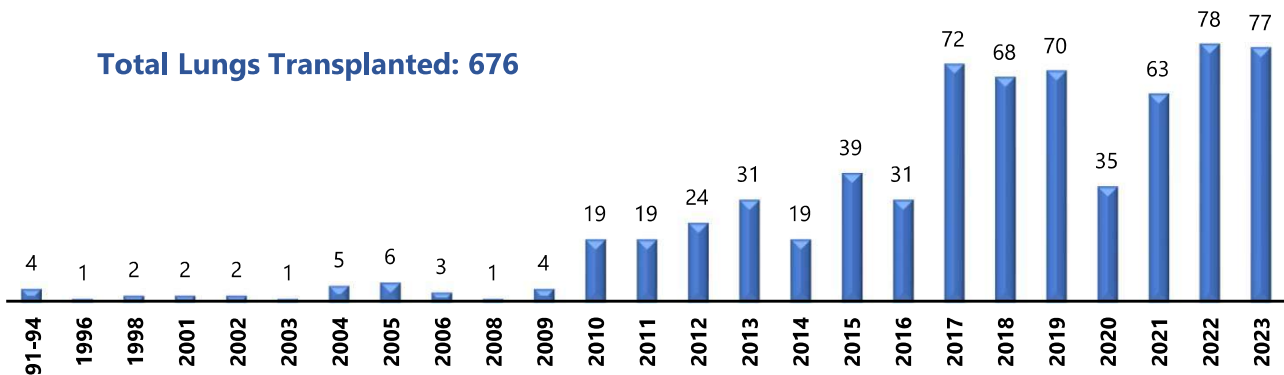
2.4 Lung Transplantation



In the year 2023, 77 lungs were transplanted 41 recipients from deceased donation inside the Kingdom of Saudi Arabia. It is worth mentioning that a total of 676 lungs has been transplanted from 1991-2023. Illustration of the cumulative deceased lung transplantation is shown in figure 2.4.1

Cumulative deceased lung transplantation 1991-2023

Figure 2.4.1



2.4.1 Deceased Lung Donation 2023

201 deceased donors were consented for deceased organ donation. Of the consented donors, 121 donors (242 lungs) were consented from KSA, while there were 78 consented donors from GCC only 56 lung donors (112 lungs) were offered to KSA. From Lung donors in KSA 30 donors were recovered of which 60 lungs were recovered, 56 lungs were transplanted, 1 donor lungs were discarded and 90 were non-recovered 180 lungs. From GCC donors, 11 were recovered from which, 21 lungs were transplanted, 4 donors lungs were discarded and 41 donors lungs were not recovered (82 lungs) (see figure 2.4.1.1). The details of the utilized lung donor characteristics are listed in table 2.4.1.1

Figure 2.4.1.1 Lungs from deceased donation 2023

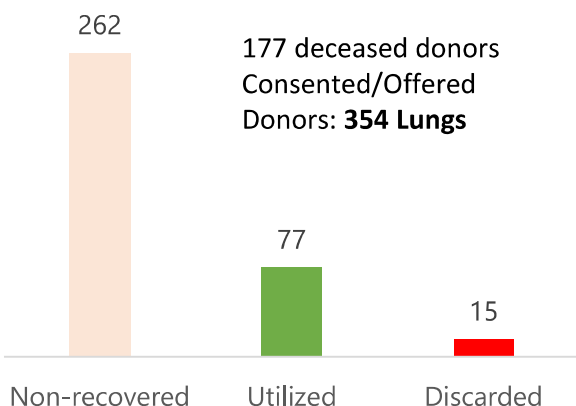


Table 2.4.1.1 Utilized Deceased Lung Donor Characteristics 2023

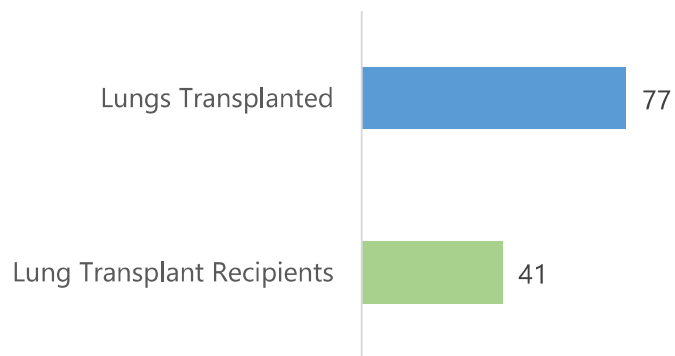
Characteristic	N	%
Age		
11-20	2	5
21-30	6	15
31-40	13	32
41-50	13	32
51-60	5	12
61-70	2	5
Blood Group		
A	19	46
B	1	2
AB	9	22
O	12	29
Gender		
Male	34	83
Female	7	17
Cause of Death		
Anoxia	8	20
Cerebrovascular/Stroke	21	51
Head trauma	12	29
CNS Tumor	0	0
Other	0	0
Circumstance of Death		
MVA	8	20
Non-MVA	33	80

Characteristics utilized deceased lung donors 2023

2.4.2 Deceased Lung Transplantation

177 deceased lungs donors (354 lungs) were consented and offered for the purpose of transplantation of which 77 (22%) lungs were transplanted to 41 recipients, wherein 36 recipients had double lung transplant and 5 recipients single lung transplant. It is worth mentioning that this year King Abdulaziz National Guard Hospital in Riyadh, opened their services for deceased lung transplant. (see Figure 2.4.2.1).

Figure 2.4.2.1 Deceased Lung Transplantation



Performance of deceased lung transplantation in currently active national lung transplant center in the year 2023

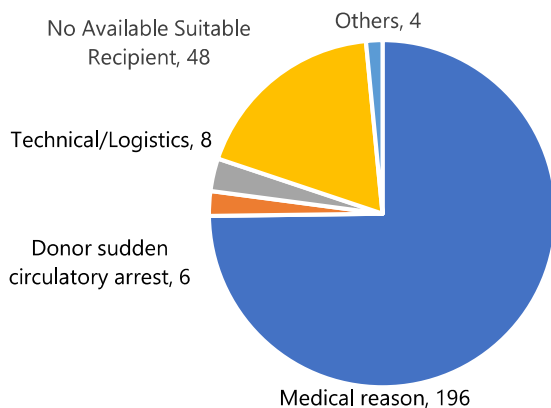
2.4.2.1 Non-recovered deceased lungs

354 deceased lungs were consented for lung transplantation; out of which 262 lungs (74%) were non-recovered (see table 2.4.2.1.1). The major causes of non-recovered deceased lungs is shown in figure 2.4.2.1.1)

Table 2.4.2.1.1 Reasons of non-recovered deceased lungs

Reasons of Non-Recovery	N	%
Infection	114	44%
• Lung Infections (Pneumonia, Pus in lungs, TB)		
• Systemic Bacterial Infection (COVID 19, Bacteremia, Candidemia, MDR)		
• Hepatitis (HbSag)		
Organ donor Assessment finding (Pre-operative Findings): (Labs and Investigations resulting to organ declination)	58	22%
• Xray, CT and Bronchoscopy findings: Aspiration pneumonia, lung collapse, consolidation		
• Challenge test findings: poor gas exchange		
Donor Medical History: (Demographics (old age, too young, previous diseases, co-morbidities)	10	4%
• Emphysema		
• History of status asthmaticus		
• Post CABG, borderline xray		
No available suitable lung recipient	48	18%
• No ABO compatible recipient	38	
• No Pediatric recipient/neonate	4	
• Crossmatched positive	4	
• Donor-Recipient size mismatched	2	
Micro/Macroscopic findings (Intraoperative Findings)	4	2%
▪ Other organs: Lung nodules, Pancreas tumor		
Donor Sudden Cardiac Arrest	6	2%
Donor Instability (Rapid Organ Retrieval)	10	4%
Logistics	8	3%
Others	4	2%
• Can't accept organ without TB PCR		
• Team didn't arrive at the airport after accepting the organ		
Total	262	100%

Table 2.4.2.1.1 Major causes of non-recovered lungs



131 donors: 262 Lungs

The reasons of non-recovery of lungs among eligible donors consented for lung donation 2023

Reasons of non-recovered of lungs among eligible donors consented for lung donation in 2023

2.4.2.2 Discarded Lungs

354 deceased lungs were consented for lung donation of which 15 lungs were discarded (see table 2.4.2.2.1)

Table 2.4.2.2.1 Reasons of discarded deceased lungs

Reason of discard	N
Lung Consolidation	6
Pus in lungs, heavy thick secretions	3
Lung collapse	2
Lung Nodule (malignancy)	4
Long CIT, bad perfusion	15
Total	15

2.4.2.3 Adult and pediatric lung transplantation

77 deceased lungs were transplanted to 41 recipients where all lung were transplanted to adult recipients. Lung recipients age ranged from 18-71 years old. (see table 2.4.2.3.1).

Discarded lungs among actual deceased lung donors in 2023

Table 2.4.2.3.1 Adult and Pediatric Lung Transplantation

Adult and Pediatric Lung Transplant	Adult		Pediatric (< 14)	
	Single	Double	Single	Double
King Faisal Specialist Hospital & Research Center-Riyadh	5	35	0	0
King Abdulaziz Medical City National Guard Riyadh	0	1	0	0

2.4.2.4 Cold ischemia time (CIT)

CIT for the 77 deceased transplanted lungs was ranging from 1 hr. 55 mins. & 8 hrs. 10 minutes with mean CIT of 5 hours. & 18 minutes. Cold Ischemic Time for deceased lungs transplant shows that 42 lung were transplanted with CIT of ≤ 6 hours and 35 with > 6 hours.

2.4.2.5 Deceased donor-recipient matching

Matching sex was done in 27 donor-recipient (59%) of the cases and matching blood group for lung transplantation between deceased donors and recipients was done in 40 (98%) of the cases. Age distribution between deceased lung donors and recipients are shown in table 2.4.2.5.1.

Table 2.4.2.5.1.: Age distribution between deceased lung donor and recipients 2023

Donor Age (yrs.)	Recipient Age (yrs.)						Total
	<5	5-15	16-29	30-50	51-65	>65	
<5	0	0	0	0	0	0	0
5-15	0	0	0	0	0	0	0
16-29	0	0	2	2	3	1	8
30-50	0	0	8	8	8	2	26
51-65	0	0	0	3	3	0	6
>65	0	0	0	0	1	0	1
Total		0	10	13	15	3	41

Adult and pediatric deceased lung transplanted in currently active national lung transplant center in 2023

Table 2.4.2.1 Deceased lung Transplantation Activity 1991-2023

Center	Period	Single Lung	Double Lung* recipients	Total Lungs	Recipient
KFH-Jeddah	1991-1994	4	0	4	4
KFSH-Jeddah	2001-2010	8	4 (8 lungs)	16	12
KFSH-Riyadh	1996-2015	20	71 (142 lungs)	162	91
KFSH-Riyadh	2016-2022	17	200 (400 lungs)	417	217
KFSH Riyadh	2023	5	35 (70 lungs)	75	40
KAMC Riyadh	2023	0	1 (2 lungs)	2	1
TOTAL	1991-2023	54	311 (622 lungs)	676	365

*double lung transplant operation is counted as 2 lungs per transplant



2.5 Pancreas Transplantation



In the year 2023, 18 pancreases was transplanted inside the kingdom of Saudi Arabia with a total of 117 pancreases transplantation done from 1990-2023. It is worth mentioning that the first pancreas transplantation in the Kingdom was performed in 1990 then followed by kidney-pancreas transplantation in 1991. Another combined operation was also done in 1992 at Al Shati Hospital in collaboration with King Abdul-Aziz Hospital-Jeddah. Illustration of the cumulative deceased pancreas transplantation is shown in figure 2.5.1.

Cumulative Deceased Pancreas Transplantation

Figure 2.5.1

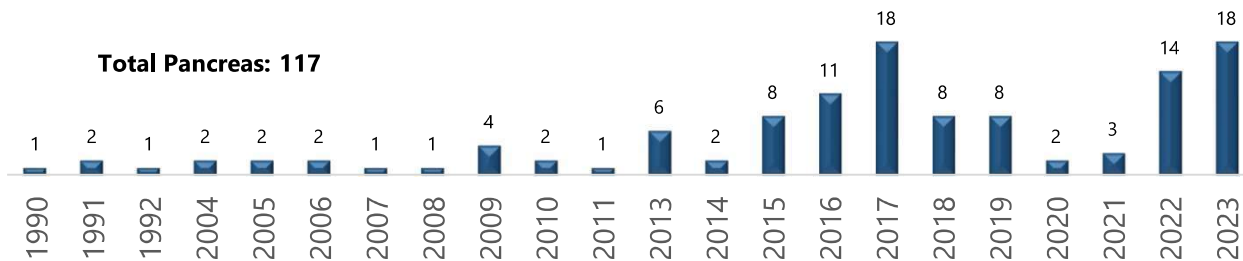


Table 2.5.1.1 Utilized Deceased pancreas donor characteristics

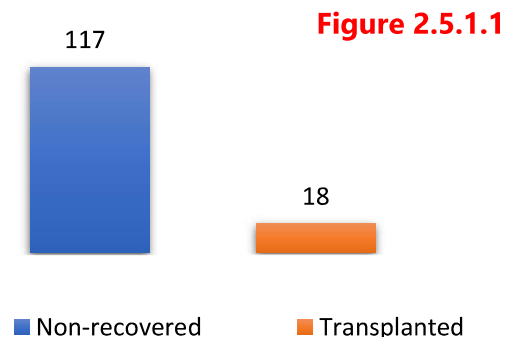
Characteristic	N	%
Age		
1-10	3	17%
11-20	1	6%
21-30	3	17%
31-40	5	28%
41-50	6	33%
Blood Group		
A	5	28%
B	2	11%
AB	0	0%
O	11	61%
Sex		
Male	16	89%
Female	2	11%
Cause of Death		
Anoxia	3	17%
Cerebrovascular/Stoke	5	28%
Head Trauma	9	50%
CNS Tumor	1	6%
Others		
Circumstance of Death		
MVA	5	28%
Non-MVA	13	72%

Characteristics utilized deceased pancreas donors 2023

2.5.1 Deceased Pancreas Donation 2023

In 2023, 201 donors were consented for organ donation. Wherein, 135 donors (121 in KSA and 14 in UAE) pancreas were offered to KSA out of which 18 donor's pancreas were recovered and utilized. From donors in KSA (123 donors): 17 pancreas were transplanted, 104 were non-recovered and 2 donors pancreas were not consented for donation. Donors from GCC (78 donors), 14 donor's pancreas were offered in KSA of which, 1 pancreas were recovered and transplanted, 13 pancreas were non-recovered. (See table 2.5.1.1 for Characteristics of utilized pancreas donor characteristics).

Pancreas from Deceased Donors consented and offered the Kingdom 2023



*Pancreas for GCC- other donor organs (e.g. liver, heart, lungs) were offered or shared to KSA except the Pancreas.

2.5.2 Deceased Pancreas Transplantation 2023

18 pancreases were transplanted inside the Kingdom of which were transplanted as Simultaneous Kidney-Pancreas and Mult visceral transplant (MVT). (See table 2.5.2.1).

Hospital Name	PTA	SKP	MVT
King Faisal Specialist Hospital & Research Center-Riyadh	7	10	1

Table 2.5.2.1: Deceased pancreas transplantation 2023

2.5.2.3 Non-recovered Deceased Pancreas 2023

A total of 135 donor's pancreas was consented/offered for pancreas donation, out of which 117 not recovered. Reason for non-recovered pancreas are shown in [table 2.5.2.3.1](#)

Reasons of Non-Recovery	N	%
Donor Medical History: (Demographics (old age, too young, previous diseases, co-morbidities))	51	44%
▪ History of DM		
▪ Old age		
▪ High BMI, obesity		
▪ Long ICU stay		
▪ Previous abdominal surgery and trauma		
No Available Suitable Recipients	32	27%
▪ No ABO compatible recipient	19	
▪ Crossmatched Positive, highly sensitized recipients	8	
▪ No available suitable recipient (PTA, Pediatric, sick recipient)	4	
▪ Recipient refused to come	1	
Micro/Macroscopic findings (Intraoperative Findings)	14	12%
▪ On Pancreas: Fatty, inflamed, edematous, anatomical issues	13	
▪ Other organs: Lung nodules	1	
Infection	6	5%
▪ Sepsis, fungal infection, culture positive		
Organ donor Assessment finding (Pre-operative Findings): (Labs and Investigations resulting to organ declination)	11	9%
▪ High pancreatic enzymes		
Donor Sudden Cardiac Arrest	2	2%
Donor Instability (Rapid Organ Retrieval)	1	1%
Total	117	100%

Table 2.5.2.3.1: Reasons for non-recovered deceased pancreas 2023

Table 2.5.2.3.2: Major causes of non-recovered deceased pancreas 2023

Not recovered	N	%
Medical reason	85	73%
No Available Suitable Recipient	32	27%
Total	117	100%

The reasons of non-recovery of pancreas among eligible donors consented for pancreas donation in 2023

2.5.2.2 Adult and Pediatric Pancreas Transplantation

Age distribution between deceased pancreas donor and recipient is shown in table 2.5.2.2.1

N	Hospital Name	Adult	Pediatric
1	King Faisal Specialist Hospital & Research Center-Riyadh	17	1

Table II.5.7: adult and paediatric deceased pancreas transplantation

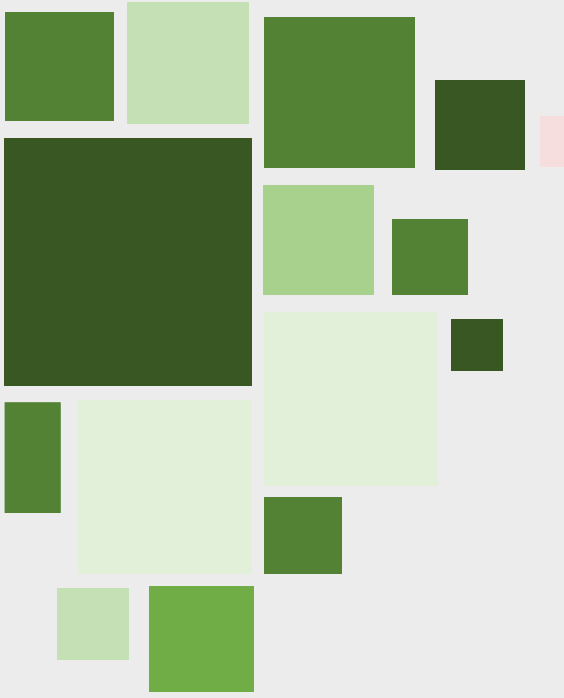
Adults and paediatric pancreas transplantation in currently active pancreas transplant center in 2023

2.5.2.3 Discarded Deceased Pancreas 2023

Table 2.5.2.3.2: Major causes of non-recovered deceased pancreas 2023

Discarded Pancreas	N	%
No discarded pancreas this year	0	0

The reasons of discarded pancreas among eligible donors consented for pancreas donation in 2023



2.7 Intestinal Transplantation

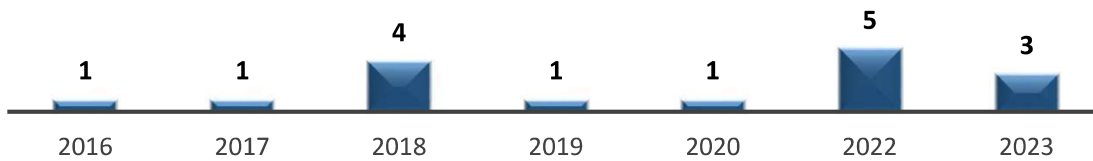


Intestinal or small bowel transplantation program from deceased organ donors was initiated in the Kingdom during the year 2016 and it was first performed at King Faisal Specialist Hospital and Research Center (KFSH & RC) Riyadh. The first small bowel was utilized as a multi-visceral organ transplant (transplanted along with liver and pancreas).

It is worth mentioning that the first donor for small bowel donation in the Kingdom was from Prince Mohammed Bin Abdulaziz Hospital Riyadh. On February 7, 2016, a multivesicular transplantation was performed by KFSH & RC including the small bowel, liver and pancreas.

In 2023, 201 donors were consented for organ donation. Wherein, 127 donors (121 in KSA and 6 in UAE) pancreas were offered to KSA out of which 3 donor's intestines were recovered and utilized. From donors in KSA (123 donors): 3 intestines were transplanted, 118 were non recovered and 2 donors small bowels were not consented for donation. Donors from GCC (78 donors), 6 donor's pancreas were offered in KSA of which all donors small bowel were declined.

Cumulative deceased small bowel transplantation 2016-2023 **Figure 2.7.1**



2.7.2 Deceased Small Bowel Transplantation 2023

3 small bowel were transplanted inside the Kingdom of which, 2 were transplanted as isolated small bowel transplant and 1 as multi visceral transplant. (See table 2.7.1)

Table 2.7.1 Types of Small Bowel Transplantation 2016-2023

Year	Type of Transplant	Organ Combination
2016	Multivisceral	Pancreas, Liver, Intestine
2017	Isolated	Small Bowel Only
2018	Isolated	Small Bowel Only
2019	Isolated	Small Bowel Only
2020	Isolated	Small Bowel Only
2022	4 Isolated, 1 MVT	Pancreas, Liver, Intestine
2023	2 isolated, 1 MVT	Pancreas, Liver, Intestine

2.7.2.1 Non-recovered Small Bowel

A total of 127 donor's intestines were consented/offered for transplantation, out of which 124 not recovered. Reason for non-recovered intestines are shown in table 2.7.2.1

Reasons of Non-Recovery	N	%
No available suitable lung recipient	76	61%
▪ No ABO compatible recipient	60	
▪ No recipient on list	11	
▪ No pediatric recipient	1	
▪ High DSA	3	
▪ Size mismatched	1	
Donor Medical History: (Demographics (old age, too young, previous diseases, co-morbidities))	41	33%
▪ Old age, high BMI, history of DM and HTN		
▪ Long ICU stat, multiple blood transfusions, multiple cardiac arrest during admissions		
▪ Polytrauma		
Infection	5	4%
▪ Positive blood and sputum cultures		
▪ Fungal infection		
Donor Sudden Cardiac Arrest		
Donor Instability (Rapid Organ Retrieval)	1	1%
Logistics	1	1%
▪ No available medevac for the team	1	
Total	124	100%



2.6.1 Corneal Recovery & 2.6.2 Bone Banking





Corneal tissue donation and transplantation program was established in the kingdom in 1983. Corneal recovery were usually done along with multi-organ retrieval procedure from actual DBD donors. **In 2023, 201 deceased donor were consented for organ donation, of which 58 deceased donor were consented for corneal donation.** to date 715 corneas were recovered from deceased donors inside the kingdom from 1983-2023.

2.6.1.1 Deceased corneal donation 2023

201 deceased donors were consented for the purpose of organ donation; of these donors 123 were from KSA and 78 were from GCC countries. From KSA donors, 58 donors were consented for corneal donation, wherein 37 donors cornea were recovered, while 21 cornea donor were declined by corneal centers; and 65 donors were not consented for corneal donation. (see table 3.6.3 Reasons for Non-recovered deceased corneas in KSA.

2.6.1.2 Corneal Recovery Activity and Procurement

In 2023 deceased corneal recovery were performed by 3 corneal transplant centers

N	Corneal Center	Recovered Corneas from DD
1	King Faisal Specialist Hospital & Research Center-Riyadh	52
2	King Abdulaziz Medical City National Guard - Riyadh	12
3	Dhahran Eye Specialist Hospital	6
	Total	70

2.6.1.3 Non-Recovered Deceased Corneas

21 deceased donors consented for corneal donation were declined by corneal transplant centers while 4 single corneas were also declined during corneal retrieval. (see table for reason of non-recovered corneas 2.6.1.1).

Table 2.6.1.1 Reasons for non-recovered deceased corneas

Reasons of Non-Recovery	N=Donors	N=cornea	%
Non Recovered Donors (declined by Centers)			
▪ Infection	11	22	
• Covid 19	3		
• Positive blood and Swab culture	8		
▪ Others	3	6	
• Police case	1		
• No corneal solution	1		
• No Available recovery team	1		
▪ Donor Medical History	2	4	
• Very young age <1 years old			
▪ Donor organ assessment findings (Pre-operative findings)	2	4	
• Corneal Damage and eye disease			
▪ Donor Sudden Cardiac Arrest	1	2	
▪ Logistic	1	2	
• Team won't go on commercial flight			
▪ Micro/macrosopic findings (Intra-operative)	1	2	
Non Recovered single corneas(during retrieval)			
Dry Damage corneas		4	
	21	46	

Bone donation program from deceased donors was started in the Kingdom by King Faisal Specialist Hospital & Research Center in 2009. In 2023, transplant center for bone (KFSH Riyadh) has ceased their operation indefinitely. Illustration of the cumulative recovered deceased bones and musculoskeletal tissues is shown in figure 2.6.2.1.

Cumulative Recovered Deceased Bones and Musculoskeletal Tissues, 2009-2022

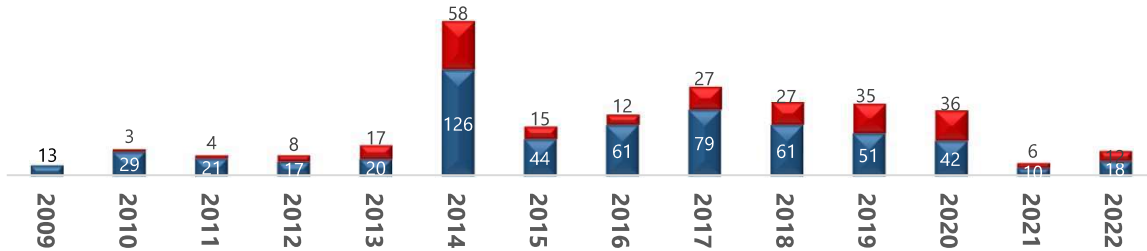


Figure 2.6.2.1 Total Bones Recovered: 592
Total MSKT: 260

2.6.2.1 Deceased Bone Donation 2022

127 deceased donors were consented for organ donation; of which 12 (9%) were consented for bone and MSKT in KSA. Wherein, 3 (25%) donors were recovered and 9 donors (75%) were not recovered. The details of the recovered deceased bone and MSKT donors characteristics are listed in table 2.6.2.1.1 and details of collected bones and MSKT in fig. 2.6.2.1.1.

Characteristic	N	%
Age		
10-20		0%
21-30		0%
31-40	1	34%
41-50	1	33%
51-60	1	33%
Blood Group		
A	1	3%
B	1	3%
AB		0%
O	1	34%
Gender		
Male	2	67%
Female	1	33%
Cause of Death		
Anoxia		0%
Cerebrovascular/Stroke	1	33%
Head trauma	2	67%
CNS Tumor		0%
Others		0%
Circumstance of Death		
MVA		0%
Non-MVA	3	100%

Table 2.6.2.1.1 Characteristics of Deceased Bone & MSKT donors

2.6.2.2 Non-recovered bones

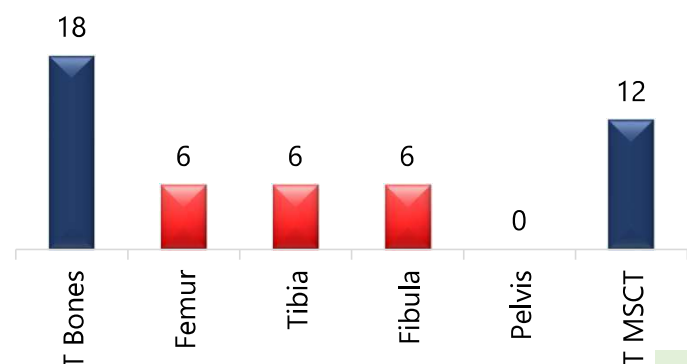
4 deceased donors were consented for bone donation and of which 2 (50%) were not recovered see (see table 2.6.2.1.2).

Reasons of Non-Recovery	N	%
Medical Reasons:		
History of tumor	1	12%
Technical: Bone program on hold		
	8	88%
Total	9	100%

Table 2.6.2.1.1 Reasons of non-recovered bones

Performance of deceased bone and MSKT recovery in currently active national bone bank in 2022

Figure 2.6.2.1.1



2.8 Organ Sharing between Kingdom of Saudi Arabia and GCC Countries 2023



In 2023, 78 possible deceased donors were reported to KSA from GCC of which 78 were consented for organ donation. From the consented/offered deceased donors 29 organ donors were utilized by the Kingdom from these, 4 kidneys, 4 livers, 17 hearts, 21 lungs, and 1 pancreas were transplanted in KSA. In addition, 4 heart for Valves (HFV) were also recovered; Details of the organs shared between KSA and GCC countries. Over the years, the successful cooperation in the organ sharing program between the GCC countries and the KSA yielded a total of 628 deceased organs utilized by KSA in addition to 88 HFV were shared from Kuwait, Qatar, Bahrain, U.A.E. and Spain since 1996.

Table 2.8.1

Recovery and transplantation activities from organ sharing program between the Kingdom and other countries 1996-2023

Year	Recovered/Transplanted Organs*												Total		Tissues
	Kidney		Liver		Heart		Lung		Pancreas		Intestine		Rec.	Tx.	Rec.
	Rec.	Tx.	Rec.	Tx.	Rec.	Tx.	Rec.	Tx.	Rec.	Tx.	Rec.	Tx.			
1996-2000	6	6	19	14	4	4	2	2					31	26	11
2001	13	12	3	3									16	15	1
2002	2	2	2	2									4	4	2
2004	6	6	6	5	1	1							13	12	4
2005	7	7	13	10	1	1	4	2					25	20	12
2006	6	3	12	8									18	11	7
2007	2	2	14	13	1	1							17	16	2
2008	6	5	12	11									18	16	
2009	2	2	5	5									7	7	1
2010	2	2	11	10									13	12	
2011	4	3	5	3	1	1							10	7	
2012	6	3	13	10			10	10					29	23	7
2013	2	2	5	6	2	2	4	4	1	1			14	15	
2014	8	8	21	20	5	5	4	4					38	37	7
2015	0	0	13	12	3	3	8	6					24	21	3
2016	2	2	13	10	3	3	12	12					30	27	1
2017	2	2	17	14	3	3	20	16	2	2			44	37	2
2018	5	5	5	5	4	4	10	10					24	24	3
2019	2	2	19	14	19	9	22	21					62	46	10
2020	5	5	12	11	12	10	12	12	0	0			41	38	2
2021	19	14	17	17	33	29	40	39	0	0			109	99	4
2022	12	12	8	8	24	19	24	24	3	3	2	2	73	68	5
2023	4	4	8	4	21	17	30	21	1	1	0	0	64	47	4
Total	123	109	253	215	137	112	200	183	7	7	2	2	722	628	88

*Kuwait, Qatar, Bahrain and Spain; **Rec.: Recovered Organs; ***Tx.: Transplanted Organs, ****HFV: Heart for Valves

Table 2.8.2

Transplant activities from organ sharing program between the kingdom and other countries 1996-2023

Year	Country	Transplanted Organs						Total Organs	Tissues
		Kidney	Liver	Heart	Lung	Pancreas	Intestine		HFV
1996-2002	Kuwait	3	19	4	2			28	14
2000-2001	Spain	17						17	
2004-2009	Kuwait	10	39	2	2			82	18
	Qatar	15	12	1					8
	Bahrain		1						
2010	Kuwait		5					12	
	Qatar	2	4						
	Bahrain		1						
2011	Kuwait	1	2	1				7	
	Qatar	2	1						
2012	Kuwait	1	9		10			23	7
	Qatar	2	1						
2013	Kuwait	2	6	1	2	1		15	
	Qatar			1	2				
2014	Kuwait	1	16	5	4			37	4
	Qatar	4	1						
	Bahrain	3	3						3
2015	Kuwait		10	2	6			21	2
	Bahrain		2	1					1
2016	Qatar	2						27	
	Kuwait		10	3	12				1
2017	Kuwait	2	13	3	12	1		31	1
	U.A.E.		1		4	1		6	1
2018	Kuwait	3	5	3	8			24	3
	UAE	2		1	2				
2019	Kuwait		11	8	17			36	10
	UAE	2	3	1	4			10	
2020	Kuwait	3	8	7	8	0		26	2
	UAE	2	3	3	4	0		12	
2021	Kuwait	8	16	12	17	0		53	1
	UAE	6	1	17	22	0		46	3
2022	UAE	12	8	19	24	3	2	68	5
2023	UAE	4	4	17	21	1	0	47	4
Total		109	215	112	183	7	2	628	88

Note: 4 Kidneys were shared by KSA to UAE, 2 in 2013 and 2 in 2016

Cost of organ and tissue utilized inside and outside the Kingdom in 2023 (Million SR)

Figure 2.1

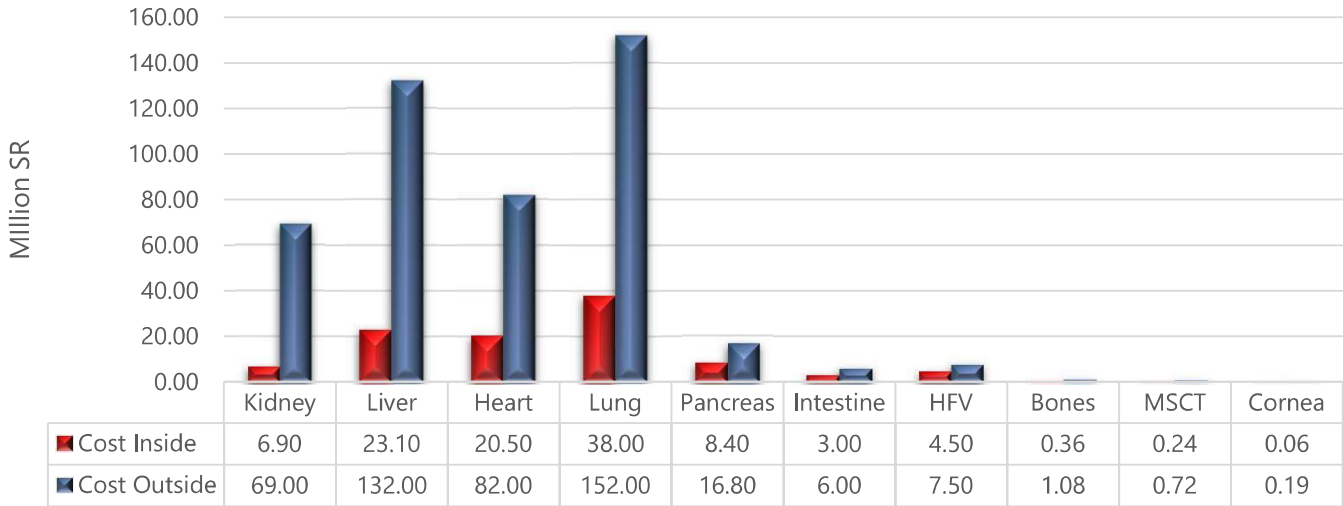
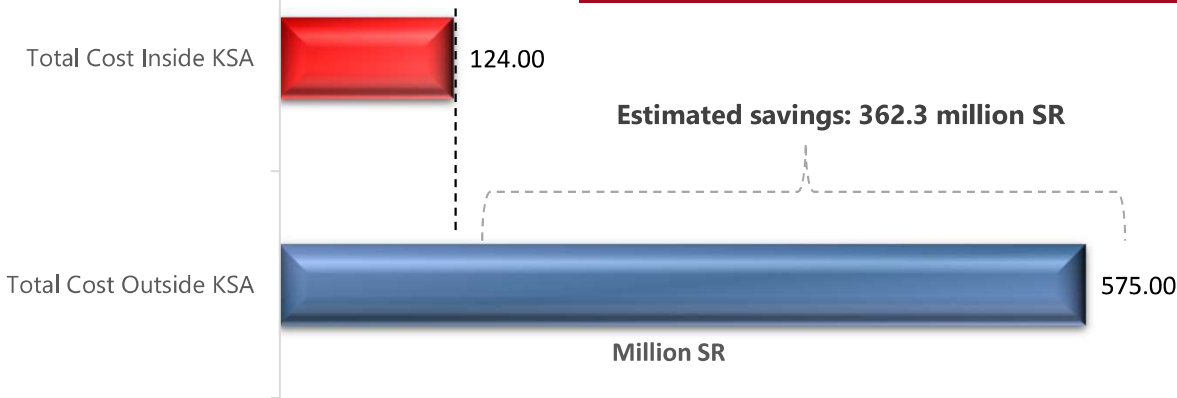


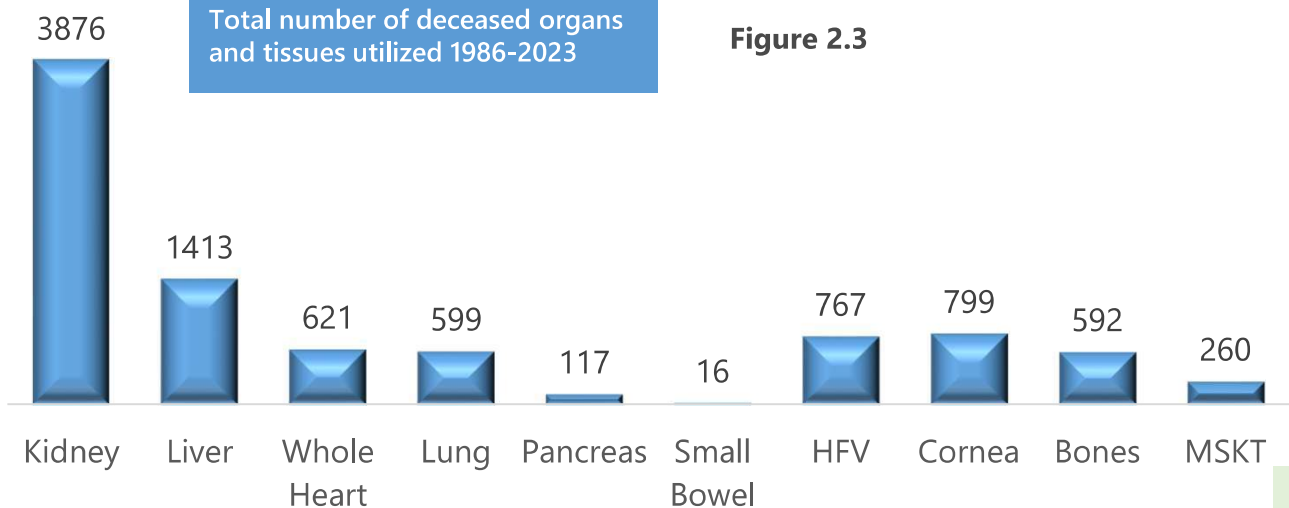
Figure 2.2

Comparison of estimated total cost of organs and tissues transplanted inside and outside the Kingdom in 2023



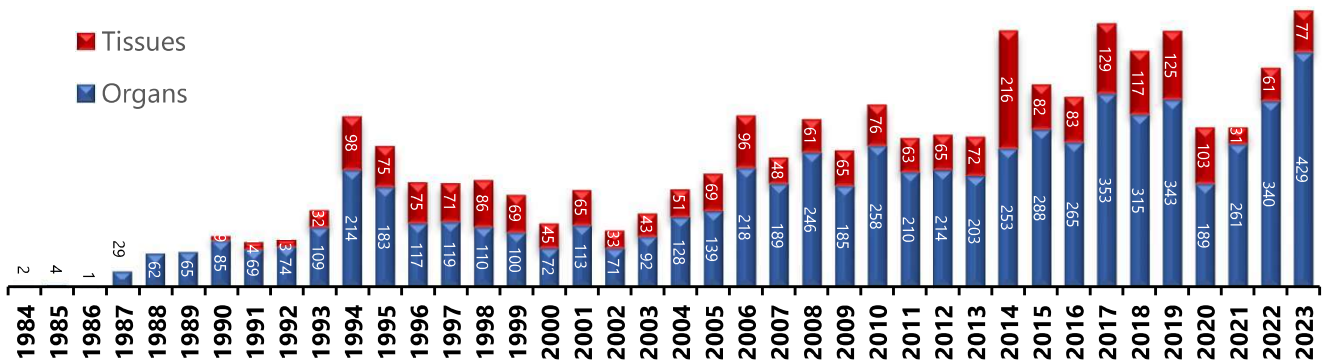
Total number of deceased organs and tissues utilized 1986-2023

Figure 2.3



Total number of deceased organs and tissues utilized 1984-2023

Figure 2.4



Total Organs (kidney, liver, heart, lungs, pancreas, small bowel)

6,717

Total Tissues (corneas, heart for valves, bones, musculoskeletal tissues)

2,418

The cost of transplantation for different organs (kidney, liver heart, etc.) and the amount of savings when comparing inside and outside the Kingdom in organ transplantation. (see fig. 2.2)