Explaining variations in waiting time for elective surgery

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Rationale

- Long waiting lists and waiting times for elective surgery: major debate in countries with a NHS
  - Cost for the patient: pain, disease progression, stress, incapacity + payment for private facilities
  - Cost for the society: productivity loss (est. 0.5 to 0.8% of GDP, Cullis & Jones, AER, 1986)
  - Equity issue: differences in ability to pay for private facilities

Rationale

- However:
  - Rationing when price tends to zero
  - Management of stochastic demand for interventions
  - The “optimal waiting time”

Literature: focus on “macro” aspects

- Estimating the cost of waiting
- Impact of waiting times on demand for surgery and private insurance
- Impact of increasing supply and supplier-induced demand
- Impact of additional payments to reduce times/lists, to treat patients on the list, to increase productivity
- Impact of subsidies to the private sector
- Determinants of waiting times through international comparisons

Objective: focus on “micro” aspects

- Measure how waiting times vary according to
  - Patients’ characteristics
  - Hospital characteristics
- Provide evidence on equity in waiting times: variations in waiting times that are unrelated to needs
- Provide evidence on supply determinants: what are the beneficial hospital characteristics?

Context

- June 2004, Portugal: Integrated system for the management of patients registered for elective surgery (SIGIC)
- Prioritization: very high, high, normal
- Additional payment (FFS-type) to treat a patient on the list
- 9-months maximum waiting time (MWT) guarantee
  - After MWT: transfer to another NHS hospital
  - Otherwise: voucher to be treated in a private hospital

Context

- Maximum waiting time guarantee + transfer:
  - Incentive to the patient's first hospital
  - Efficiency-enhancing redistribution across hospitals
- Prioritization:
  - Signaling the expected benefit (?)
  - Deter demand from low-severity cases

Context

- Equity:
  - “first come-first served”
  - Needs-based distribution of resources (prioritization)
  - Redistribution between hospitals and regions with different capacities and needs
  - Central management
- However:
  - Which priority criteria and which MWT?
  - Different practices, activity and incentives (hospitals)

Data

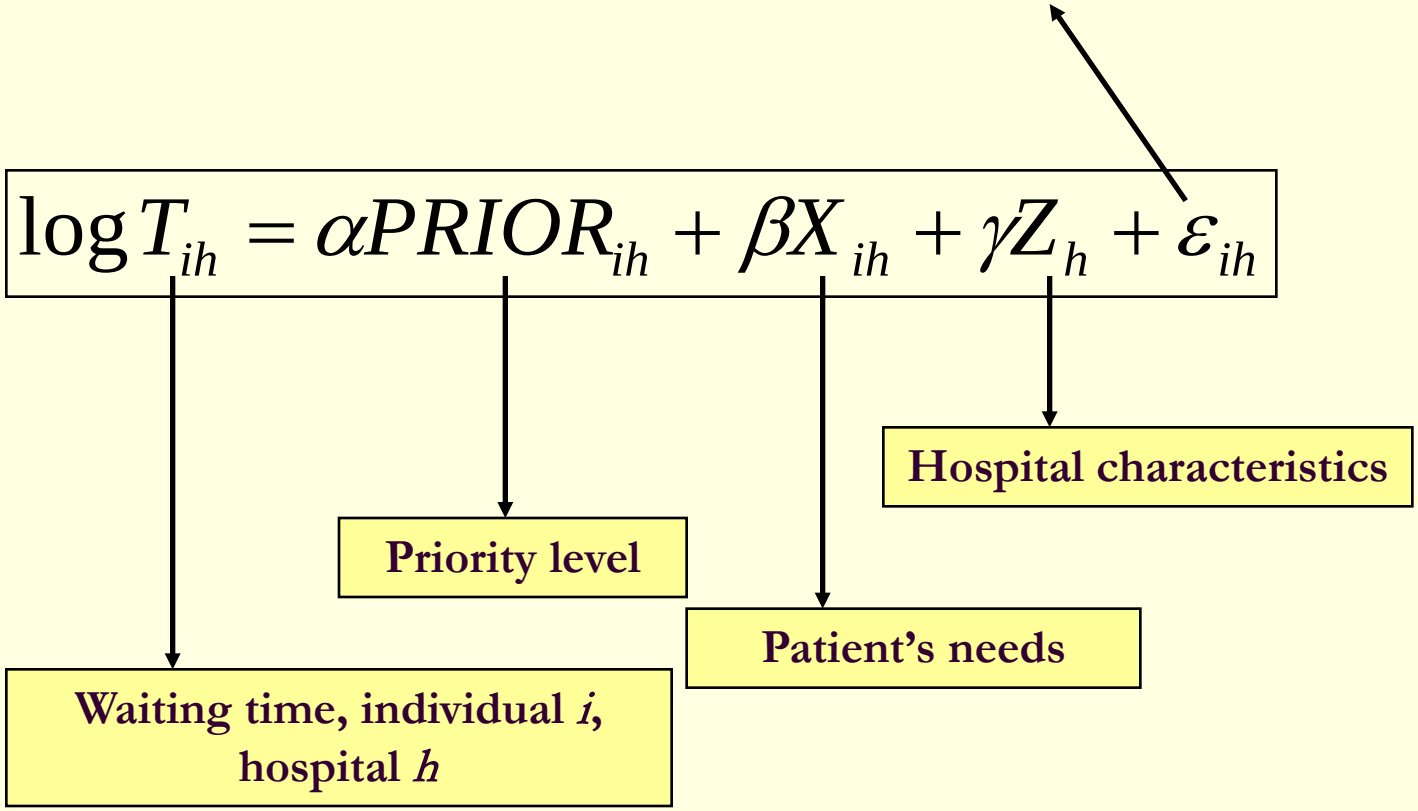
- All patients in waiting lists between 30/06/2004 and 6/02/2006 at NHS hospitals
- Focus on 6 interventions (111,668 observations):
  - Ligation and stripping of varicose veins (ICD-9-CM 38.59)
  - phacoemulsification and aspiration of cataract (ICD-9-CM 13.41)
  - carpal tunnel release (ICD-9-CM 04.43)
  - knee arthroscopy (ICD-9-CM 80.26)
  - total knee replacement (ICD-9-CM 81.54)
  - total hip replacement (ICD-9-CM 81.51)

Data

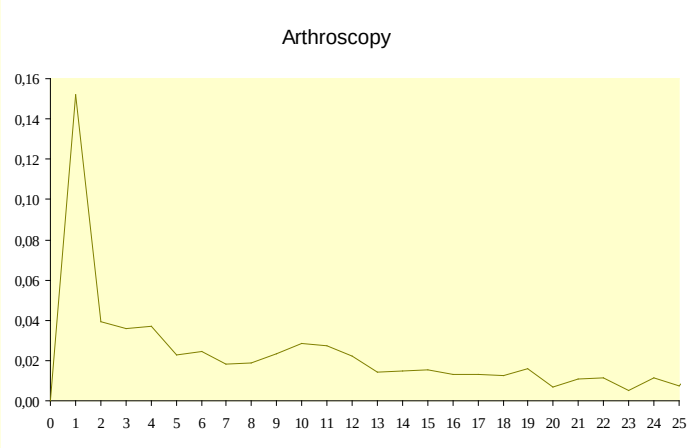
- Fully-comparable individual information:
  - Intervention and waiting time
  - Age, sex, pathology
  - Priority level
  - Hospital type (index admission):
    - private vs public management
    - % of total surgeries the intervention represents
    - % of total admissions the intervention represents
    - % of total admissions the list represents for a given intervention

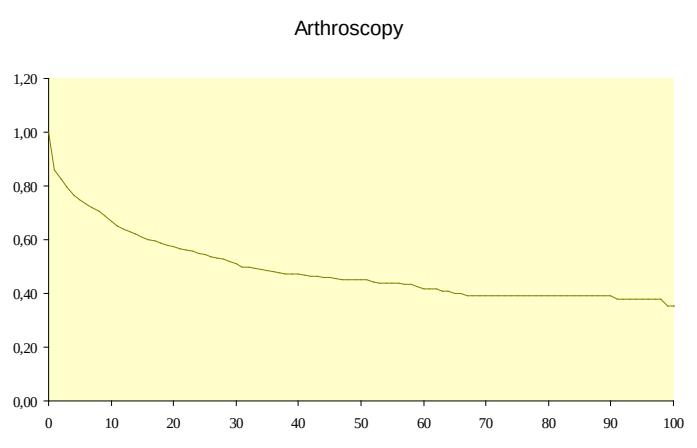
Methods

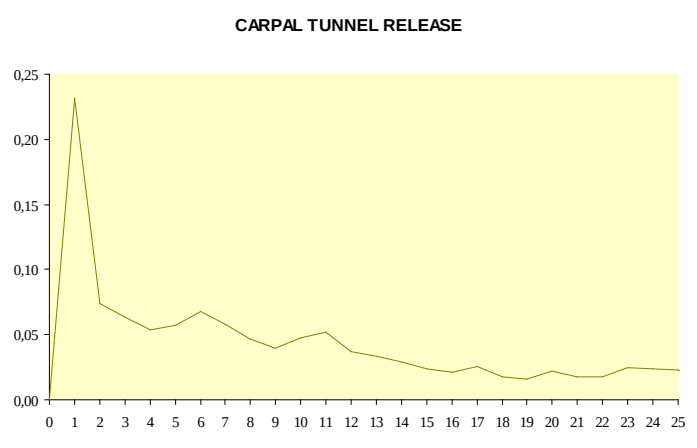
- Model specification (random error follows a log-normal distribution)

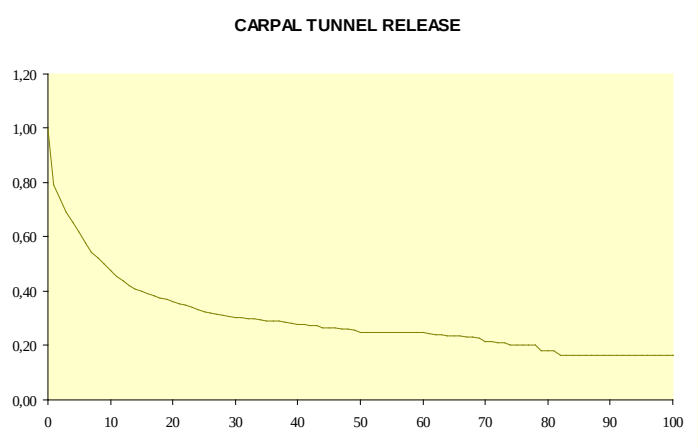


Hazard and survival curves









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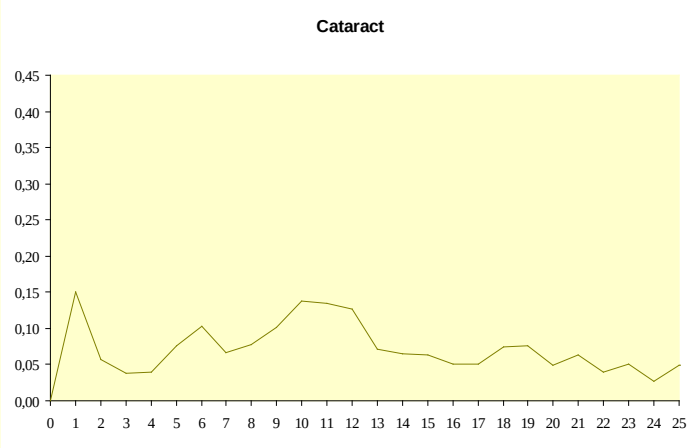
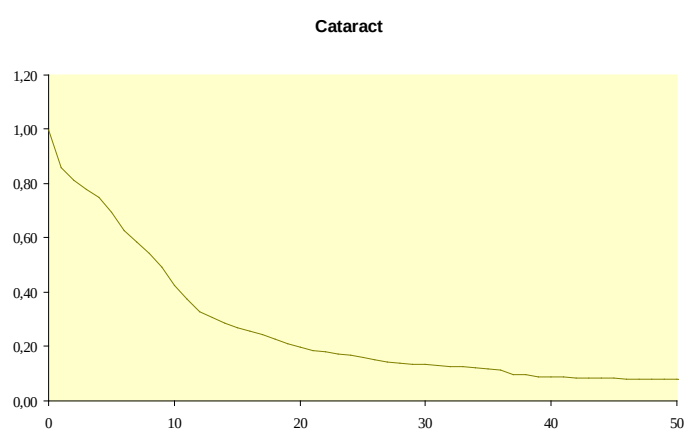
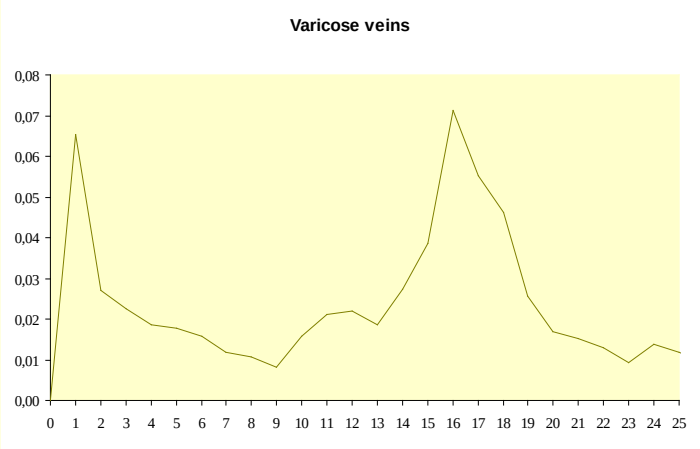
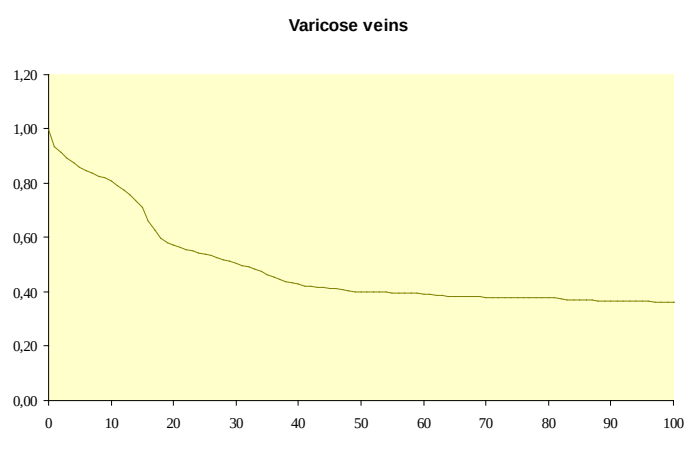
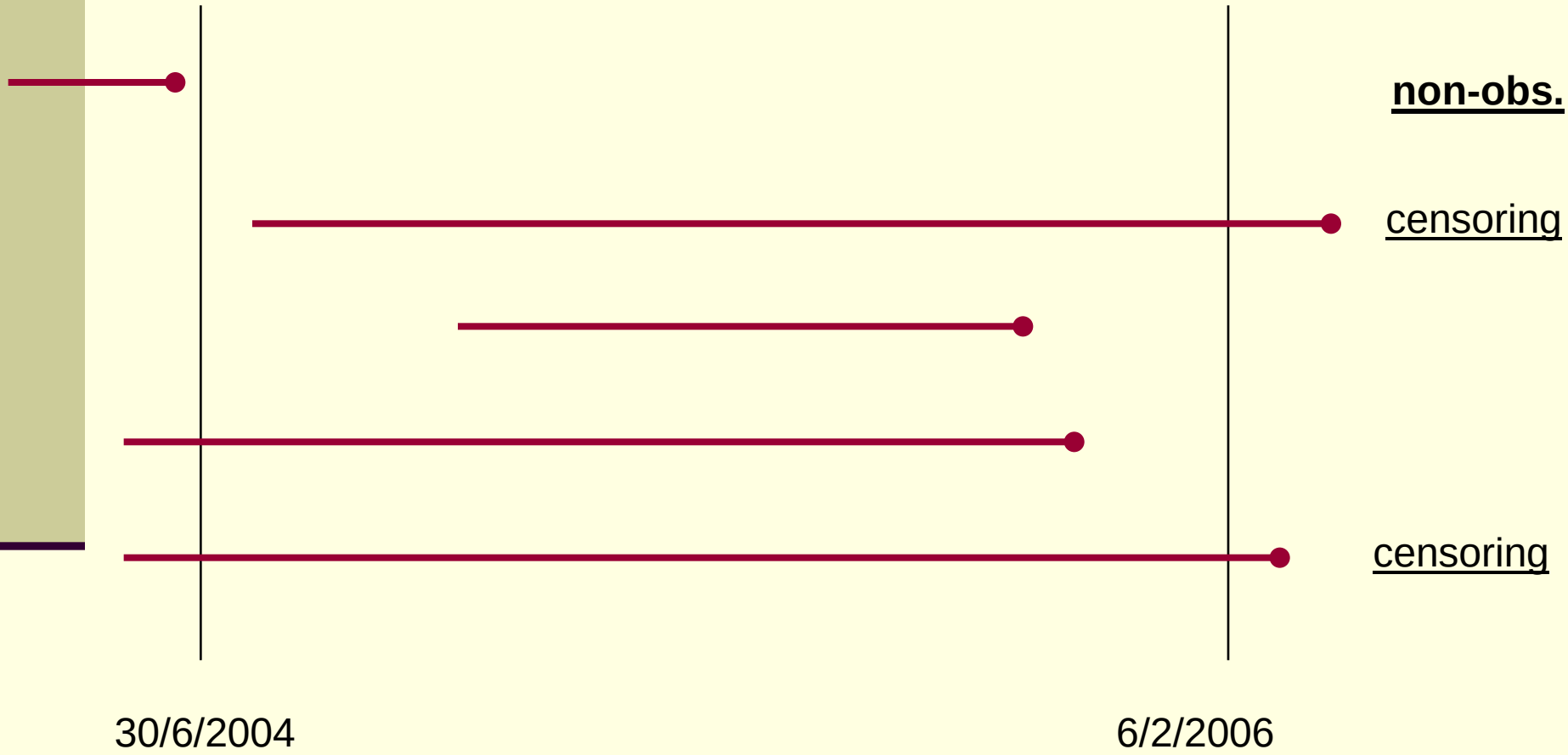








Methods



Results: caract surgery

Log-normal regression -- accelerated failure-time form

No. of subjects = 39262 Number of obs = 39262
No. of failures = 20803
Time at risk = 251116
LR chi2(11) = 1937.40
Log likelihood = -43272.361 Prob > chi2 = 0.0000

_t	Tm. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
female	1.066276	.014754	4.64	0.000	1.037748	1.095589
age30_44	1.071855	.1127266	0.66	0.509	.8721984	1.317214
age45_59	1.20609	.1064101	2.12	0.034	1.014566	1.433768
age60_74	1.488406	.1259944	4.70	0.000	1.26086	1.757018
age75	1.593886	.1346727	5.52	0.000	1.35063	1.880954
high_priority	.2213307	.0103441	-32.27	0.000	.2019574	.2425623
priority	.5820145	.0196594	-16.02	0.000	.5447306	.6218503
hospital SA	1.312331	.0186714	19.10	0.000	1.276241	1.349441
catar_2	.9247874	.0159439	-4.54	0.000	.89406	.9565709
catar_3	.8704616	.0155769	-7.75	0.000	.8404606	.9015336
catar_4	1.138553	.0193363	7.64	0.000	1.101278	1.177089
/ln_sig	.1536203	.0050697	30.30	0.000	.1436838	.1635568
sigma	1.166048	.0059116			1.154519	1.177692

if >1, longer waiting time
if <1 shorter waiting time

Results: caract surgery

- Hospital variables:
  - Status: longer waiting at hospitals SA
  - CATAR_2: shorter waiting time when cataracts represent a high share of total surgeries
  - CATAR_3: shorter waiting time when cataracts represent a high share of total admissions
  - CATAR_4: longer waiting time when waiting lists for cataracts represent a high share of total admissions

Results: varicose veins

Log-normal regression -- accelerated failure-time form

No. of subjects = 13800 Number of obs = 13800
No. of failures = 4053
Time at risk = 184699
LR chi2(11) = 4113.24
Log likelihood = -10874.409 Prob > chi2 = 0.0000

_t	Tm. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
female	1.103939	.047413	2.30	0.021	1.014815	1.20089
age30_44	1.005397	.0895447	0.06	0.952	.8443571	1.197151
age45_59	1.06641	.0930186	0.74	0.461	.8988294	1.265234
age60_74	1.266678	.1151082	2.60	0.009	1.06002	1.513626
age75	1.408746	.2344889	2.06	0.040	1.016596	1.952168
high_pri	1.465803	.1863202	3.01	0.003	1.142558	1.880498
prio	.3281087	.0305799	-11.96	0.000	.2733287	.3938676
hospital SA	2.203663	.0808423	21.54	0.000	2.050777	2.367946
vveins_2	.2100735	.0182107	-18.00	0.000	.1772487	.2489772
vveins_3	.1948684	.0183131	-17.40	0.000	.1620871	.2342796
vveins_4	5.134049	.2501726	33.57	0.000	4.666406	5.648556
/ln_sig	.447331	.0118183	37.85	0.000	.4241676	.4704944
sigma	1.564132	.0184853			1.528318	1.600785

if >1, longer waiting time
if <1 shorter waiting time

Results: varicose veins

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  - Status: longer waiting at hospitals SA
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  - CATAR_4: longer waiting time when waiting lists for cataracts represent a high share of total admissions

Results: hip replacement

Log-normal regression -- accelerated failure-time form

No. of subjects = 8363 Number of obs = 8363
No. of failures = 3608
Time at risk = 80573
LR chi2(11) = 1270.81
Log likelihood = -9049.1691 Prob > chi2 = 0.0000

_t	Tm. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
female	.9112138	.0355693	-2.38	0.017	.8440993	.9836646
age30_44	.8414938	.1903739	-0.76	0.446	.5401082	1.311055
age45_59	1.016471	.2137822	0.08	0.938	.6730881	1.535034
age60_74	1.104578	.2288095	0.48	0.631	.7359917	1.657753
age75	1.160364	.2424583	0.71	0.477	.7704339	1.747644
high_priority	.275396	.0252621	-14.06	0.000	.230079	.3296389
priority	.6644452	.0387255	-7.01	0.000	.5927192	.7448508
hospital SA	.7242065	.0299385	-7.81	0.000	.6678424	.7853276
hip_2	.4518698	.0279983	-12.82	0.000	.4001954	.5102166
hip_3	.4980426	.0281768	-12.32	0.000	.4457688	.5564464
hip_4	4.900236	.2551898	30.52	0.000	4.424752	5.426815
/ln_sig	.4057701	.0124842	32.50	0.000	.3813015	.4302386
sigma	1.500458	.018732			1.464189	1.537624

if >1, longer waiting time
if <1 shorter waiting time

Results: hip replacement

- Hospital variables:
  - Status: SHORTER waiting at hospitals SA
  - CATAR_2: shorter waiting time when cataracts represent a high share of total surgeries
  - CATAR_3: shorter waiting time when cataracts represent a high share of total admissions
  - CATAR_4: longer waiting time when waiting lists for cataracts represent a high share of total admissions

Results: knee arthroscopy

Log-normal regression -- accelerated failure-time form

No. of subjects = 7298 Number of obs = 7298
No. of failures = 2584
Time at risk = 75898
LR chi2(11) = 690.41
Log likelihood = -7607.3152 Prob > chi2 = 0.0000

if >1, longer waiting time
if <1 shorter waiting time

_t	Tm. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
female	.9809498	.0554923	-0.34	0.734	.8779995	1.095971
age30_44	1.156715	.0894474	1.88	0.060	.9940406	1.346012
age45_59	1.5411	.1157535	5.76	0.000	1.330137	1.785523
age60_74	1.654482	.148959	5.59	0.000	1.386837	1.97378
age75	3.35495	.7918464	5.13	0.000	2.112432	5.32831
high_priority	.1771732	.0257592	-11.90	0.000	.1332423	.2355884
priority	.3988413	.036245	-10.11	0.000	.3337695	.4765996
Hospital SA	.5839074	.0341494	-9.20	0.000	.5206695	.6548259
arth_2	.6448518	.0557065	-5.08	0.000	.5444119	.7638221
arth_3	.3722279	.0329636	-11.16	0.000	.3129165	.4427814
arth_4	2.404605	.1587549	13.29	0.000	2.112742	2.736788
/ln_sig	.6392839	.0152253	41.99	0.000	.6094429	.6691249
sigma	1.895123	.0288538			1.839406	1.952528

Results: knee arthroscopy

- Hospital variables:
  - Status: SHORTER waiting at hospitals SA
  - CATAR_2: shorter waiting time when cataracts represent a high share of total surgeries
  - CATAR_3: shorter waiting time when cataracts represent a high share of total admissions
  - CATAR_4: longer waiting time when waiting lists for cataracts represent a high share of total admissions

Results: total knee replacement

Log-normal regression -- accelerated failure-time form

No. of subjects = 12675 Number of obs = 12675
No. of failures = 3310
Time at risk = 146692
LR chi2(11) = 880.54
Log likelihood = -9776.9635 Prob > chi2 = 0.0000

if >1, longer waiting time
if <1 shorter waiting time

_t	Tm. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
female	1.019106	.0438198	0.44	0.660	.9367399	1.108714
age30_44	.3626168	.1808752	-2.03	0.042	.1364156	.9638995
age45_59	.4814076	.2184176	-1.61	0.107	.1978416	1.171408
age60_74	.4593819	.2069637	-1.73	0.084	.18997	1.110869
age75	.524169	.2366299	-1.43	0.152	.2163746	1.269803
high_priority	.4316679	.0590104	-6.15	0.000	.3302082	.5643021
priority	.6400394	.0460573	-6.20	0.000	.5558456	.736986
hospital SA	.8026546	.0327606	-5.39	0.000	.7409461	.8695024
knee_2	.4529187	.0281825	-12.73	0.000	.4009174	.5116649
knee_3	.8613927	.0498875	-2.58	0.010	.7689603	.964936
knee_4	3.002201	.1448921	22.78	0.000	2.731235	3.300049
/ln_sig	.4842433	.0131309	36.88	0.000	.4585071	.5099794
sigma	1.622946	.0213108			1.581711	1.665257

Results: total knee replacement

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  - Status: SHORTER waiting at hospitals SA
  - CATAR_2: shorter waiting time when cataracts represent a high share of total surgeries
  - CATAR_3: shorter waiting time when cataracts represent a high share of total admissions
  - CATAR_4: longer waiting time when waiting lists for cataracts represent a high share of total admissions

Equity in waiting times?

- Impact of age and sex: different needs not included in the priority level?
- Surgery for varicose veins: high-priority patients wait longer than priority ones. How are priority determined?
- Significant impact of hospital-management type (the sign varies)
- Significant impact of hospital activity type:
  - Shorter waiting when higher specialization in the intervention
  - Longer waiting when longer list (contradicts the “management effect” of the lists?)

Further research

- Up-date: more recent data, after longer implementation of the reform
- Measure the impact of socio-economic factors in waiting time and priority level
- Impact of hospital characteristics:
  - Determine the impact of private-public competition level
  - Determine the impact of financial incentives