Diabetes Treatment in Denmark: Hospital- vs. GP-based Monitoring

Focus on Type 2 Diabetes

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Background and Research Aims

- Denmark has a national publicly financed healthcare system, including a public drug insurance component, where primary care doctors are gatekeepers to almost all specialist and non-emergency secondary care
- Hospital-based care is regarded as expensive relative to GP-based care
  - For patients with chronic diseases which can be managed in the primary care setting there is a high potential for incremental costs of Hospital-based care to be substantial in aggregate (vs. GP-based)
- Most recent Danish GP contract (agreed late 2017): approximately 25000 (of 38000) T2DM patients treated in Hospital outpatient clinics should have diabetes care moved exclusively to GP setting
- Aim 1: Characterize differences between Hospital-monitored and GP-monitored Type 2 diabetes patients
  - Demographics
  - Health status indicators
  - Annual healthcare costs
- Aim 2: Estimate cost-impacts attributable to hospital-based monitoring

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Hospital-based Monitoring of Diabetes in Denmark

- Danish Health Board (Sunhedsstyrelsen)
  - Policy document: Disease management program for Diabetes (Foreløbesprogram for diabetes)
- Officially, responsibility for Type 1 diabetes monitoring is supposed to be hospital-based
  - Although not all T1DM patients have their regular-monitoring at hospital-based specialist clinics
- Type 2 diabetes patients are risk-stratified (Foreløbesprogrammer)
  - Risk-level 1: Only-GP based treatment
  - Risk-level 2: Referred to hospital-based specialist care for short period
  - Risk-level 3: Referred to hospital-based specialist care for permanent responsibility
  - In fact, Regions may stratify differently

Type 2 Diabetes	Risk Level 1	Risk Level 2	Risk Level 3
Glycemic control after intervention	HbA1c < 7%		HbA1c > 9 % despite at least 6 months of attempts to optimize
Blood pressure	< 130/80		> 160/90 despite at least 6 months of attempts to optimize
Metabolic complications		Severe insulin resistance	Very fluctuating plasma glucose, or sever hypoglycaemia
Cardiovascular Disease		1 previous MACE	> 1 previous MACE
Diabetic foot disease		Signs of neuropathy or arterial insufficiency	Previous or existing foot ulcer or Charcot foot
Nephropathy		Micro-albuminuria	Macro-albuminuria
Retinopathy	None or simple	Progressed	Macula oedema or proliferative
Above criteria	All	Not Risk-Level 1 or 3	Any

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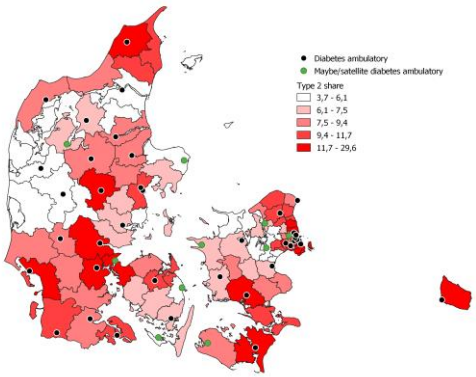
Type 2 Diabetes: Hospital-based care

- Map: 98 Danish municipalities in 5 regions
- Presented by quintiles: Estimated fraction of adult Type 2 diabetes patients receiving ongoing hospital-based diabetes monitoring in 2016
- Estimated number of hospital-based and satellite clinics where specialist diabetes outpatient care was provided: 36
- Overall estimated average fraction of adult Type 2 diabetes patients receiving ongoing hospital-based diabetes monitoring: 9.4%



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Data and Algorithms

- Anonymized National Danish Administrative Registries (*not clinical*)
  - Linked through encrypted personally-identifying code
- Primary Care and Non-Hospital specialist visits: Danish National Health Services Registry
- Hospital Admission: Danish National Patient Registry
- Prescription Medications: Danish National Prescription Registry
  - National insurance for prescription medications
- Additionally: Danish Income / Employment / Education registries

- Diabetes algorithm based on RUKS criteria
  - History of diabetes hospital admission or diabetes-specific medications
- Hospital-based monitoring algorithm based on RKKP DVDD completeness algorithm

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T2DM Demographics (2016)

	GP-based (n=250559)		Hospital-based (n=26147)	
	Mean	s.d.	Mean	s.d.
Age	63.760	14.887	62.865	12.658
Diabetes Age	8.502	5.568	13.108	6.037
Male	0.503	0.500	0.615	0.487
Income	237260	1072337	250455	1857878
Adult Children	1.573	1.328	1.609	1.350
Single	0.355	0.479	0.350	0.477
Primary Education	0.389	0.487	0.382	0.486
Secondary Education	0.431	0.495	0.451	0.498
Undergraduate Education	0.108	0.310	0.098	0.297
Graduate Education	0.039	0.194	0.038	0.190
Employed	0.272	0.445	0.250	0.433
Retired	0.603	0.489	0.622	0.485
Danish	0.835	0.371	0.833	0.373
First Generation Immigrant	0.121	0.327	0.133	0.340
Charlson Comorbidity Index	1.962	2.249	3.769	2.415
Previous Year ED Admissions	0.384	1.196	0.626	1.627

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Annual Costs (2016 DKK)

	GP-based (n=250559)		Hospital-based (n=26147)	
Healthcare Cost	Mean	s.d.	Mean	s.d.
Primary GP	2132	1610	1773	1718
Drugs	4301	6538	9348	8464
Non-hospital-based Specialist	2415	3764	2766	3807
Outpatient	9558	30760	22158	47453
Inpatient	19677	67386	30730	93511
Emergency Department*	12895	51182	20329	74116
Total Healthcare	38607	81669	67304	115628

- *ED admissions can result in either inpatient or outpatient admissions

- So, there are cost differences… which is not unsurprising…
- But, to what extent are the cost differences between Hospital- and GP-monitored patients driven by hospital monitoring per sé??

SDU Danish Centre for Health Economics - DaCHE

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IMPROVING QUALITY OF CARE IN EUROPE

Propensity Score Matching

- Idea behind PSM is to use observational data to predict conditional likelihoods of treatment assignment, and use these to create comparison groups which don't suffer from selection bias. (Think RCT, but using observational data)

- Estimation of Treatment Effect (ATET) of Hospital-based monitoring on Healthcare costs
  - Compare average annual costs for Hospital-based with similar GP-based patients for whom hospital-based monitoring or Gp-based monitoring may be appropriate
  - Trying to estimate cost impacts which can be attributed to the fact of hospital-based monitoring

- Exclude Risk Level-3 T2DM hospital-based Patients and CCI = 0
  - Patients who should continue with, or unlikely to have any potential need for hospital-based monitoring

- Estimation of propensity scores for regular hospital-based monitoring
  - Personal socio-demographic characteristics
  - Medical need: history of disease (CCI) & recent ED admissions
  - Local factors affecting accessibility of hospital-based care

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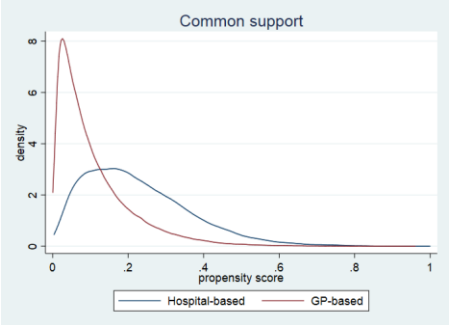

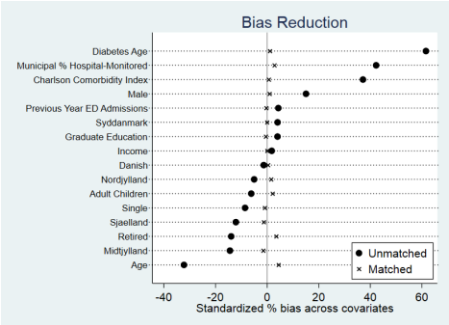

Common support covers full probability range

Pre-matching mean bias = 16.5%
Post-matching mean bias = 1.4%

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Results (INTERIM – Research Continues…)

Healthcare Cost	beta (ATT)	s.e.	p
Primary GP	-498.7	22.5	<0.001
Drugs	3569.7	97.1	<0.001
Non-hospital-based Specialists	55.0	47.4	0.246
Outpatient	4625.0	577.3	<0.001
Inpatient	-2666.0	919.0	0.004
Emergency Department*	-1513.4	698.7	0.030
Total Healthcare	5074.8	1266.1	<0.001

- These results suggest that regular hospital-based care does appear to be more expensive and higher quality (i.e. negative ED costs) for T2DM patients who could potentially be monitored exclusively in primary care.
  - Perhaps not shocking, but this is of current policy interest within Denmark

- 1:1 matching, bootstrapped 100 times
- *ED admissions can result in either inpatient or outpatient admissions

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Limitations and Future Steps

- Algorithmic identification of diabetes patients based on administrative datasets
  - For 2016 more likely T2DM patients identified than reported by the Danish Health Data Protection Agency (www.esundhed.dk)
    - 276,706 vs. 228,400
- Algorithmic identification of ongoing hospital-based monitoring
  - Based on RKKP algorithm: hospital outpatient visits within same region over 2+ consecutive years
  - Ignores patients who only attend hospital-based clinics for short periods of time within 1 year
- Improvements to evaluation of clinical/risk need
  - Currently based on administrative records, not clinical records
  - Access to a clinical database has been requested (DVDD)
- Shortcoming of PSM in practice: Matching is only on observables, but unobservables *may* be important…
- IV approach

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Thank you for your attention!

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