The Danish national type 2 diabetes cohort – the DD2 study

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Editorial

Type 2 diabetes is a pandemic and an enormous public health problem. This supplemental issue of Clinical Epidemiology describes the rationale, design, and implementation of the establishment of a large cohort of all Danes with type 2 diabetes (the DD2 study) and of a biobank to bridge the scientific disciplines of epidemiology, clinical medicine, genetics, epigenetics, and pharmacology. This will most likely result in great benefits for the application of evidence-based medicine to the care of, and improved outcomes for, Danish type 2 diabetes patients.

This real-life clinical scientific investment will be an international resource for diabetes research for many years to come. Type 2 diabetes is a rapidly growing disease affecting around 205 million people worldwide and, in a “worst case scenario”, 439 million will be diagnosed with type 2 diabetes by the year 2025. The disease is associated with a two-fold increased mortality rate compared with the general population, due to complications such as myocardial infarction, stroke, gangrene in the lower extremities, end-stage renal failure, and blindness. The excess global mortality in 2000 attributable to diabetes overall, most of which was attributable to type 2 diabetes, was 2.9 million deaths. These complications are very troublesome for the individual diabetic patient and major public health problem.

Therefore, cost-effective national organization and intervention are strongly needed, both in order to prevent the disease, but also in an attempt to improve treatment of the metabolic abnormalities behind the disease with the aim of preventing the devastating complications.

Recent clinical trials have emphasized the importance of early intensive treatment of type 2 diabetes patients in order to prevent complications and improve quality of life. Therefore, evidence for new national guidelines for treatment and organisation for newly diagnosed type 2 diabetes patients is needed. In this case – if the guidelines are effective – the prognosis of newly diagnosed patients may be expected to improve significantly.

The overall aim of the DD2 study is to near-normalize metabolic control in newly diagnosed type 2 diabetes patients in order to prevent diabetic complications and improve quality of life. The DD2 study thus has two specific aims:

1. To investigate whether or not it is possible through treatment guidelines and structured organization to near-normalize the risk profile and to avoid/reduce diabetic complications by continuous monitoring through Danish health registries, thereby...
obtaining knowledge about predictors for the long-term outcome and thus objectives for new interventions.

2. To establish a biobank of DNA and plasma, urine, and tissue samples for individual characterization of type 2 diabetes patients that will improve the prognosis and build a platform for individualized treatment.

In Denmark the outcome of treatment and clinical course can be followed through comprehensive health registries with complete follow-up. Therefore the DD2 study will be able to evaluate treatment and intervene if the current treatment fails. Based on the data obtained, outcome will be evaluated prospectively, independently of the specific phenotypes and genotypes, and will thus be unbiased.

The identification of new genes and pathways involved in type 2 diabetes predisposition and increased risk of diabetic complications offers opportunities for developing novel therapeutic and preventative approaches. Furthermore, the identification of additional genetic variants – both protective and risk variants – may render it possible to use patterns of predisposition to tailor individual management of these conditions.

Denmark holds an internationally leading position within many aspects of clinical care and diabetes research, but such Danish research has been carried out in many institutions focusing on different aspects such as physiology, clinical medicine, health services research, biotechnology, clinical epidemiology, and biostatistics.

The pandemic of type 2 diabetes is showing no signs of abatement and therefore progress is urgently needed to slow progression and reduce the consequences. The establishment of a large cohort of all Danes with type 2 diabetes and of a biobank to bridge all scientific disciplines will be an important international resource for diabetes research for many years.

Disclosure
The authors report no conflicts of interest in this work.

Acknowledgement
DD2 is the acronym for ‘The Danish Centre for Strategic Research in Type 2 Diabetes’ supported by the Danish Agency for Science (grant no. 09-067009 and 09-075724). DD2 is also supported by The Danish Health and Medicines Authority, The Danish Diabetes Association and an unrestricted donation from Novo Nordisk A/S. The partners of the project are listed on the project website at “http://www.DD2.nu”.

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Supplementary data

DD2 organization

Members of the executive committee

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Professor Jørgen Rungby, DMSc, Aarhus University
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Chief consultant Hanne Agerbak, the Danish Ministry of Health, Copenhagen, Denmark (observer)
Consultant Maj-Britt Laursen, Danish Regions, Copenhagen, Denmark (observer)
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Chief medical officer Anders Dejgaard, MD, DMSc, Novo Nordisk A/S, Denmark

Project management

Project leader Jens Steen Nielsen, MSc, PhD, Odense University Hospital, Denmark
Communications consultant and coordinator Jane Jærndal, Odense University Hospital, Denmark
General practice coordinator Søren Friborg, MD, Odense University Hospital, Denmark
### Table S1 Hospitals participating in DD2 (June 2012)

| Hospital                        | Department                                      | Responsible consultant          |
|---------------------------------|-------------------------------------------------|---------------------------------|
| Odense University Hospital      | Dept of Endocrinology M                         | Henning Beck-Nielsen           |
| Fredericia Hospital             | Dept of Medicine                                | Hans Gjessing                   |
| NBG—Aarhus University Hospital  | Dept of Medicine and Endocrinology              | Jens Sandahl Christiansen       |
| Svendborg Hospital              | Outpatient Dept of Diabetes                      | Klaus Levin                    |
| THG—Aarhus University Hospital  | Dept of Medicine and Endocrinology              | Jørgen Rungholm Christiansen    |
| Regional Hospital Viborg        | Outpatient Dept of Endocrinology                 | Torben Østergaard              |
| Hospital Unit Nyborg            | Outpatient Dept of Endocrinology                 | Klaus Levin                    |
| Veje Hospital                   | Outpatient Dept of Medicine                      | Cramer Christensen              |
| Herlev Hospital                 | Dept of Medicine and Endocrinology               | Henrik Westergaard              |
| Regional Hospital Silkeborg     | Dept of Medicine                                | Klaus W Hansen                  |
| Regional Hospital Randers       | Clinic of Endocrinology C10                      | Henning K Nielsen               |
| Bispebjerg Hospital             | IC – Research                                    | Hans Perrild                    |
| Aalborg Hospital                | Endocrinology Lab 2 Hospital West                | Hans-Henrik Lervang            |
| Regional Hospital Horsens       | Dept of Medicine                                | Lise-Lotte Fisker               |
| Hillerød Hospital               | Dept of Cardiology and Endocrinology H 0652      | Michael Repper                 |
| Steno Diabetes Center           | Steno Diabetes Center                            | Peter Rossing                   |
| Hospital Himmerland Farsø      | Dept of Medicine                                | Henning S Rønne                 |
| Sønderborg Hospital             | Outpatient Dept of Diabetes (M43)                | Hans R Rasmussen                |
| Regional Hospital Herning       | Dept of Medicine                                | Nancy Kristensen                |

### Table S2 Departments/outpatient clinics that have consented to participate in DD2, but have not yet referred any patients

| Hospital                        | Department                                      | Responsible consultant          |
|---------------------------------|-------------------------------------------------|---------------------------------|
| Rigshospitalet                  | Clinic of Medicine and Endocrinology            | Allan Vaag                      |
| Aabenraa Hospital               | Dept of Medicine                                | Jolanta Topolska                |
| Haderslev Hospital              | Dept of Medicine                                | Jolanta Topolska                |
| Esbjerg Hospital                | Dept of Medicine                                | Jeppe Gram                      |
| Hospital Vendysssel             | Dept of Medicine                                | Kim Helg Christiansen           |
| Slagelse Hospital               | Dept of Medicine                                | Henning Friis Juhl              |
| Dronninglund Hospital           | Center of Medicine Aalborg, Dronninglund        | Grzegorz Jaroslaw Pacyk         |
| Frederiksberg hospital          | Clinic of Cardiology and Endocrinology E         | Anne Elisabeth Jarlov           |
| Køge Hospital                   | Dept of Medicine                                | Leif Breum                      |
| Helsingør Hospital              | Dept of Medicine                                | Per Lund / Pernille Vedel       |
### Table S3 General practitioners participating in DD2 (June 2012)

| Name                        | Address                                      |
|-----------------------------|----------------------------------------------|
| Glamsbjerglægerne          | Stensgårdsvej 20, 5620 Glamsbjerg            |
| Mogens Carl Petersen        | Fynsvej 7, 6000 Kolding                     |
| Lagerne Nørre Voldgade 58   | Nærrevoldgade 58, 5800 Nyborg                |
| Lagerne Willemoesvej        | Willemoesvej 31, 5700 Svendborg             |
| J.Ravn and M.Richert        | Vestergade 2, 6640 Lundeskov                |
| Jacobilægerne               | Ringkøbingvej 38, 6800 Varde                |
| Lagerne i Øksbøl            | Torvegade 17, 6840 Øksbøl                   |
| Li Tronegård-M. and Michael Schmidt | Birkevej 2, 5300 Kerteminde                  |
| Lagerne J B Winsløws Vej    | J.B. Winsløws Vej 9 A, 5000 Odense C        |
| Lægehuse—Farum Midpunkt     | Nygårdterrasserne 204, 3520 Farum            |
| Lægekompagniskabet Venusvej 2 | Venusvej 2, 7000 Fredericia                     |
| Paul Jørgen Schultz Aps     | Hovedgaden Vest 86, 6500 Vojens             |
| Lagerne Danmarksgade 13     | Danmarksgade 13, 7000 Fredericia            |
| Haarbylægerne               | Møllevej 2, 5683 Hårby                      |
| Lagerne i Østergade         | Østergade 1 A, 5 B, 5700 Ringe              |
| Larsen, Genthøj and Nielsen | Birkevej 2, 5300 Kerteminde                |
| Claus Olesen and Elin Franck| Ny Vestergade 1, 1 A, 6000 Kolding           |
| Lægehuset Havnepladsen      | Torvegade 16 A, 6800 Varde                  |
| Lægeklinikken Østergade 10  | Østergade 10 A, 6500 Vojens                 |
| Lagerne i Vindeby           | Bregningevej 48, 5700 Svendborg             |
| Bylden Peer Kirkebjerg      | Skt. Anne Plads 2, 5000 Odense C            |
| Lægehuset i Rødning         | Louisevej 13, 6630 Rødning                   |
| Peter Larsen                | Skt. Anne Plads 4 A, 5000 Odense C          |
| Lagerne i Harndrup          | Skovvej 2, 5463 Harndrup                    |
| Bente K. Bertelsen          | Tvedgade 21, 6760 Ribe                     |
| Lægehushet Aps.             | Mellemgade 19 A, 5600 Faaborg               |
| Lone Manane and Bent Stolberg| Monmarkevej 259, 6470 Sydals                |
| Uwe Karstensen Aps          | Låningen 1, 6280 Højers                   |

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