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Cancer in kidney transplant recipients: epidemiology and prevention

Adnan Sharif

Queen Elizabeth Hospital Birmingham

Outline

1. The burden of cancer after kidney transplantation
2. Epidemiology of post-transplant cancer
   - The common cancers: incidence versus mortality
   - Who is at risk?
3. Can we prevent post-transplantation cancer?
   - Lifestyle modification
   - Screening programs
   - Modified immunosuppression
   - Personalised medicine
4. Expanding our evidence-base – the EpCOT project
5. Conclusions

The burden of cancer after kidney transplantation

UK Transplant data – long-term mortality

Table 11.2 Patient survival after first adult kidney only transplant from a DBD

Year of transplant	No. at risk on day 0	% Patient survival (95% confidence interval) One year	Two year	Five year	Ten year
					75 (73-77)

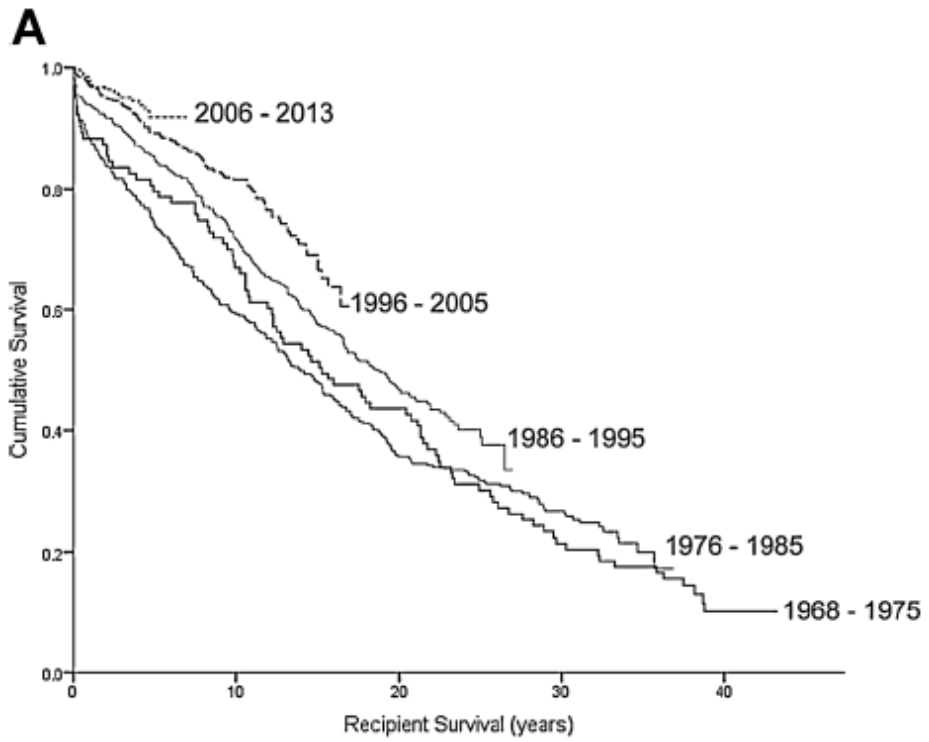
Table 11.4 Patient survival after first adult kidney only transplant from a DCD

Year of transplant	No. at risk on day 0	% Patient survival (95% confidence interval) One year	Two year	Five year	Ten year
					67 (57-75)

Table 11.6 Patient survival after first adult living donor kidney transplant

Year of transplant	No. at risk on day 0	% Patient survival (95% confidence interval) One year		Two year		Five year		Ten year	
1998-2000	655	98	(96-99)	98	(96-98)	95	(93-97)	90	(87-92)
2001-2003	916	98	(97-99)	97	(96-98)	95	(94-96)		
2004-2006	1317	99	(98-99)	98	(97-99)	96	(95-97)		
2007-2010	2860	99	(98-99)						

Risk for cancer increases with time post-transplant



Comorbidity	n
Hypertension[1]	62 (41%)
Cancer	58 (37%)
Nonmelanoma skin cancer	42
Squamous cell carcinoma of vulva	3
Squamous cell carcinoma of cervix	2
Squamous cell carcinoma of larynx	2
Squamous cell carcinoma of breast	1
Squamous cell carcinoma of lung	1
Adenocarcinoma of colon	8
Adenocarcinoma of lung	3
Adenocarcinoma of prostate	2
Adenocarcinoma of breast	1
Adenocarcinoma of thyroid	1
Posttransplant lymphoproliferative disorder	4
Transitional cell carcinoma of bladder	1
Malignant melanoma	1
Cardiovascular disease	42 (27%)
New onset diabetes after transplantation[1]	11 (8%)

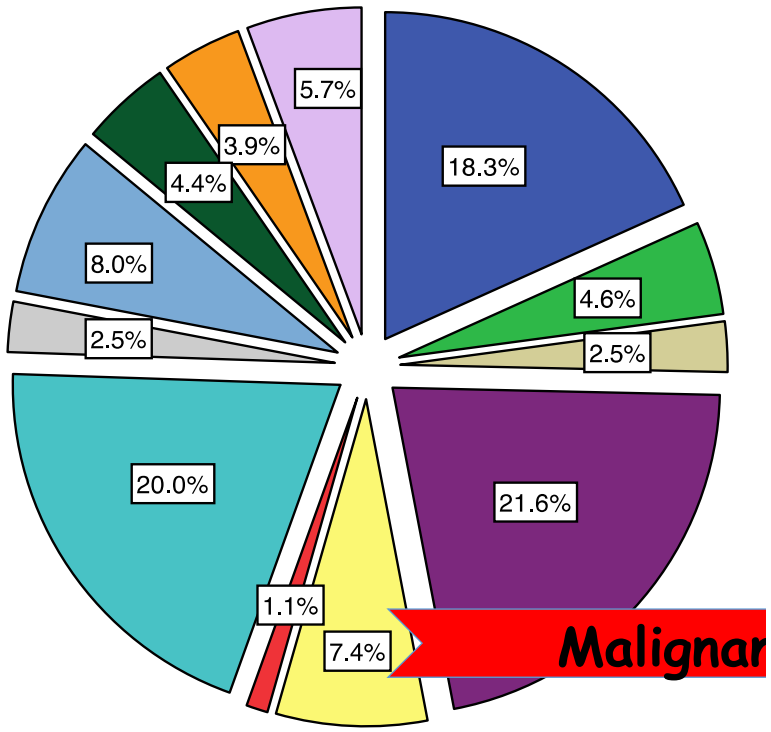
[1]Recipients who developed comorbidity after 20 years of graft function.

McCaughan and Courtney. Am J Transplant 2015

Cause of mortality after kidney transplantation (kidney-only transplants, England, 2001-2012)

Death within first year

Death by median 4.4 year follow up (IQR 2.2-7.3 years)

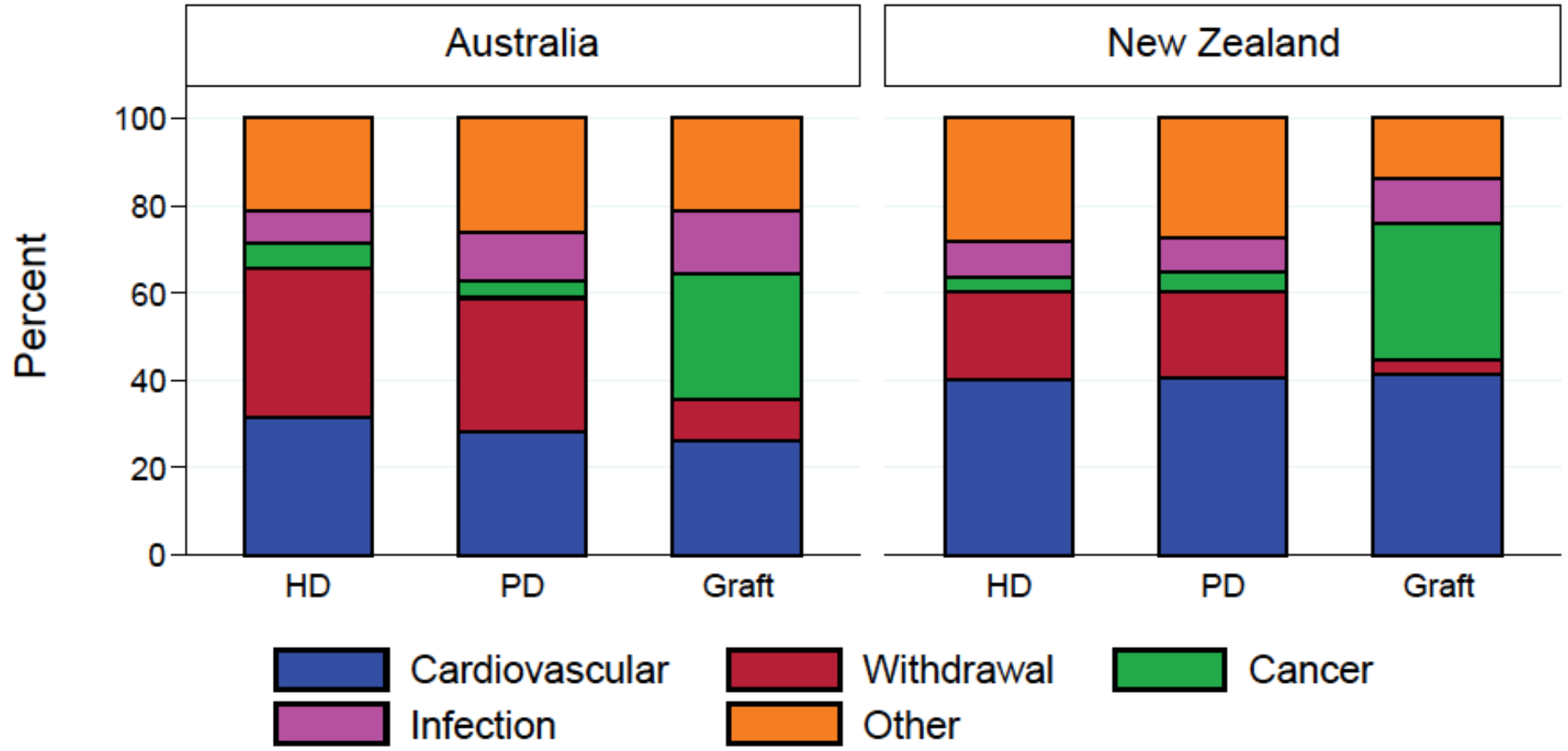


Farrugia et al. Transplant Int 2014

UK Renal Registry 19th Annual Report: Chapter 5 Survival and Causes of Death in UK Adult Patients on Renal Replacement Therapy in 2015

	All modalities		Dialysis		Transplant	
Causes of death	*N*	%	*N*	%	*N*	%
Cardiac disease	714	22	613	23	101	18
Cerebrovascular disease	138	4	114	4	24	4
Infection	688	21	554	21	134	24
Malignancy	327	10	201	7	126	22
Treatment withdrawal	581	18	566	21	15	3
Other	666	20	534	20	132	24
Uncertain	144	4	115	4	29	5
Total	**3,258**		**2,697**		**561**	
Missing data	1,747	35	1,439	35	308	35

Deaths in Australia/NZ for 2016 for RRT patients

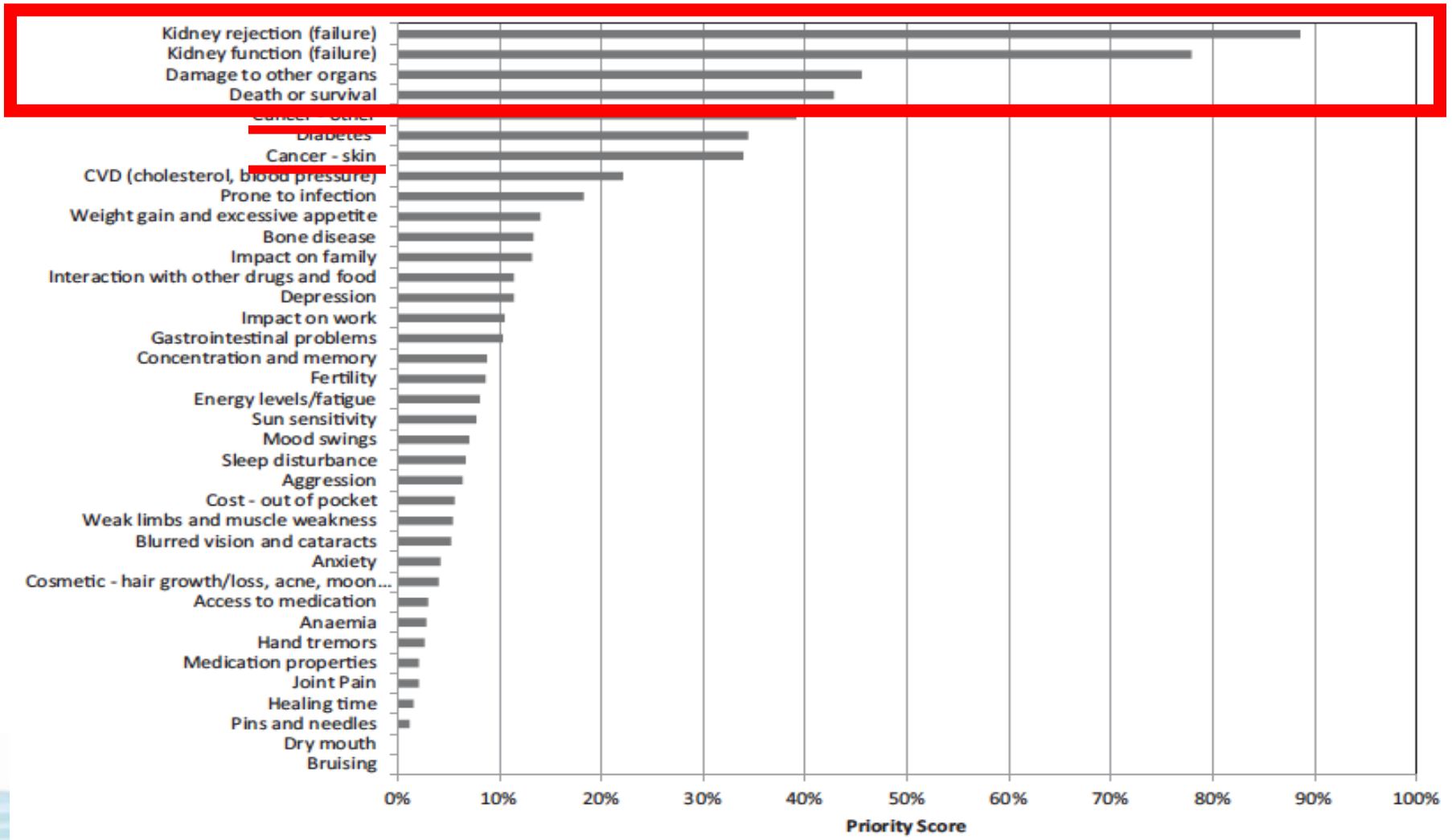


Outcomes in Australia/NZ for 1990-2012 after incident post-transplant cancer

	Overall graft loss Adjusted HR (95%CI)	Death censored graft loss Adjusted HR (95%CI)	Death with a functioning graft Adjusted HR (95%CI)
Incident cancer			
None	1.00	1.00	1.00
Yes	4.34 (3.90, 4.82)	1.43 (1.16, 1.77)	9.53 (8.30, 10.95)

Lim et al. Oncotarget 2017

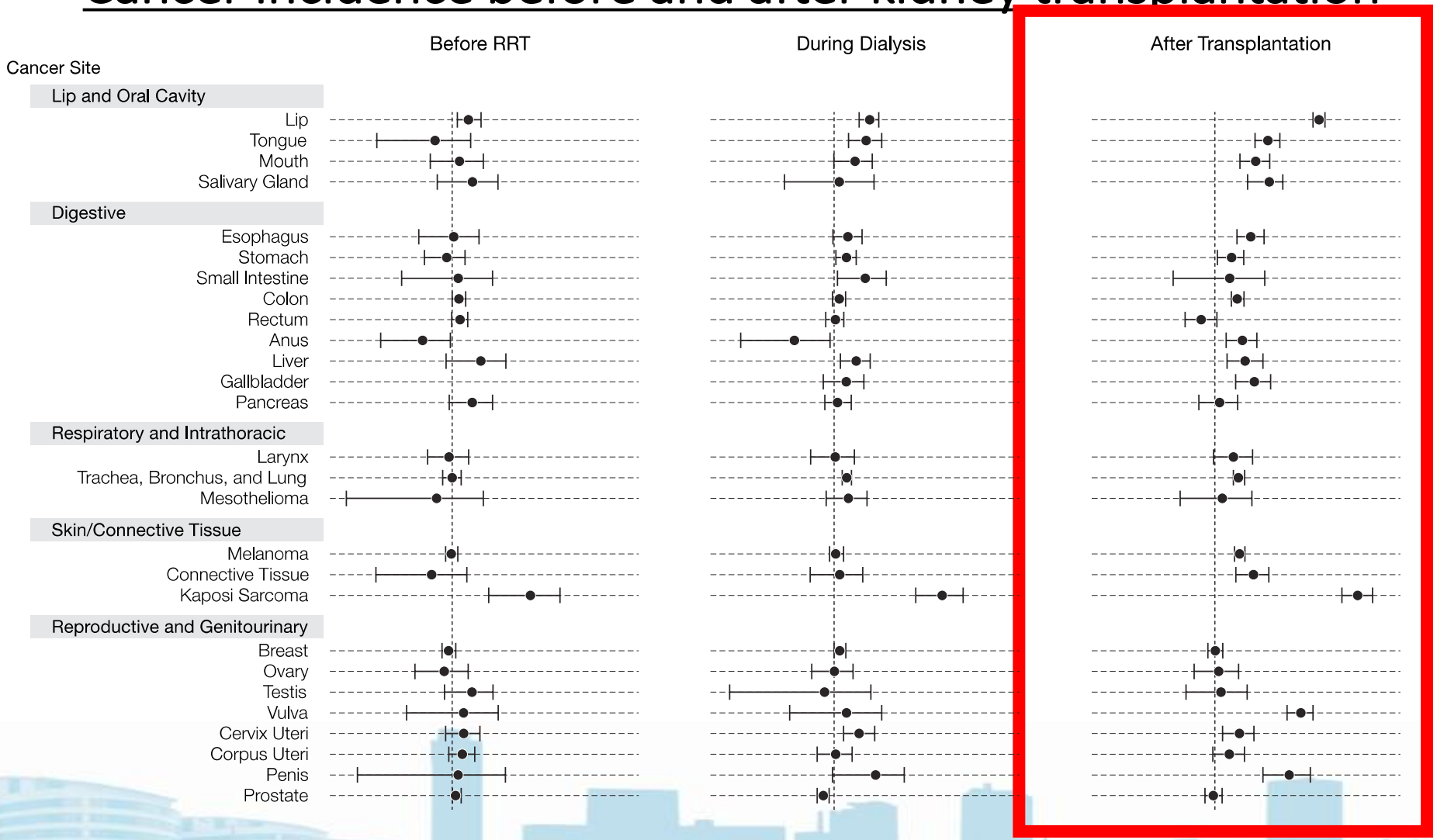
Patient perspectives after transplantation



Howell et al. AJKD 2012

Epidemiology of post-transplant cancer

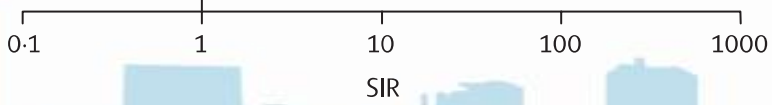
Cancer incidence before and after kidney transplantation



Vajdic et al. JAMA 2006

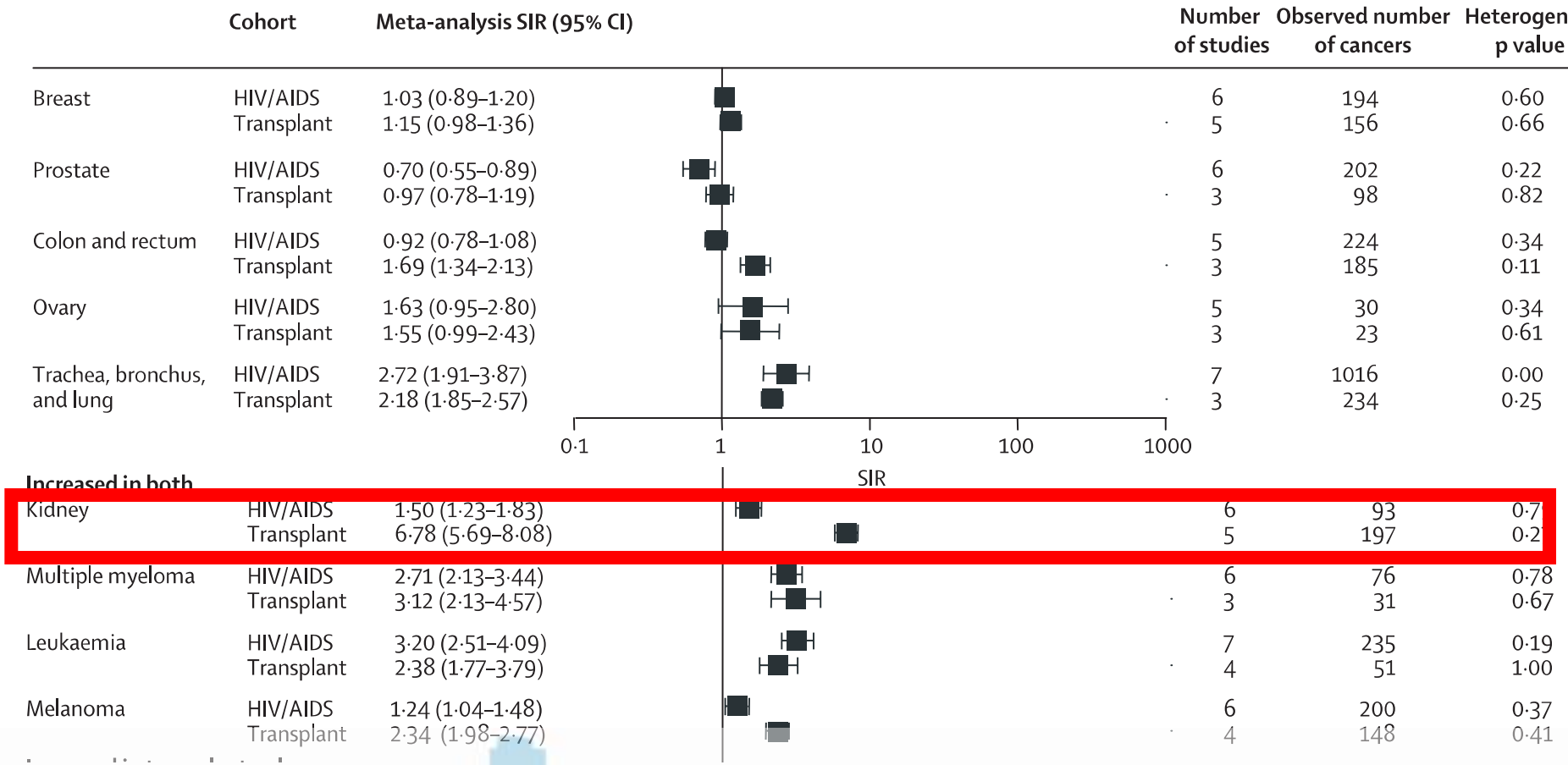
SIR for HPV-related cancers comparing HIV/AIDS versus transplant

	Cohort	Meta-analysis SIR (95% CI)	Number of studies	Observed number of cancers	Heterogenity p value
HPV-related cancers					
Cervix uteri	HIV/AIDS*	5·82 (2·98–11·3)	6	104	0·00
	Transplant	2·13 (1·37–3·30)	3	22	0·67
Vulva and vagina	HIV/AIDS	6·45 (4·07–10·2)	2	21	0·55
	Transplant	22·76 (15·8–32·7)	2	33	0·85
Penis	HIV/AIDS	4·42 (2·77–7·07)	3	21	0·52
	Transplant	15·79 (5·79–34·4)	1	6	-
Anus	HIV/AIDS	28·75 (21·6–38·3)	6	303	0·03
	Transplant	4·85 (1·36–17·3)	2	18	0·04
Oral cavity and Pharynx †	HIV/AIDS	2·32 (1·65–3·25)	4	238	0·07
	Transplant	3·23 (2·40–4·35)	3	49	0·37
Possibly HPV-related cancers					
Non-melanoma Skin ‡	HIV/AIDS	4·11 (1·08–16·6)	4	121	0·00
	Transplant	28·62 (9·39–87·2)	3	448	0·00
Lip	HIV/AIDS	2·80 (1·91–4·11)	2	30	0·45
	Transplant	30·00 (16·3–55·3)	5	506	0·00
Oesophagus	HIV/AIDS	1·62 (1·20–2·19)	4	48	0·53
	Transplant	3·05 (1·87–4·98)	3	28	0·28
Larynx	HIV/AIDS	2·72 (2·29–3·22)	5	142	0·55
	Transplant	1·99 (1·23–3·23)	3	20	0·88
Eye	HIV/AIDS	1·98 (1·03–3·81)	2	11	0·92
	Transplant	6·94 (3·49–13·8)	2	10	0·35



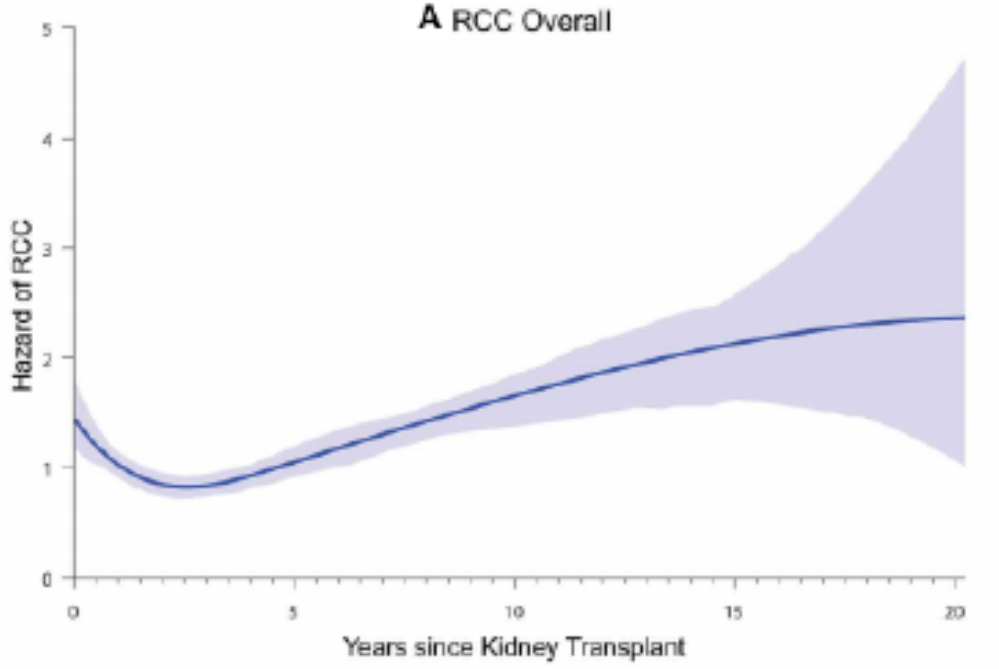
Grulich et al. Lancet 2007

SIR for selected cancers comparing HIV/AIDS versus transplant



Grulich et al. Lancet 2007

Risk for renal cell cancer stratified by time on dialysis before kidney transplantation



Duration of dialysis (vintage), yrs					HR	95% CI	
No	40	5.9	12 264	10.6	1.00		
<1	114	16.7	23 658	20.5	1.26	0.87–1.81	
1–<2	146	21.4	23 330	20.2	1.60	1.12–2.29	
2–<3	79	11.6	16 788	14.5	1.23	0.84–1.81	
3+	301	44.1	38 401	33.2	2.23	1.58–3.13	
Missing/unknown	3	0.4	1084	0.9	0.51	0.16–1.64	<0.0001

Karami et al. AJT 2016

Post-transplant cancer in the UK – incidence versus mortality

Site	Incidence[1] (17.6%)	Mortality[2] (18.0%)
Renal	3.5%	9.8%
Upper GI	2.0%	7.2%
Lower GI	4.7%	8.0%
Lung	4.0%	17.6%
Lymphoma	8.8%	18.4%
Breast	2.6%	3.2%
GU (not including renal)	1.7%	2.7%
Prostate	2.5%	1.6%
Haematological	0.4%	2.7%
Skin	55.9%	3.2%
Pancreas	0.6%	4.0%
Liver	0.4%	2.7%
Female	1.4%	2.4%

[1]Incidence population (n=25,104, median follow up 16 years), Collett et al, AJT 2010
[2]Mortality population (n=19,103, median follow up 4.4 years), Farrugia et al, Kidney Int 2014

What general risk factors exist for developing cancer?

- Age
- Alcohol
- Cancer-causing substances
- Chronic inflammation
- Diet
- Genetic
- Hormones

- Infectious agents
- Immunosuppression
- Obesity
- Radiation
- Sun exposure
- Tobacco

Transplantation risk

Post-transplant cancer as a complication of (over)immunosuppression

INCREASED CANCER RISK

- T-cell depletion treatment for rejection[1]
- Increasing HLA-DR mismatches[2]
- Extended criteria kidneys[3]
- Kidney re-transplants (RCC only)[4]

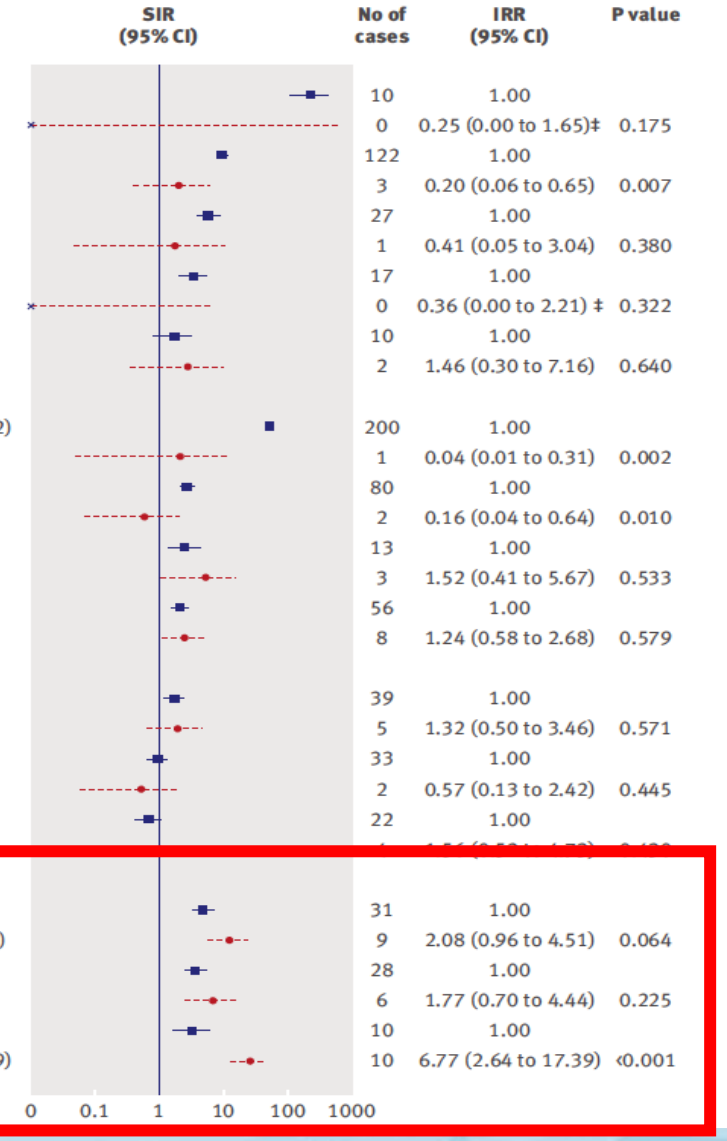
NO INCREASED CANCER RISK

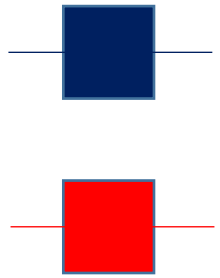
- Steroid treatment for rejection[1]
- Kidney re-transplants (non-RCC cancers)[4]
- ABO-incompatible kidney transplantation[5]

[1]Lim et al. Transplantation 2014
[2]Hussain et al. Transplantation 2016
[3]Kalil et al. Clin Transplant 2015
[4]Ma et al. Transplantation 2014
[5]Hall et al. Transplantation 2013

Risk for cancer comparing transplant versus failed transplant recipients

Cancer site*	Transplant function	SIR (95% CI)	No of cases	IRR (95% CI)	P value
Infection related					
Kaposi's sarcoma	Transplant	231 (111 to 425)	10	1.00	
	Dialysis	Upper CI 622†	0	0.25 (0.00 to 1.65)‡	0.175
Non-Hodgkin's lymphoma	Transplant	9.73 (8.08 to 11.62)	122	1.00	
	Dialysis	2.05 (0.42 to 5.99)	3	0.20 (0.06 to 0.65)	0.007
Anogenital	Transplant	5.96 (3.93 to 8.67)	27	1.00	
	Dialysis	1.82 (0.05 to 10.11)	1	0.41 (0.05 to 3.04)	0.380
Oral cavity and oropharynx	Transplant	3.46 (2.01 to 5.53)	17	1.00	
	Dialysis	Upper CI 6.32 †	0	0.36 (0.00 to 2.21) ‡	0.322
Stomach	Transplant	1.76 (0.85 to 3.24)	10	1.00	
	Dialysis	2.89 (0.35 to 10.45)	2	1.46 (0.30 to 7.16)	0.640
Increased in immunodeficient populations					
Lip	Transplant	52.27 (45.27 to 60.02)	200	1.00	
	Dialysis	2.16 (0.05 to 12.05)	1	0.04 (0.01 to 0.31)	0.002
Melanoma	Transplant	2.74 (2.17 to 3.41)	80	1.00	
	Dialysis	0.58 (0.07 to 2.08)	2	0.16 (0.04 to 0.64)	0.010
Leukaemia	Transplant	2.58 (1.38 to 4.42)	13	1.00	
	Dialysis	5.25 (1.08 to 15.33)	3	1.52 (0.41 to 5.67)	0.533
Lung	Transplant	2.14 (1.61 to 2.77)	56	1.00	
	Dialysis	2.59 (1.12 to 5.11)	8	1.24 (0.58 to 2.68)	0.579
Not increased in immunodeficient populations					
Colon	Transplant	1.75 (1.24 to 2.39)	39	1.00	
	Dialysis	1.99 (0.65 to 4.65)	5	1.32 (0.50 to 3.46)	0.571
Breast (female)	Transplant	0.97 (0.66 to 1.36)	33	1.00	
	Dialysis	0.54 (0.06 to 1.93)	2	0.57 (0.13 to 2.42)	0.445
Prostate	Transplant	0.70 (0.44 to 1.06)	22	1.00	
End stage kidney disease related					
Kidney	Transplant	4.93 (3.35 to 7.00)	31	1.00	
	Dialysis	12.38 (5.66 to 23.49)	9	2.08 (0.96 to 4.51)	0.064
Urinary tract	Transplant	3.69 (2.45 to 5.33)	28	1.00	
	Dialysis	7.07 (2.59 to 15.38)	6	1.77 (0.70 to 4.44)	0.225
Thyroid	Transplant	3.29 (1.58 to 6.05)	10	1.00	
	Dialysis	26.37 (12.64 to 48.49)	10	6.77 (2.64 to 17.39)	<0.001

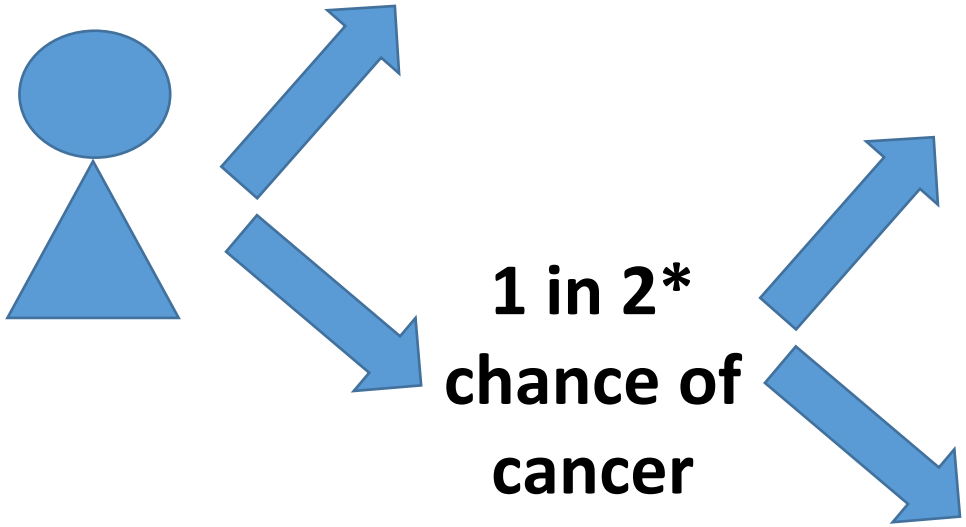




Van Leeuwen et al. BMJ 2010

Can we prevent cancer post kidney transplantation?

(1) Encourage lifestyle modifications



1 in 2* chance of cancer

4 in 10* cancers could be prevented by lifestyle changes

- **Not smoking**
- **Keep a healthy body weight**
- **Eat a healthy, balanced diet**
- **Cut back on alcohol**
- **Enjoy the sun safely**
- **Keep active**

*General population data from Cancer Research UK

www.cancerresearchuk.org/about-cancer/causes-of-cancer

(2) Screening guidelines from the RA (endorsed by the BTS)

Pre-transplantation (2010)

- We recommend that renal transplantation should only be considered in potential recipients with previous malignancy (excluding NMSC) if there is no evidence of persistent cancer. It is recommended the waiting time between treatment/remission and transplantation be at least 2-years (and in some cases >5 years). The Israel Penn Transplant Tumour Registry should be consulted for specific advice (1A)

https://bts.org.uk/guidelines-standards/

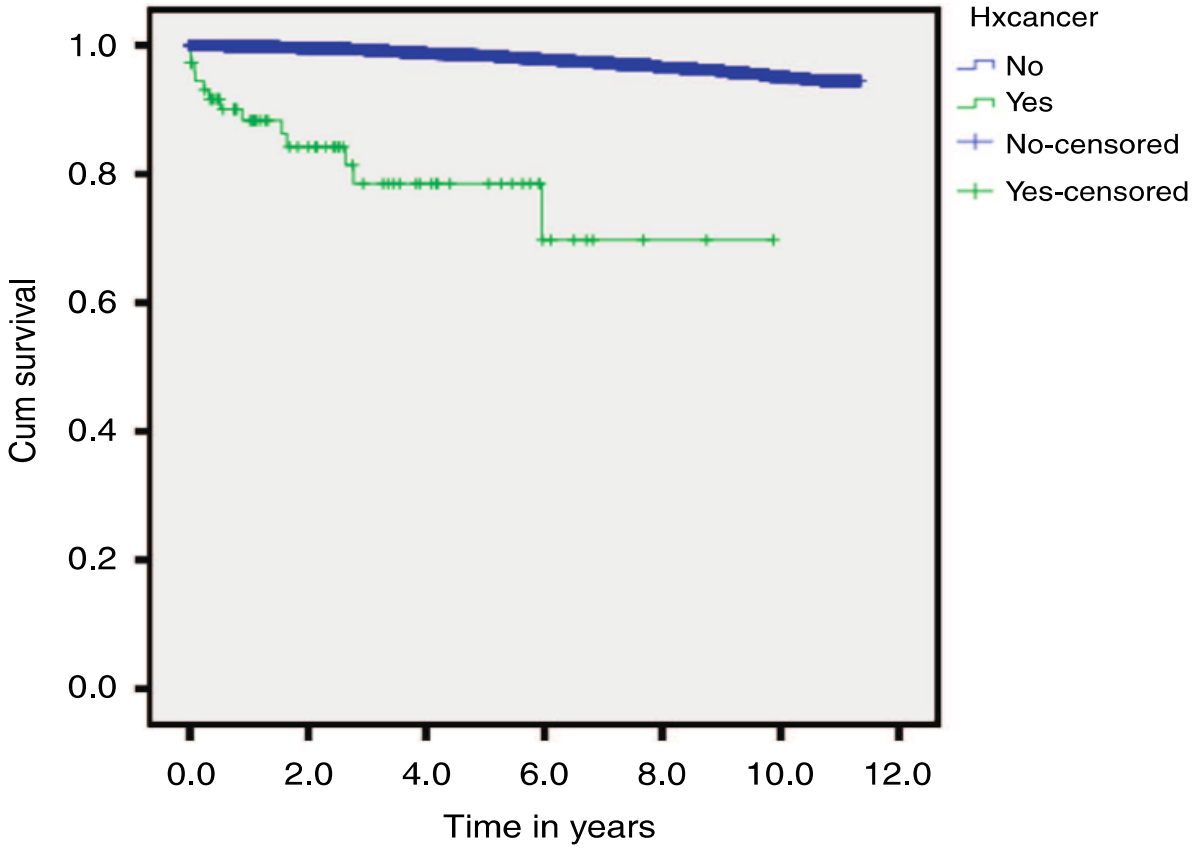
(2) Screening guidelines for minimum cancer-free time intervals for transplantation

Type	Stage	AST	CARI	B&D	CST	EBPG	MMOH
Renal cell carcinoma	Small or discovered incidentally	○	○	○			○
	Symptomatic	⣀	●	⣀		⣀	
	Large or invasive	●		⣀			▨
Bladder cancer	In situ or noninvasive papilloma	○	○	○	○	⣀	○
	Invasive	⣀	⣀	⣀	⣀		▨
Breast cancer	Stage 0–2 (including early stage)	⣀	▨	▨	⣀	●	▨
	Stage 3–4 (advanced/invasive)	●	●	▨	●	●	▨
Colorectal cancer	Duke A or B1	⣀	⣀		▨	⣀	⣀
	Duke C		●			⣀	⣀
	Duke D		●			⣀	⣀
	Patients with a history of colorectal cancer	●			●		

○ 0 years
⣀ Minimum 2 years
▨ 5 years
● Minimum 5 years
● Contraindicated
No guidance

Chapman et al. Cold Spring Harb Perspect Med 2013

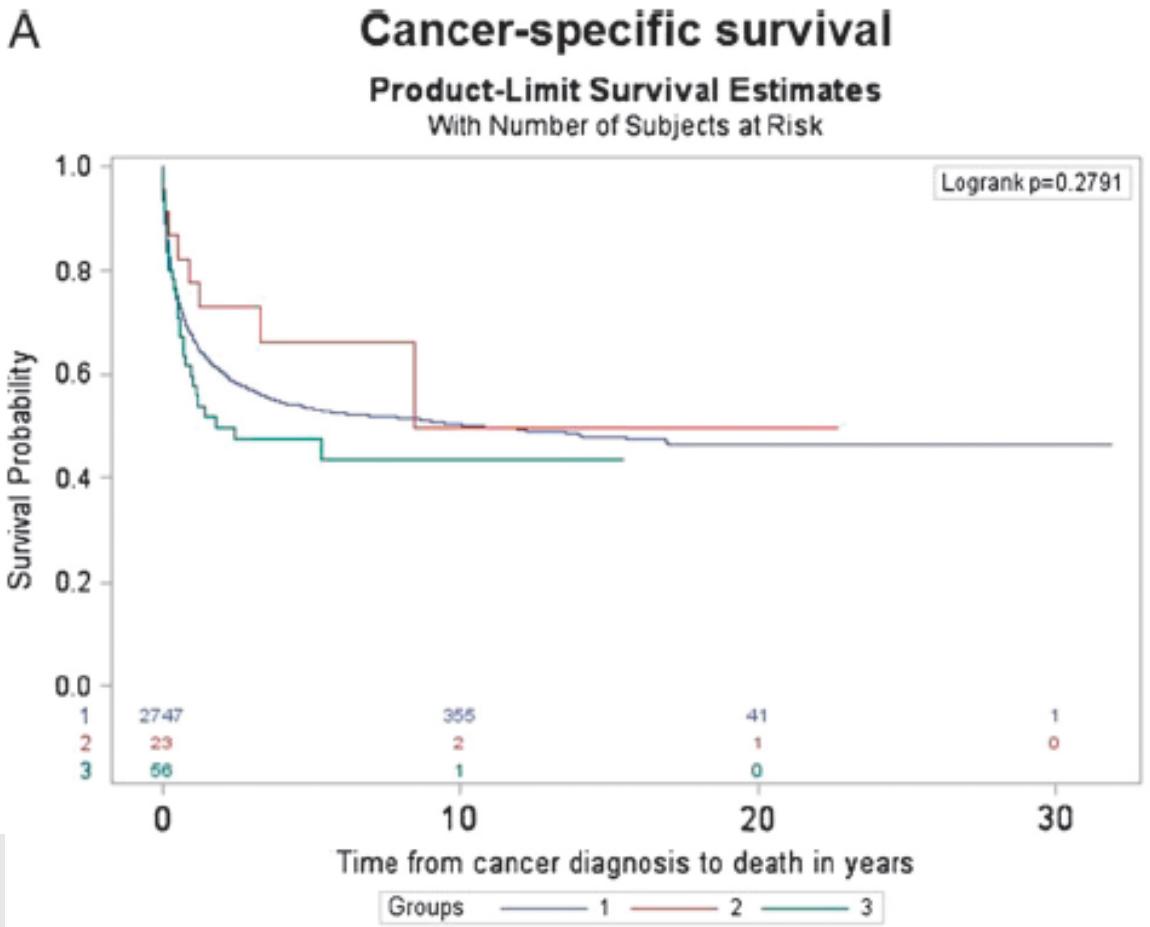
(2) Pre-transplant cancer is a risk for post-transplant cancer mortality

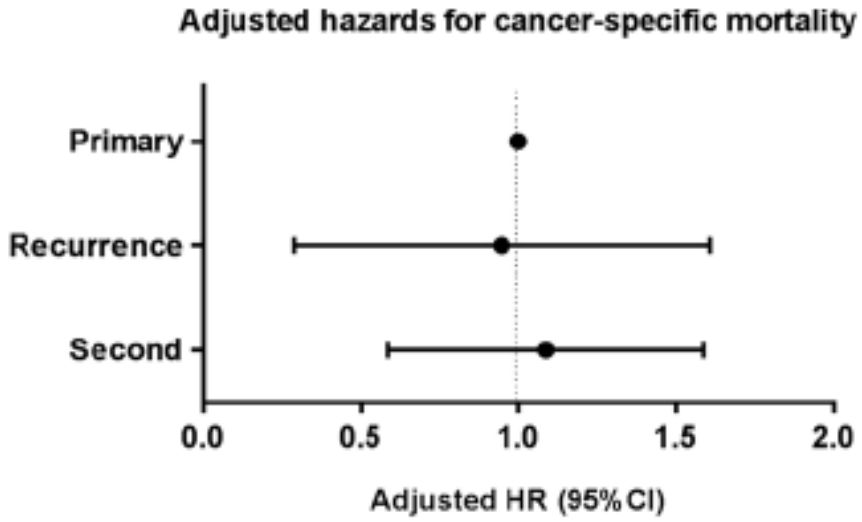


Time (years)	0	1	2	3	4	5	6	7	8	9	10	11
No previous cancer	19,029	17,042	14,795	12,532	10,413	8557	6793	5268	3875	2572	1377	377
Previous cancer	74	51	39	26	20	16	7	3	2	1	0	0

Farrugia et al. Kidney Int 2014

(2) Pre-transplant cancer is **NOT** a risk for post-transplant cancer mortality





**adjusted for the effects of age, gender, BMI, smoking status, time on dialysis, era of transplantation, history of diabetes mellitus and COPD*

Viechelli et al. Transplantation 2015

(2) Screening guidelines from the RA (endorsed by the BTS)

Pre-transplantation (2010)

- We recommend that renal transplantation should only be considered in potential recipients with previous malignancy (excluding NMSC) if there is no evidence of persistent cancer. It is recommended the waiting time between treatment/remission and transplantation be at least 2-years (and in some cases >5 years). The Israel Penn Transplant Tumour Registry should be consulted for specific advice (1A)

Post-transplantation (2017)

- Screening should be similar to the general population for cervical, breast, colon and prostate cancer (2C)
- Screening is not recommended for renal cell carcinoma (2C)

https://bts.org.uk/guidelines-standards/

(2) Which cancers are we meant to screen?

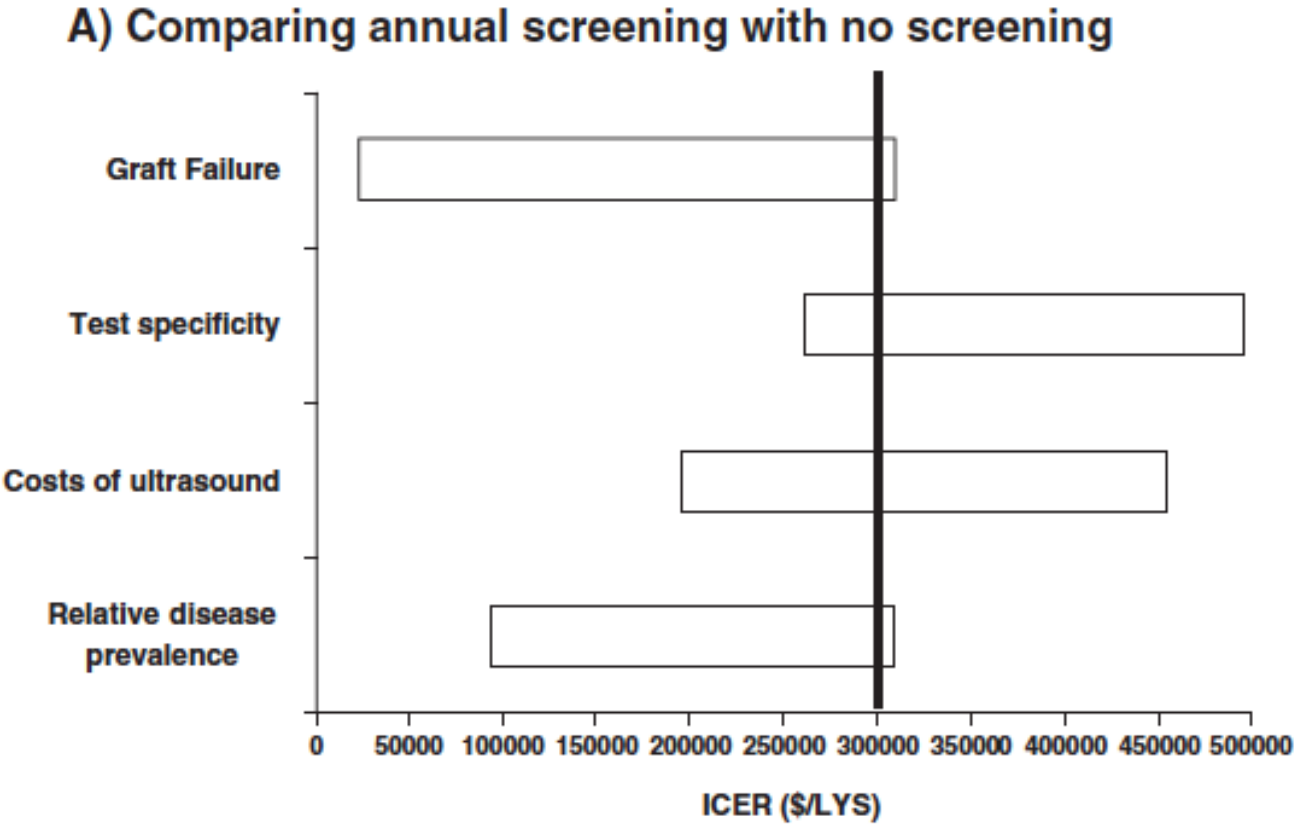
Official UK screening programs

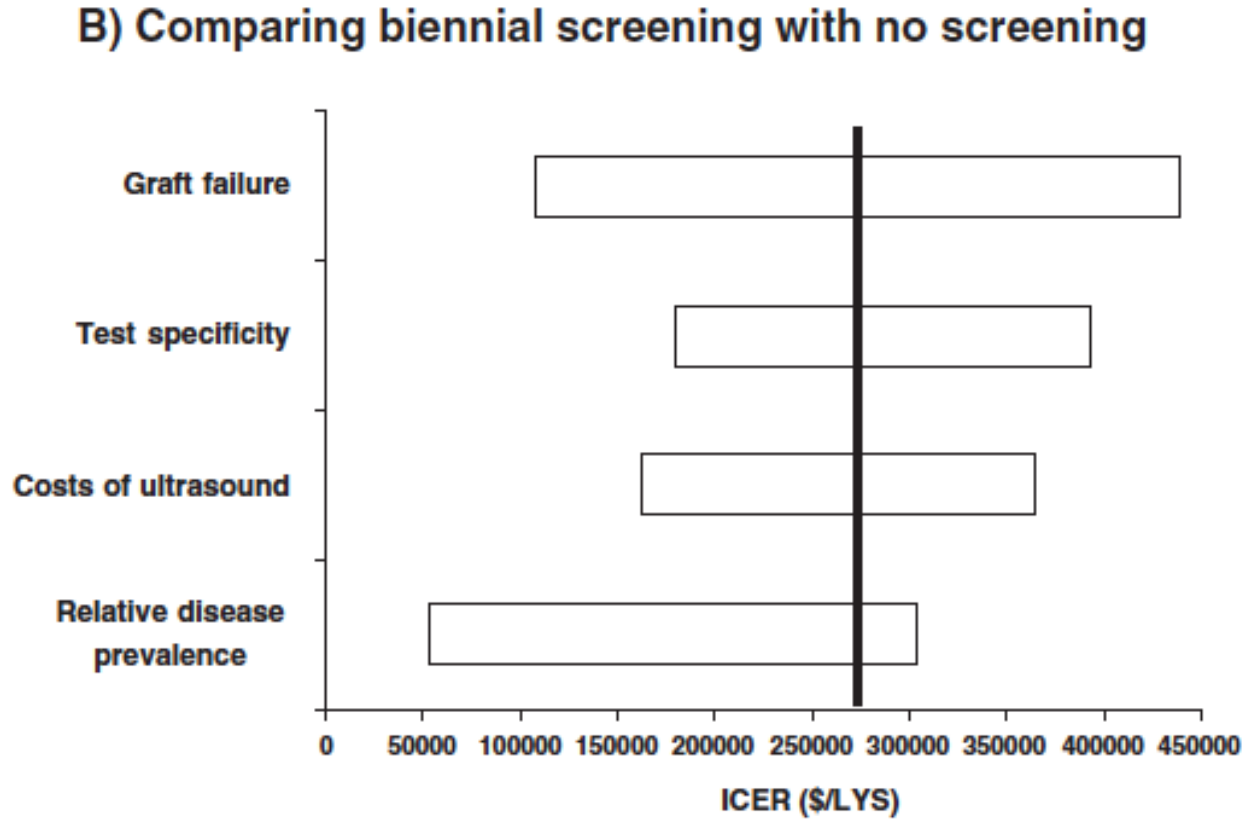
- **Bowel**
  - Two-yearly test kits for men and women aged 60-74 (50-74 in Scotland)
- **Breast**
  - All women aged 50-70 (every three-years)
- **Cervical**
  - All women aged 25-64 (every three-years)

Other screening available

- **Prostate**
  - Men over 50 can request
- **Lung**
  - Trials in progress
- **Ovarian**
  - Trials in progress
- **PTLD**
  - EBV PCR in paediatric and stem cell transplant setting only
- **Renal**
  - No strong evidence base

(2) Screening for RCC post kidney transplantation





Wong et al. NDT 2011

(2) Cancer Screening Recommendations for Solid Organ Transplant Recipients: A Systematic Review of Clinical Practice Guidelines

	Domain (%)					
Guideline	Scope and purpose	Stakeholder involvement	Rigor of development	Clarity of presentation	Applicability	Editorial independence
KDIGO (23)	80	63	78	80	37	97
KHA-CARI (24)	91	42	66	94	50	100
AASLD-Adult (30)	91	56	38	69	0	50
AASLD-Pediatric (31)	89	61	71	56	21	42
AST-Kidney (25)	100	54	64	63	14	0
AST-Liver (32)	94	63	10	98	18	72
EBPG (26)	89	39	46	91	1	6
ISHLT (31)	100	63	62	74	1	100
RA (27)	93	48	33	61	0	28
SCPG (33)	96	57	20	72	28	25

Domain 1. Scope and Purpose
Domain 2. Stakeholder Involvement
Domain 3. Rigour of Development relates to the process used to gather and synthesize the evidence, the methods to formulate the recommendations, and to update them.
Domain 4. Clarity of Presentation
Domain 5. Applicability pertains to the likely barriers and facilitators to implementation, strategies to improve uptake, and resource implications of applying the guideline.
Domain 6. Editorial independence

Acuna et al. AJT 2016

(2) Aggressive cancer screening post kidney transplantation

ANNUAL

- Abdominal USS and CT
- Chest CT
- Neck USS
- Upper GI endoscopy
- Tumour markers
- Mammogram (women)
- Pap smears (women)
- PSA (men)
- Skin and lip exam

3-6 MONTHLY

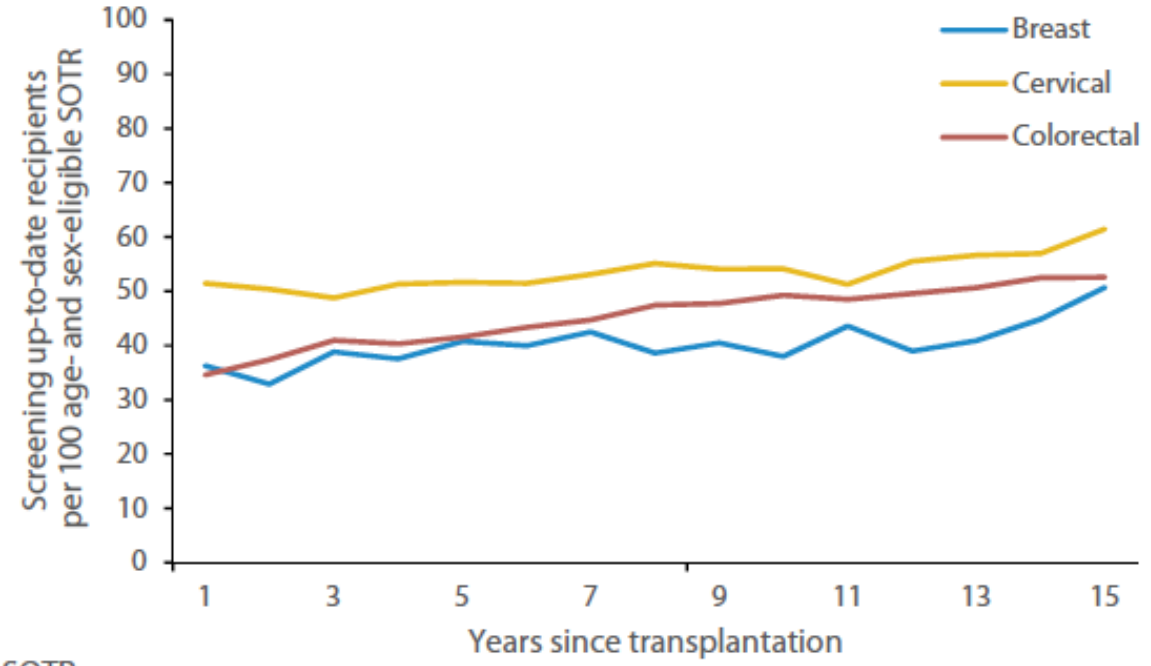
- Faecal blood test (colonoscopy if +)
- Urine cytology

Table 2. Types of screening-detected and symptom-detected cancers after kidney transplantation.

	Screening-detected cancers	Symptom-detected cancers	
	Group A	Group B	Group C
		Screening (–)	Screening (+)
Lymphomas	3	2	10
Urinary tract			
Renal cell carcinoma of the native kidney	8	1	1
Renal cell carcinoma of the allograft kidney	0	1	1
Urothelial carcinoma	0	0	3
Gastrointestinal tract			
Gastric cancer	7	1	0
Colorectal cancer	1	1	3
Hepatocellular cell carcinoma	1	1	1
Genital tract			
Uterine cancer	2	1	0
Ovarian cancer	1	1	0
Breast cancer	8	1	0
Thyroid cancer	5	0	1
Others	0	11	0
Total	36	21	20

Kato et al. Cancer Med 2015

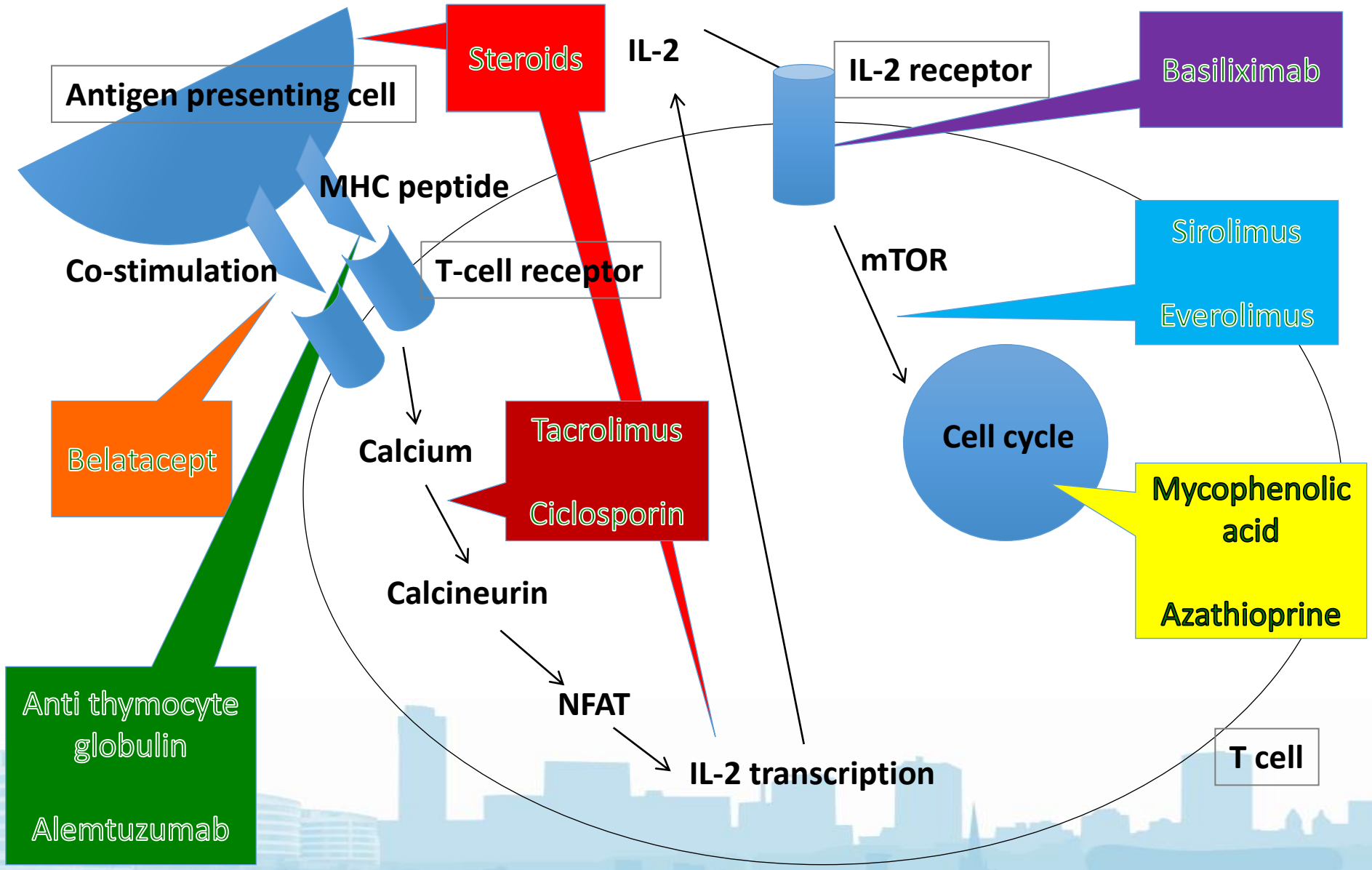
(2) Screening compliance is poor post-transplantation



EligibleSOTR								
Breast	1,154	1,184	979	729	484	328	181	71
Cervical	2,225	2,030	1,545	1,079	719	476	256	96
Colorectal	3,459	3,505	2,806	2,041	1,353	909	561	253

Acuna et al. AJT 2017

(3) Can we pre-emptively modify immunosuppression?



(3) Induction agents and risk for post-transplant cancer

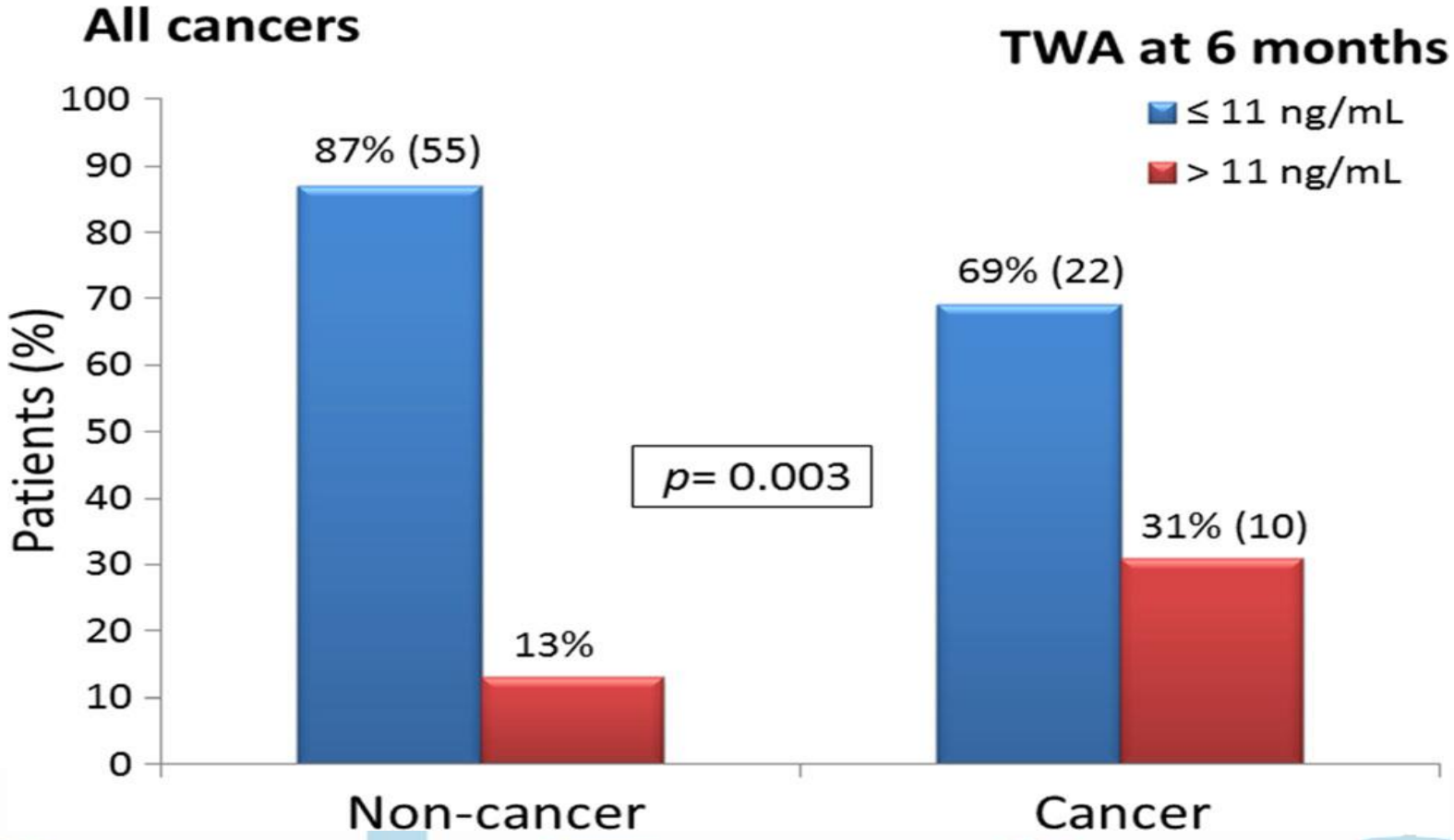
TABLE 2. Association between induction therapy and incident virus-related cancers

	Cancers, N	Incidence[a]	aIRR (95% CI)	*P*
NHL				
No induction	377	142.1	Reference	
Polyclonal	125	131.6	0.96 (0.77–1.20)	0.7
Muromonab-CD3	80	210.9	1.37 (1.06–1.76)	0.02
Alemtuzumab	15	216.2	1.79 (1.02–3.14)	0.04
Anti–IL2R	96	114.9	0.82 (0.65–1.05)	0.1
Non-NHL VRCs				
No induction	164	61.8	Reference	
Polyclonal	56	60.0	1.11 (0.82–1.53)	0.5
Muromonab-CD3	25	65.9	1.02 (0.65–1.58)	0.9
Alemtuzumab	4	57.6	2.05 (0.66–6.33)	0.2
Anti–IL2R	53	63.5	1.09 (0.78–1.51)	0.6
All VRCs				
No induction	541	203.9	Reference	
Polyclonal	181	190.6	1.01 (0.84–1.21)	0.9
Muromonab-CD3	104	276.8	1.26 (1.01–1.57)	0.04
Alemtuzumab	19	273.8	1.84 (1.11–3.03)	0.02
Anti–IL2R	149	178.4	0.90 (0.74–1.10)	0.3

[a] Per 100,000 person-years.

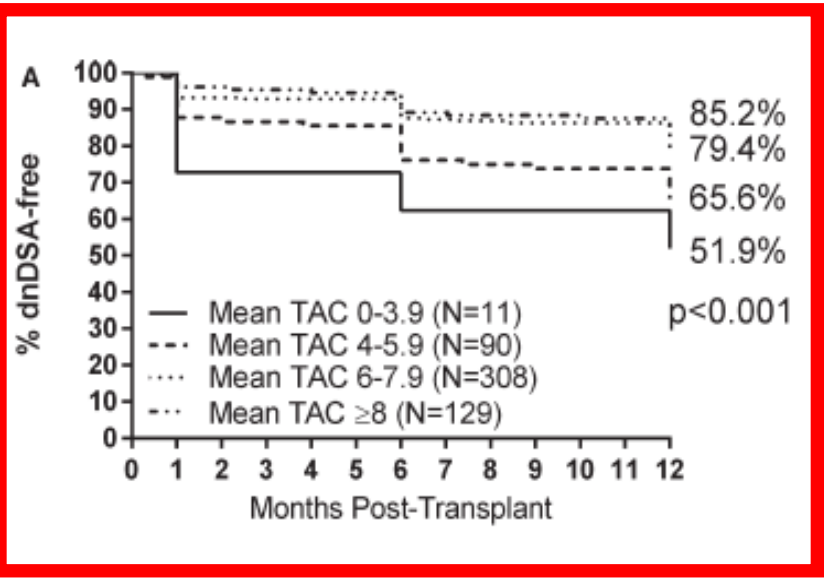
Hall et al. Transplantation 2015

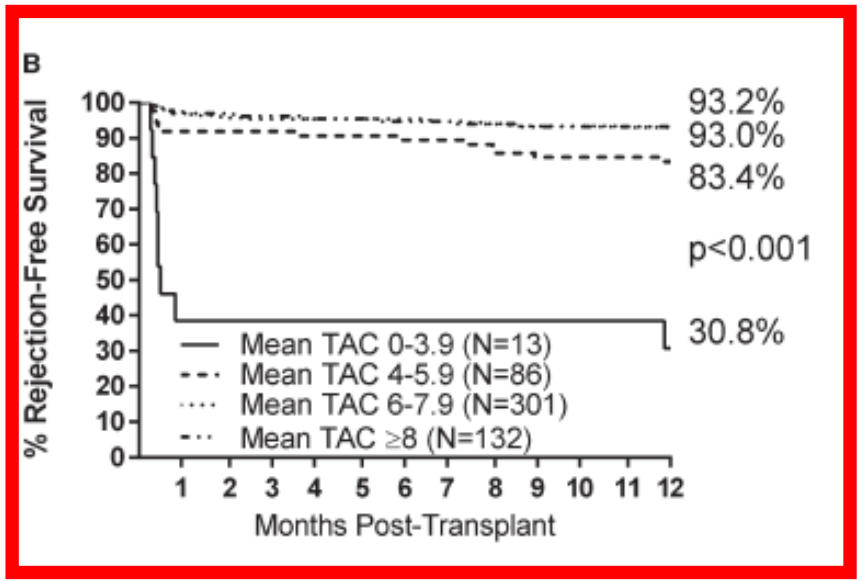
(3) Risk of post-transplant cancer is related to time-weighted average tacrolimus exposure

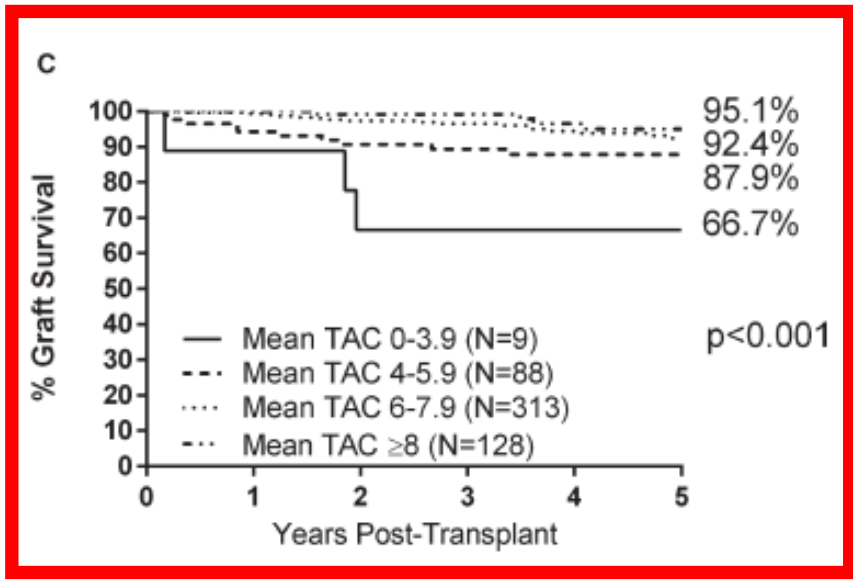


Lichtenburg et al. Eur J Clin Pharamcol 2017

(3) Low tacrolimus exposure is linked to poor graft-related outcomes







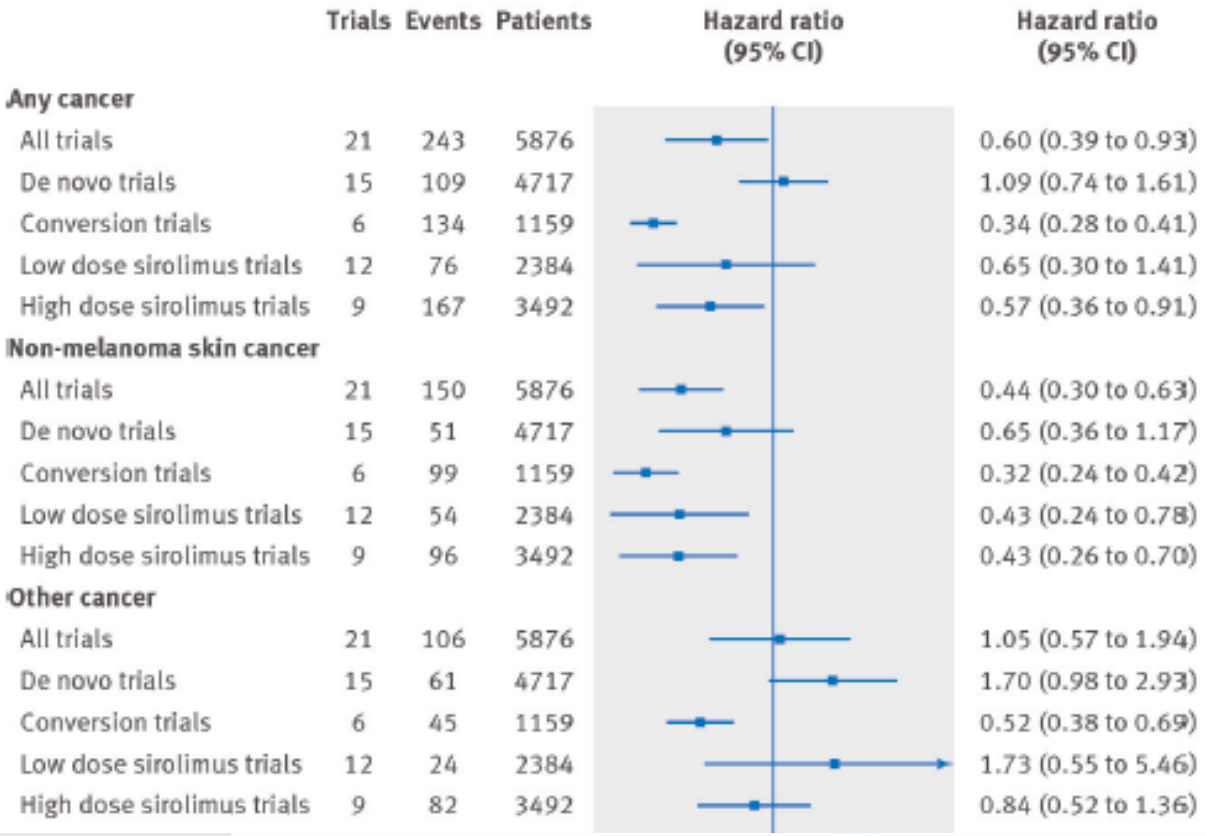
Davis et al. AJT 2017

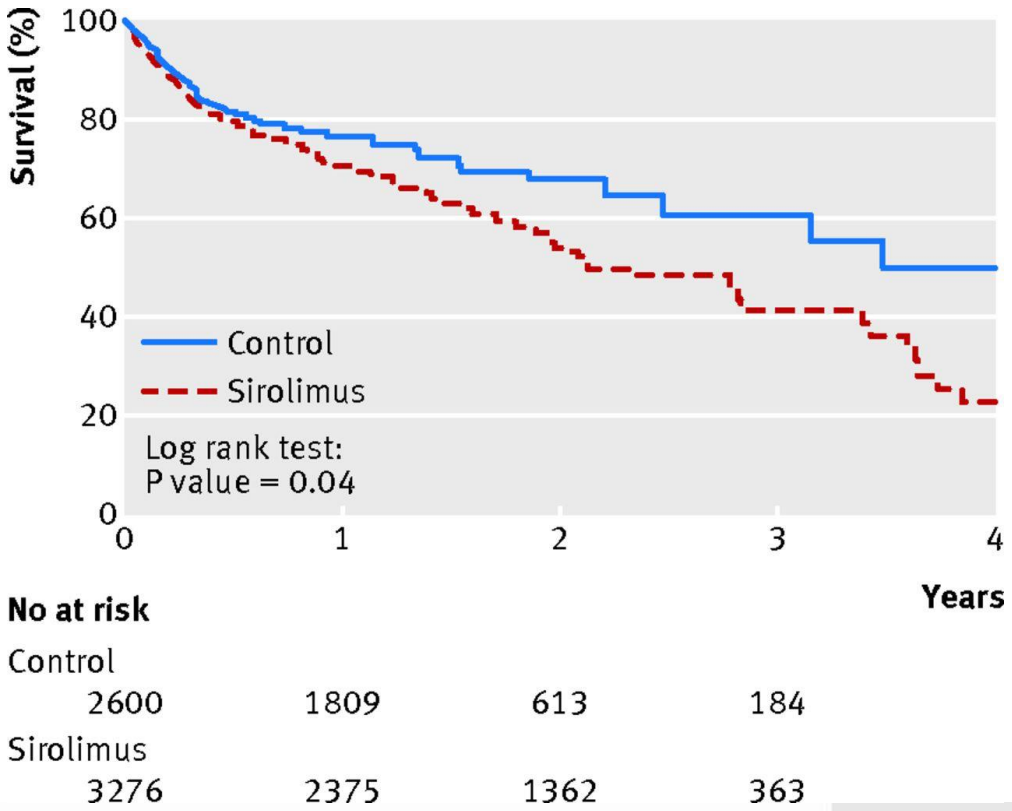
(3) MMF versus azathioprine for post-transplant cancer risk

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	AZA	MMF				
Death, all cause Follow-up: 0.5 to 5 years	**49 per 1000**	**47 per 1000** (34 to 63)	**RR 0.95** (0.7 to 1.29)	2987 (16)	⊕⊕⊕◯ **moderate**[1]	No evidence for difference due to low precision
Graft loss, censored for death Follow-up: 0.5 to 6 years	**11 per 100**	**9 per 100** (7 to 11)	**RR 0.78** (0.61 to 0.98)	2540 (17)	⊕⊕⊕⊕ **high**[2]	Statistically significant risk reduction of meaningful magnitude (~ 20%) with MMF treatment
Malignancy, any Follow-up: 1 to 6 years	**10 per 100**	**8 per 100** (6 to 11)	**RR 0.81** (0.6 to 1.09)	1735 (5)	⊕◯◯◯ **very low**[3,4,5]	Statistically not significant favourable point estimate (~20%) with MMF treatment, but very low quality evidence
Acute rejection, steroid resistant/ antibody treated As reported in the articles	**11 per 100**	**5 per 100** (4 to 7)	**RR 0.48** (0.36 to 0.65)	2914 (15)	⊕⊕⊕⊕ **high**	Statistically significant risk reduction of meaningful magnitude (~ 50%) with MMF treatment

Wagner et al. Cochrane Database Syst Rev 2015

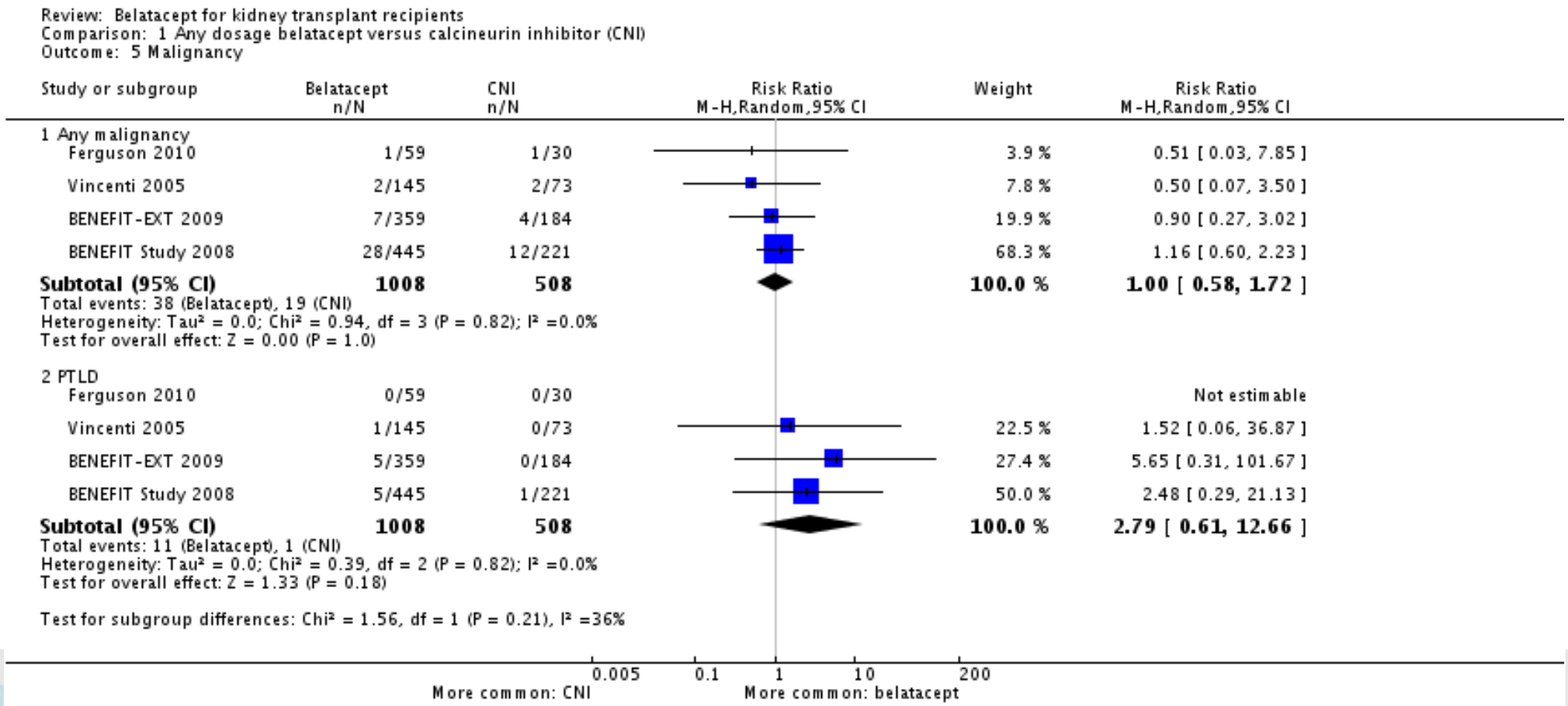
(3) Effect of sirolimus on cancer and survival after kidney transplantation





Knoll et al. BMJ 2014

(3) Cochrane review – belatacept v CNI (cancer data)



Masson et al. Cochrane Database Syst Rev 2014

(4) Personalised cancer medicine

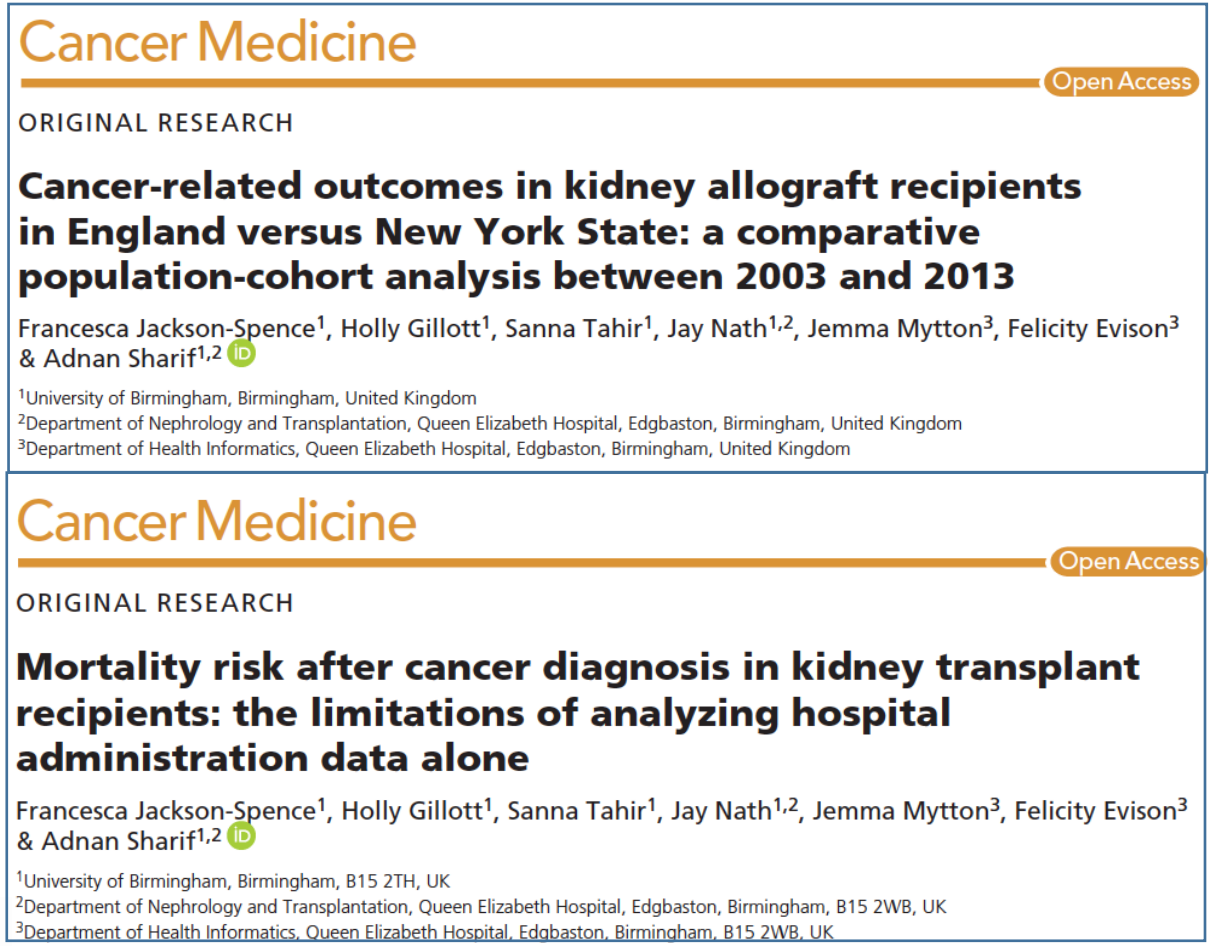
1. Find out the chances of a person developing cancer and selecting screening strategies to lower the risk

2. Match patients with treatments that are likely to be more effective and cause fewer side effects

3. Predict the rate of cancer recurrence

(4) Limitations of the data

- Transplantation practice has evolved over last decade
- US data cannot be translated to the UK for transplant recipients
- Lack of patient-level data on screening and management after post-transplantation cancer diagnosis
- Registry or administrative data in isolation is limited



Cancer Medicine

Open Access

ORIGINAL RESEARCH

Cancer-related outcomes in kidney allograft recipients in England versus New York State: a comparative population-cohort analysis between 2003 and 2013

Francesca Jackson-Spence[1], Holly Gillott[1], Sanna Tahir[1], Jay Nath[1,2], Jemma Mytton[3], Felicity Evison[3] & Adnan Sharif[1,2]

[1]University of Birmingham, Birmingham, United Kingdom
[2]Department of Nephrology and Transplantation, Queen Elizabeth Hospital, Edgbaston, Birmingham, United Kingdom
[3]Department of Health Informatics, Queen Elizabeth Hospital, Edgbaston, Birmingham, United Kingdom

Cancer Medicine

Open Access

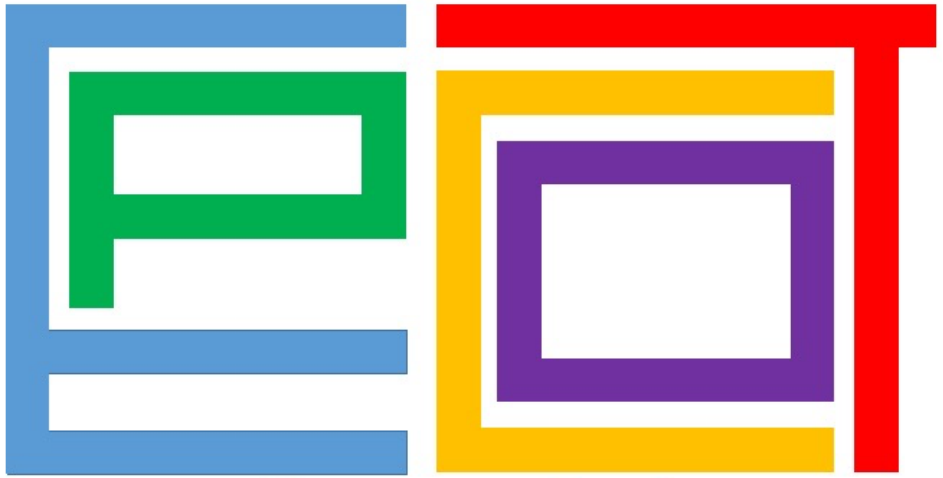
ORIGINAL RESEARCH

Mortality risk after cancer diagnosis in kidney transplant recipients: the limitations of analyzing hospital administration data alone

Francesca Jackson-Spence[1], Holly Gillott[1], Sanna Tahir[1], Jay Nath[1,2], Jemma Mytton[3], Felicity Evison[3] & Adnan Sharif[1,2]

[1]University of Birmingham, Birmingham, B15 2TH, UK
[2]Department of Nephrology and Transplantation, Queen Elizabeth Hospital, Edgbaston, Birmingham, B15 2WB, UK
[3]Department of Health Informatics, Queen Elizabeth Hospital, Edgbaston, Birmingham, B15 2WB, UK

Improving our understanding of cancer epidemiology after solid organ transplantation



clinicaltrials.org.identifer: NCT02991105

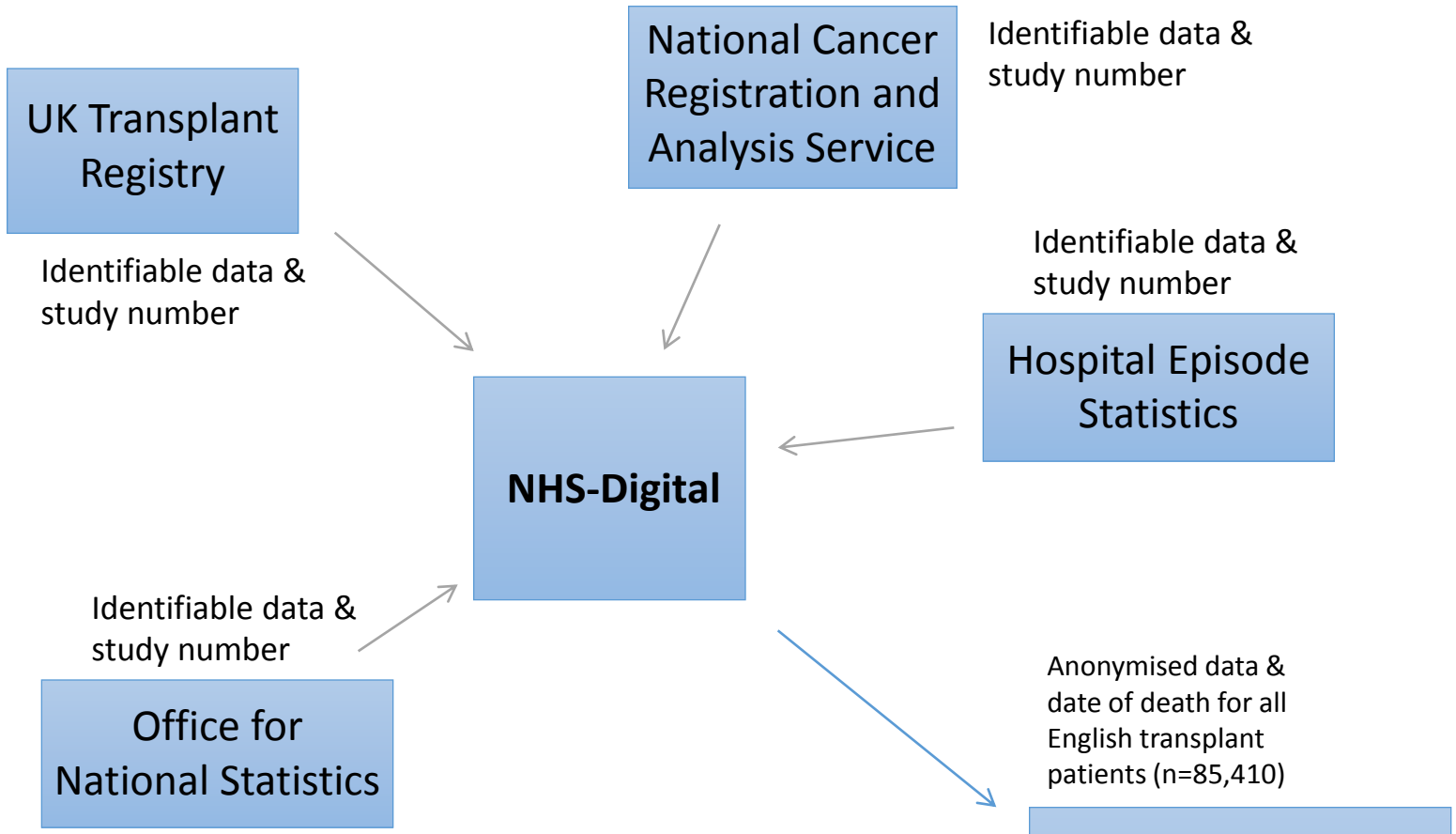
Institute of Translational Medicine Birmingham

Epidemiology of Cancer after solid Organ Transplantation

EpCOT research questions

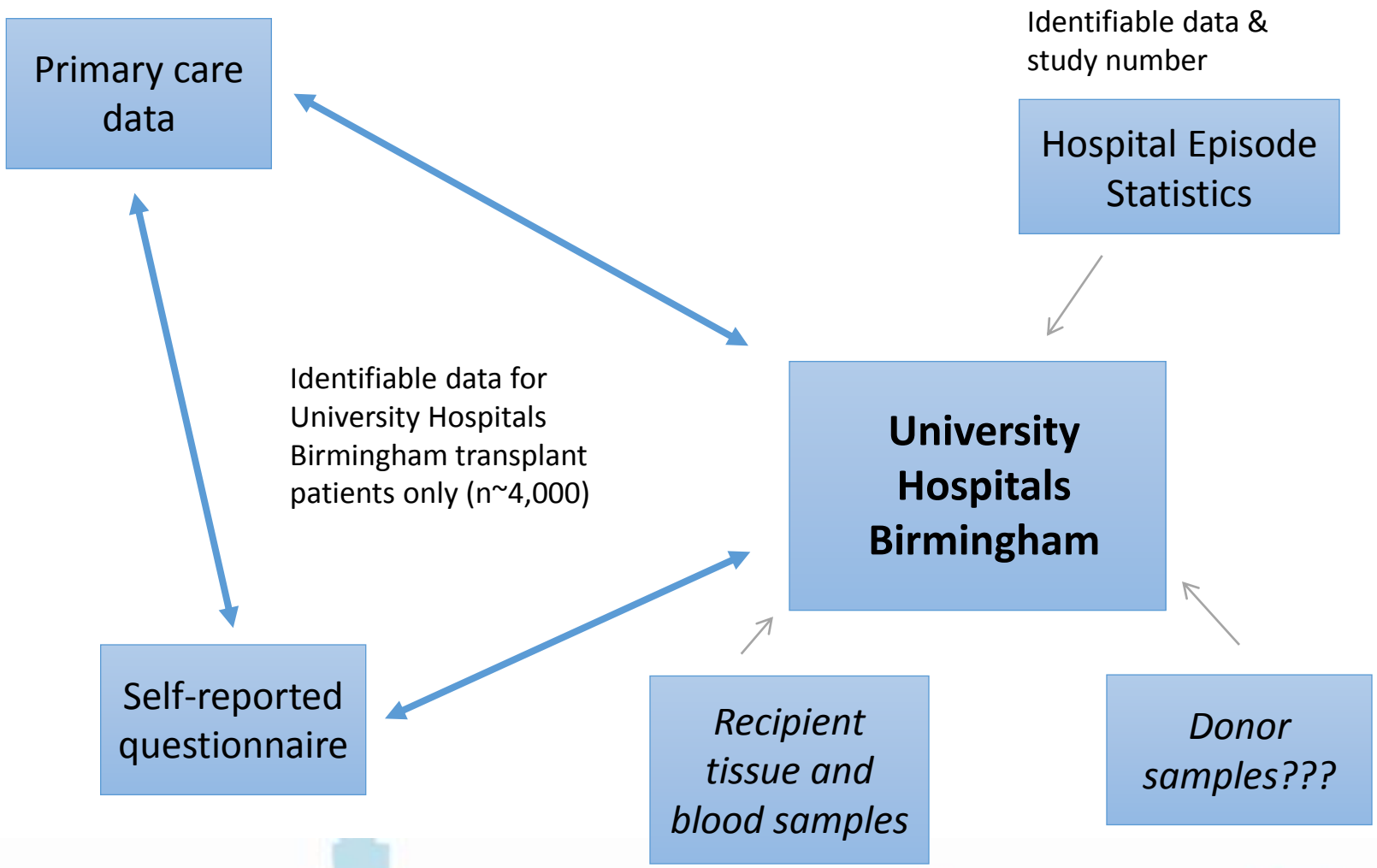
1.	Compare observed and expected risks of specific causes of deaths after transplantation	National record linkage
2.	Investigate survival and causes of death after cancer in post-transplant patients	
3.	Compare observed and expected risks of specific cancer types after transplantation	
4.	Estimate risk of morbidity requiring hospitalisation post-transplantation	
5.	Post-transplant cancer risk prediction using machine learning	
6.	Evaluate up-take of existing general population cancer screening among solid organ transplant recipients	UHB recruitment
7.	Investigate management of cancer after solid organ transplantation	
8.	Develop standardised clinical follow-up guidelines for solid organ transplant recipients	British Transplantation Society

National record linkage



Section 251 approval
Ethical approval
R&D approval
Approved Researcher status

UHB recruitment



Conclusions

- Mortality from cancer is increasing with time post-transplantation and becoming the leading cause of death
- Particular groups are at high risk for developing cancer
- Lifestyle modification must be strongly encouraged
- Screening strategies should follow national guidelines but also may require tailoring for transplant-specific risk:
  - Routine native kidney USS if high dialysis vintage?
- Attenuation/modification of immunosuppression must balance risk-versus-benefit stratification on patient-by-patient basis
- Population-based health data may provide answers and updates to un-answered questions – the EpCOT study is designed to address this evidence-base gap

Thank you for you attention

adnan.sharif@uhb.nhs.uk