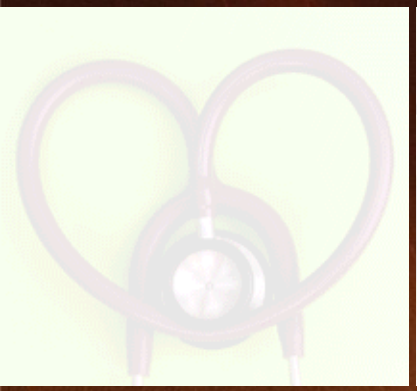

PATIENTS. AT THE HEART OF ALL WE DO.

Is simultaneous pancreas kidney transplant the most cost-effective treatment for Type 1 diabetes patients with renal failure? A cost-utility analysis

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Contents

Introduction

Introduction

- Pancreas transplant for type I diabetes mellitus:
  - ✓improve quality of life [1-3],
  - ✓cost-effective[4],
  - ✓prolong survival[5]
  - ✓induce an insulin-independent normoglycemic state[6]
- Most widely applied in Type 1 diabetes with renal failure (IDDM-RF)
  - ✓simultaneous pancreas kidney transplant (SPK).

1. Milde FK, Hart LK, Zehr PS. Diabetes Care. 1995 Jan;18(1):93-5.
2. Kiebert GM, van Oosterhout EC, van Bronswijk H, Lemkes HH, Gooszen HG. Clin Transplant. 1994 Jun;8(3 Pt 1):239-45.
3. Ziaja J, Bozek-Pajak D, Kowalik A, Krol R, Cierpka L. Transplant Proc. 2009 Oct;41(8):3156-8.
4. Kiberd BA, Larson T. Transplantation. 2000 Oct 15;70(7):1121-7.
5. Smets YF, Westendorp RG, van der Pijl JW, de Charro FT, Ringers J, de Fijter JW, et al. 1999 Jun 5;353(9168):1915-9.
6. Sutherland DE, Gruessner RW, Gruessner AC. World J Surg. 2001 Apr;25(4):487-96.

Introduction

- Established & available in US & European centres
  - ➡ not available in Singapore

- Singapore has a national liver and kidney transplant programme
  - SPK is the next natural progression

- Overseas studies[1-2] had proven that SPK is a cost-effective strategy
  - no analysis done in the region.

1. Kiberd BA, Larson T. Transplantation. 2000 Oct 15;70(7):1121-7.
2. Douzdjian V, Ferrara D, Silvestri G. Am J Kidney Dis. 1998 May;31(5):794-802

Objective

to assess cost-effectiveness of SPK compared with other treatment strategies for IDDM-RF prior to establishment of a pancreas transplant programme in Singapore.

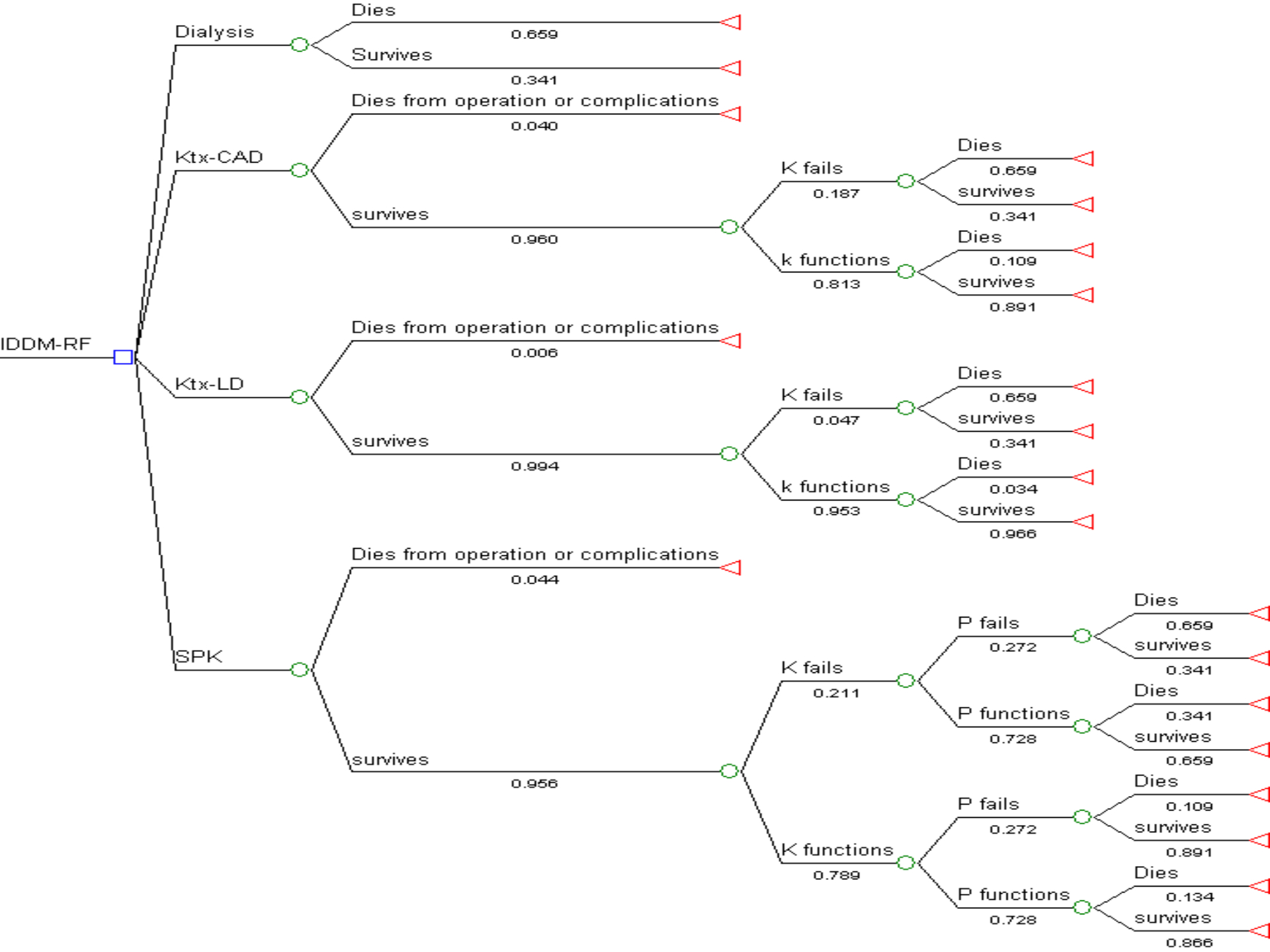
Methods

Methods

Model structure and assumptions

- A decision analysis model was used.

- Treatment strategies for IDDM-RF:
  - ✓Cadaveric kidney transplant (Ktx-CAD),
  - ✓Living donor kidney transplant (Ktx-LD),
  - ✓Simultaneous pancreas kidney transplant (SPK),
  - ✓Dialysis.


IDDM-RF
Dialysis
Dies
0.659
Survives
0.341
Ktx-CAD
Dies from operation or complications
0.040
survives
0.960
K fails
0.187
Dies
0.659
survives
0.341
k functions
0.813
Dies
0.109
survives
0.891
Ktx-LD
Dies from operation or complications
0.006
survives
0.994
K fails
0.047
Dies
0.659
survives
0.341
k functions
0.953
Dies
0.034
survives
0.966
SPK
Dies from operation or complications
0.044
survives
0.956
K fails
0.211
P fails
0.272
Dies
0.659
survives
0.341
P functions
0.728
Dies
0.341
survives
0.659
K functions
0.789
P fails
0.272
Dies
0.109
survives
0.891
P functions
0.728
Dies
0.134
survives
0.866

Methods

- Assumptions:
  - ✓all options are available to patients,
  - ✓transplantations are performed and managed according to standard techniques and immunosuppressive regimens.
- The time horizon: 5 years
- Perspective: healthcare provider.
- Analyzed using TreeAge Pro software

Methods

Probabilities

- All patients and graft survival probabilities- - 5-year survival analyses
- Exception: “Dies from operation or complication” --survival probability of 1 year.
- All survival values -- Singapore Renal Registry data
- Exception: All SPK survival variables
  - ✓American data from the United Network for Organ Sharing and Scientific Registry of Transplant Recipients (OPTN/SRTR)
  - ✓no local data available

Methods

Health Outcomes

- Outcomes: Quality adjusted life year (QALY).

- QALY: a measure of disease burden, including both the **quality** and the **quantity** of life lived.

- QALY for each treatment option were obtained from a overseas study*
  - Standard Gamble method
  - based on a 5-year model

*Douzdjian V, Ferrara D, Silvestri G. Am J Kidney Dis. 1998 May;31(5):794-802.

Methods

Cost analysis

- Only direct medical costs were considered in this study.

- Adjusted to 2010 values
  - health care component of the Singapore Consumer Price Index.

- We adopted a 3% annual discount rate for all future costs
  - which converted values that would occur in the future to their present values.

Methods

- All cost components were based on the actual patients' data locally.

- Exception: All SPK related costs were based on expert opinion of a local surgical team

  - ✓1st year SPK transplant cost--40%
  - ✓annual follow-up cost--15%

  higher than the cadaveric kidney transplant

Methods

Cost-utility analysis

- Cost-effectiveness: Cost-utility ratio (CUR, i.e., Cost per QALY gained)

- Incremental cost-utility ratio (ICUR) was also calculated versus the least costly strategy.

$$ICUR_{A\ vs.\ B} = \frac{\text{Cost A} - \text{Cost B}}{\text{QALY gained for A} - \text{QALY gained for B}}$$

- WHO guidelines:
  - ✓ ICUR below 1 GDP per capita - **highly cost-effective**
  - ✓ < 3 times GDP per capita - **cost-effective**

*GDP per capita for Singapore 2010= **SGD59,813 (USD48,382)**

Methods

Sensitivity analysis

- Sensitivity analyses were performed to evaluate the impact of uncertainties around key variables.

- Survival variables
  - variations: 95% CI (Singapore Renal Registry)

- SPK survival variables,
  - Variations: ±15% of the baseline values (the OPTN data)
  - higher level of uncertainty as no local data available.

Methods

Sensitivity analysis

- Cost variables
  - Variations: ± 20% of baseline values.

- QALY:
  - Variations: ± 1 Standard deviation
  - Previous study*

*Douzdjian V, Ferrara D, Silvestri G. Am J Kidney Dis. 1998 May;31(5):794-802.

Results

Results

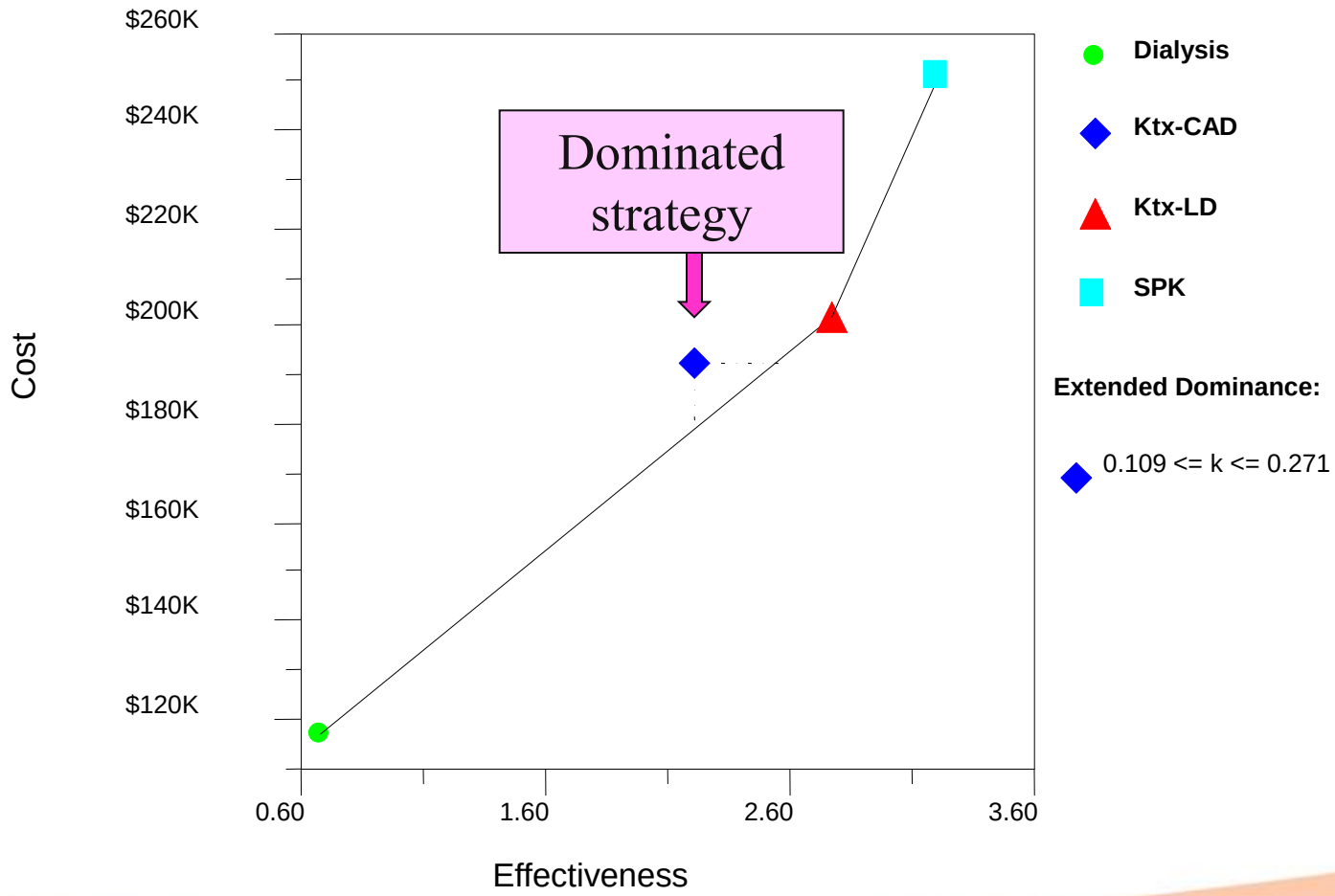
Baseline analysis

Treatment option	Cost, SGD	QALY	Cost-utility ratio, SGD	ICUR (vs dialysis), SGD
Dialysis	116,777	0.68	171,227	NA
Cadaveric kidney transplant, Ktx-CAD	192,602	2.21	87,203	Dominated
Living donor kidney transplant, KD-LD	201,900	2.78	72,702	40,630
Simultaneous pancreas kidney transplant, SPK	251,099	3.21	78,335	53,091

1 USD = SGD1.24

Results

Figure 1: Cost-utility analysis for IDDM-RF treatment strategies



Results

Baseline analysis

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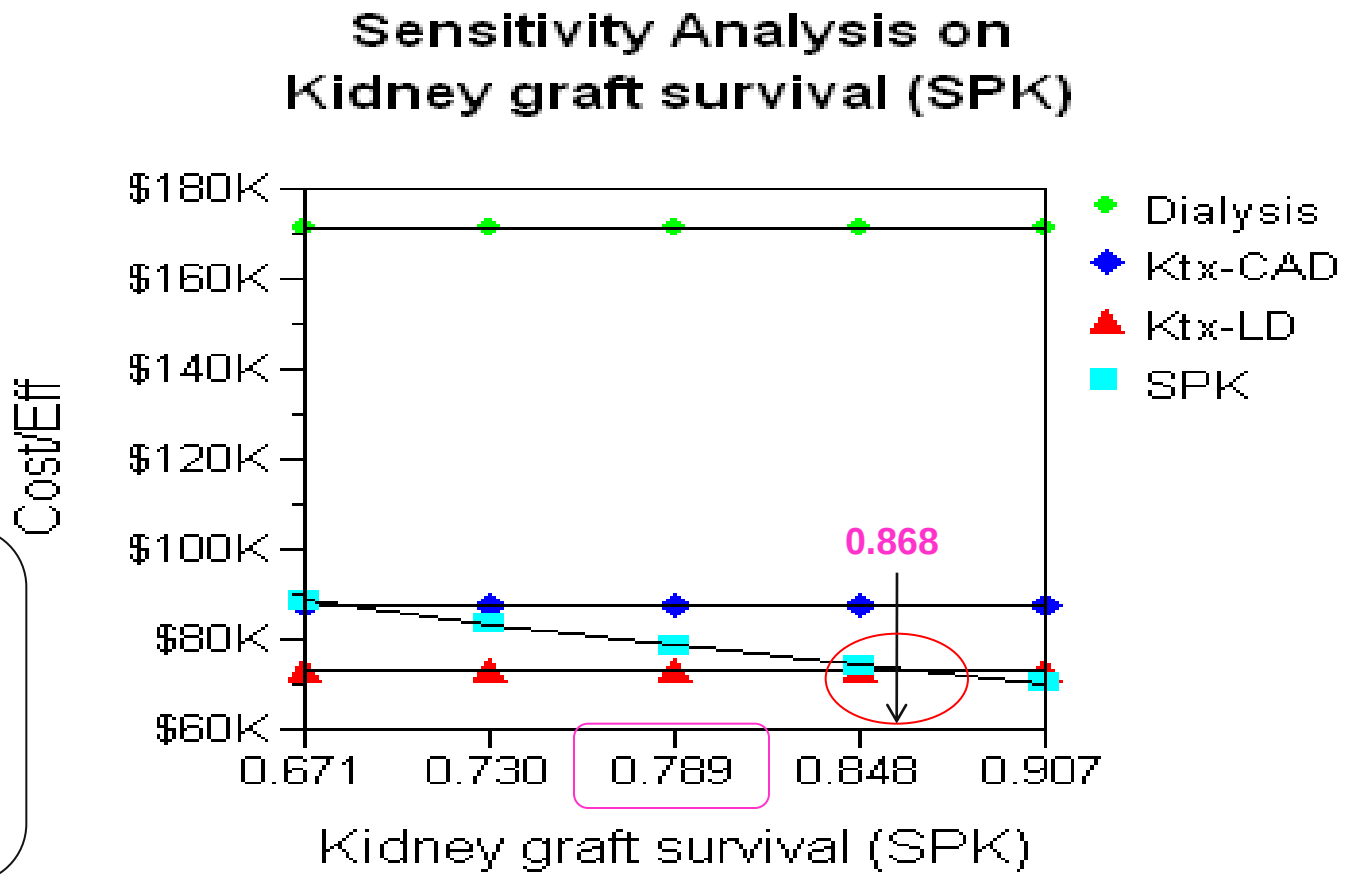
highly cost-effective under WHO guidelines

*GDP per capita for Singapore 2010= **SGD59,813 (USD48,382)**

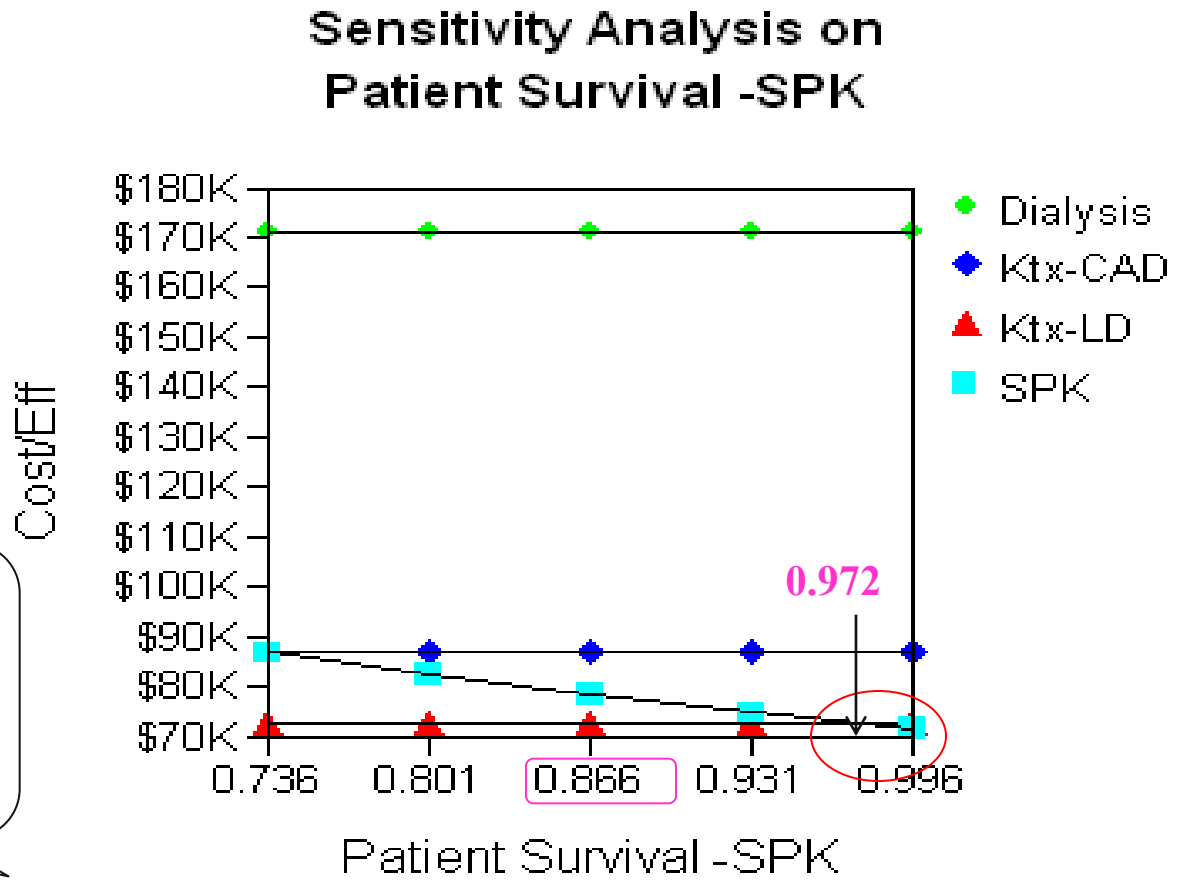
Results



The SPK would be the most cost-effective strategy

- 10% increase in SPK kidney graft survival
- i.e.,86.8% versus 78.9% used in the baseline

Results

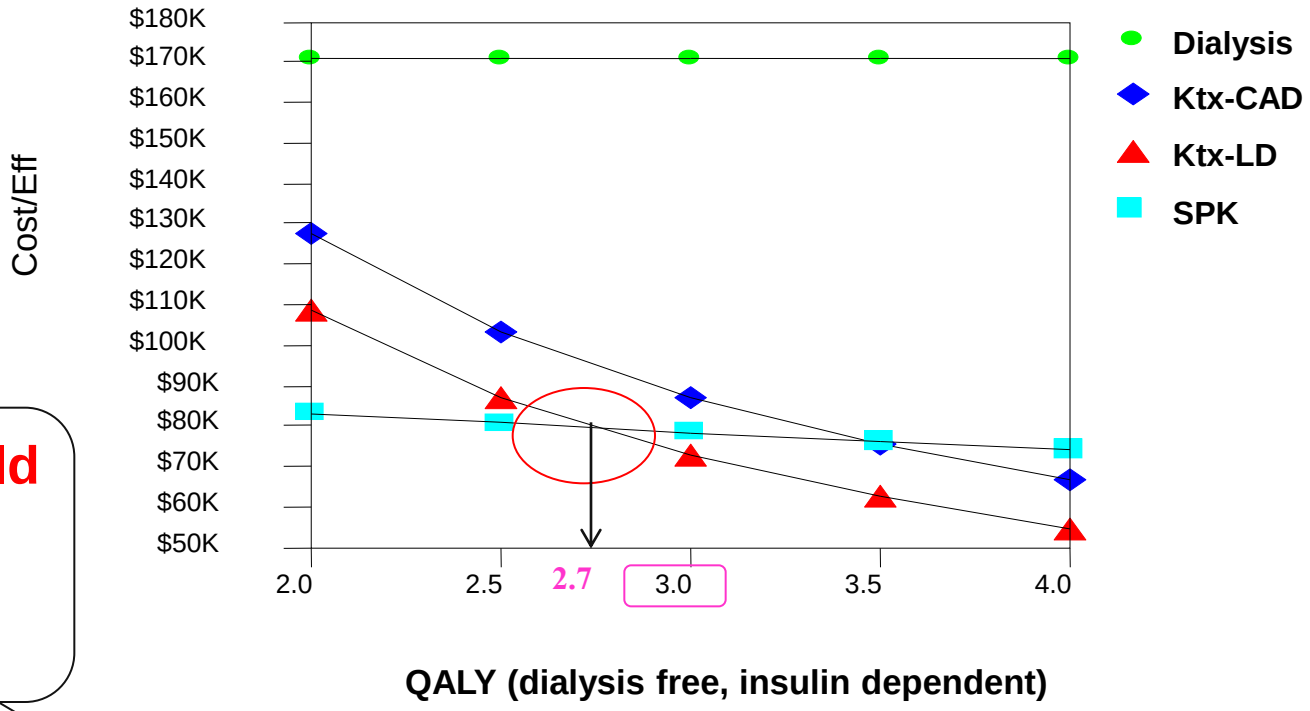


The SPK would be the most cost-effective strategy

- 12% increase in patient survival for SPK strategy
- i.e., 97.2% vs 86.6% used in the baseline

Results

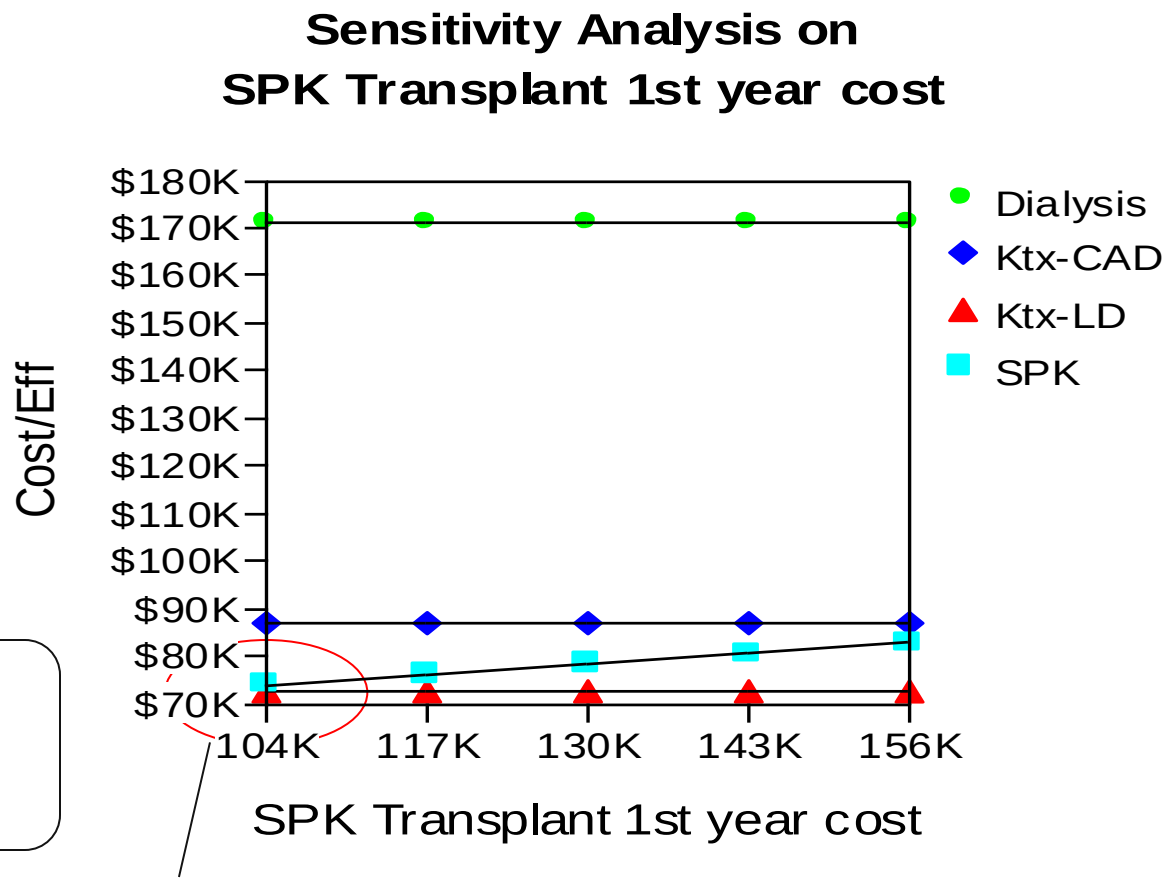
Sensitivity Analysis on QALY (dialysis free, insulin dependent state)



The SPK would be the most cost-effective strategy

- QALY for the dialysis-free, insulin dependent state falls < 2.7
- vs 3.0 used in the baseline

Results



as cost-effective as KA-LD strategy

- 1st year SPK transplant cost is only 20% higher than the KA-CAD cost
- vs 40% higher than the Ktx-CAD used in the baseline

Conclusions

Conclusions

- Both **Ktx-LD** and **SPK** are **highly cost-effective** strategies in the treatment of IDDM-RF.

- **Ktx-LD** is the most cost-effective strategy in the baseline analysis.

- **SPK** is potentially the most cost-effective strategy in the **sensitivity analyses** :

  - ✓10% increase in SPK kidney graft survival
  - ✓12% increase in SPK patient survival
  - ✓QALY for the dialysis-free, insulin dependent state falls <10 %

⟹ Reasonable within the sensitivity analyses ranges and achievable

Thank you

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