

The Danish national type 2 diabetes cohort – the DD2 study

Henrik Toft Sørensen¹
Søren Friberg²
Jørgen Rungby³
Jens Sandahl Christensen⁴
Allan Vaag⁵
Henning Beck-Nielsen⁶

¹Department of Clinical Epidemiology, Aarhus University Hospital, Aarhus,

²Department of Endocrinology M, Odense University Hospital, Odense, Denmark, ³Department of Pharmacology, University of Aarhus, Aarhus, ⁴Department of Internal Medicine and Endocrinology, Aarhus University Hospital, Aarhus, ⁵Department of Endocrinology, Rigshospitalet and Copenhagen University, ⁶Diabetes Research Centre, Department of Endocrinology, Odense University Hospital, Odense, Denmark

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 2025.¹ 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^{2,3} 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

Correspondence: Henrik Toft Sørensen
Department of Clinical Epidemiology,
Aarhus University Hospital, Olof Palmes
Allé 43–45, DK-8200,
Aarhus N, Denmark
Tel +45 871 68215
Fax +45 871 67215
Email hts@dce.au.dk

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.⁴ 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>” \t “_blank”www.DD2.nu.

References

1. Nolan CJ, Damm P, Prentki M. Type 2 diabetes across generations: from pathophysiology to prevention and management. *Lancet*. 2011;378:169–181.
2. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet*. 1998;352:837–853.
3. Action to Control Cardiovascular Risk in Diabetes Study Group; Gerstein HC, Miller ME, Byington RP, et al. Effects of intensive glucose lowering in type 2 diabetes. *N Engl J Med*. 2008;358:2545–2559.
4. Frank L. Epidemiology. When an entire country is a cohort. *Science*. 2000;287:2398–2399.

Supplementary data

DD2 organization

Members of the executive committee

Professor Henning Beck-Nielsen, DMSc, Odense University Hospital
Professor Jørgen Rungby, DMSc, Aarhus University
Professor Henrik Toft Sørensen, DMSc, Aarhus University Hospital
Professor Jens Sandahl Christiansen, DMSc, FRCPI, Aarhus University Hospital
Professor Allan Vaag, DMSc, Copenhagen University
General practitioner Søren Friberg, Odense University Hospital

Members of the board

Professor Henning Beck-Nielsen, DMSc, Odense University Hospital, Denmark (Chariman)
Professor Jørgen Rungby, DMSc, Aarhus University, Denmark
Professor Henrik Toft Sørensen, DMSc, Aarhus University Hospital, Denmark
Professor Jens Sandahl Christiansen, DMSc, FRCPI, Aarhus University Hospital, Denmark
Professor Allan Vaag, DMSc, Copenhagen University, Denmark
Professor Bente Klarlund Pedersen, DMSc, Copenhagen University, Denmark
Professor Oluf Borbye Pedersen, DMSc, Hagedorn Research Institute, Gentofte, Denmark
Head of research, knowledge and courses Malene Bagger, MSc, PhD, The Danish Diabetes Association
Professor Ulf Smith, DMSc, Sahlgrenska University Hospital, Sweden, President EASD
Professor Philip Home, MA, PhD, DMSc, FRCP, Newcastle University, England
Professor Leif Groop, MD, PhD, Lund University, Sweden
Professor John Nolan, FRCPI, FRCP(Ed), CEO of Steno Diabetes Center, Gentofte, Denmark
Staff specialist Ole Andersen, DMSc, the Danish National Board of Health, Copenhagen, Denmark (observer)
Chief consultant Hanne Agerbak, the Danish Ministry of Health, Copenhagen, Denmark (observer)
Consultant Maj-Britt Laursen, Danish Regions, Copenhagen, Denmark (observer)
General practitioner Thomas Drivsholm, DMSc, PhD, The research unit for general practice, Copenhagen, Denmark
General practice coordinator Søren Friberg, MD, Odense University Hospital, Denmark
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 Friberg, 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 Jan-Erik Henriksen
Fredericia Hospital	Dept of Medicine	Hans Gjessing
NBG—Aarhus University Hospital	Dept of Medicine and Endocrinology	Jens Sandahl Christiansen
Svendborg Hospital	Outpatient Dept of Diabete	Klaus Levin
THG—Aarhus University Hospital	Dept of Medicine and Endocrinology	Jørgen Rungby
Regional Hospital Viborg	Outpatient Dept of Endocrinology	Torben Østergaard
Hospital Unit Nyborg	Outpatient Dept of Endocrinology	Klaus Levin
Vejle 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 Røder
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 Vendsyssel	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 Jarløv
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
Lægerne Nørre Voldgade 58	Nørrevoldgade 58, 5800 Nyborg
Lægerne Willemoesvej	Willemoesvej 31, 5700 Svendborg
J.Ravn and M.Richert	Vestergade 2, 6640 Lunderskov
Jacobilægerne	Ringkøbingvej 38, 6800 Varde
Lægerne i Oksebøl	Torvegade 17, 6840 Oksebøl
Lili Tronegård-M. and Michael Schmidt	Birkevej 2, 5300 Kerteminde
Lægerne J B Winsløvs Vej	J.B. Winsløvs Vej 9 A, 5000 Odense C
Lægehuset—Farum Midtpunkt	Nygårdterrasserne 204, 3520 Farum
Lægekompagniskabet Venusvej 2	Venusvej 2, 7000 Fredericia
Paul Jørgen Schultz Aps	Hovedgaden Vest 86, 6500 Vojens
Lægerne Danmarksgade 13	Danmarksgade 13, 7000 Fredericia
Haarbylægerne	Møllevvej 2, 5683 Hårby
Lægerne i Nr. Lyndelse Aps	Carl Nielsensvej 1, 5792 Årslev
Lægerne i Østergade	Østergade 1, 2., 5750 Ringe
Larsen, Glenthøj and Nielsen	Birkevej 2, 5300 Kerteminde
Claus Olesen and Elin Franck	Ny Vestergade 1, 1., 6000 Kolding
Lægehuset Havnepladsen	Torvegade 16 A, 6800 Varde
Lægeklinikken Østergade 10	Østergade 10, St., 6500 Vojens
Lægerne i Vindeby	Bregningevej 48, 5700 Svendborg
Bylægen Peer Kirkebjerg	Skt. Anne Plads 2, 5000 Odense C
Lægehuset i Rødding	Louisevej 13, 6630 Rødding
Peter Larsen	Skt. Anne Plads 4, 1., 5000 Odense C
Lægerne i Harndrup	Skovvej 2, 5463 Harndrup
Bente K. Bertelsen	Tvedgade 21, 6760 Ribe
Lægehuset Aps.	Mellemgade 19 A, 5600 Faaborg
Lone Manane and Bent Stolberg	Mommarkvej 259, 6470 Sydals
Uwe Karstensen Aps	Låningen 1, 6280 Højer

(Continued)

Table S3 (Continued)

Name	Address
Bau-Madsen, Fricke and Stavenuiter	Egevænget 4, 5771 Stenstrup
Dorothee Paul	Vidågade 48, st. tv., 6270 Tønder
Lægerne i Bjert	Gl. Bjært 26, 6091 Bjert
Peter G Petersen	Murtefeldts Plads 5, 6800 Varde
Morten Toftager	Birkevej 2, 5300 Kerteminde
Lægerne Vissingsgade 21	Vissingsgade 21, 7100 Vejle
Lægerne Kongensgade	Kongensgade 27, 4., 5000 Odense C
Kim Rønhof	Sankt Nicolai Gade 6, st., 5700 Svendborg
Hanne Christensen	Kongensgade 3, 6070 Christiansfeld
Lægehuset Nørre Aaby	Æblehaven 1, 5580 Nørre Aaby
Lægerne Englandsgade 8	Englandsgade 8, 6700 Esbjerg
Marianne Bov	Skt. Anne Plads 2, 1., 5000 Odense C
Stig Gerdes	Danmarksgade 11, 1. tv., 7000 Fredericia
Carsten Winther Jakobsen	Kongensgade 38, 2. th., 5000 Odense C
Bak og Larsen	Teglårdsparken 100, 1., 5500 Middelfart
Lægerne Vestergade	Vestergade 2D, 1., 6600 Vejen
Berkjær, Iversen	Bønløkke, Ellegaard Ulsnæs 4, 6300 Gråsten
Søndersø Lægehus	Vesterled 2, 5471 Søndersø
Annemette Als	Kongevej 37, 6300 Gråsten
Lægerne Jernbanegade	Jernbanegade 4, 7000 Fredericia
Lægerne Syrenvej	2 Syrenvej 2, 7080 Børkop
Sundhedscenter Vejle	Nordås 17K, 7100 Vejle
Peter Mikael Klubien M D	Madsensvej 9,1, 3450 Allerød
Lægeklinikken Danmarksgade	22 Danmarksgade 22, 7500 Holstebro

Clinical Epidemiology**Publish your work in this journal**

Clinical Epidemiology is an international, peer-reviewed, open access journal focusing on disease and drug epidemiology, identification of risk factors and screening procedures to develop optimal preventative initiatives and programs. Specific topics include: diagnosis, prognosis, treatment, screening, prevention, risk factor modification, systematic

Submit your manuscript here: <http://www.dovepress.com/clinical-epidemiology-journal>

reviews, risk & safety of medical interventions, epidemiology & biostatistical methods, evaluation of guidelines, translational medicine, health policies & economic evaluations. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use.