Collective health, individual lives

Impact

Prevalence of type 2 diabetes mellitus is high and continues to rise worldwide. In the Netherlands, around 6.5% of the adult population has type 2 diabetes. This population, their health, their healthcare use and expenditures, and equity of care was assessed in detail in *Chapter 2, 3, and 4*. *Chapter 5 and 6* contribute to insights into the status quo of Population Health Management (PHM) and tailored care regarding cardiovascular risk within this population. The implications of the findings in this dissertation, however, only gain value once shared and used. Therefore, its impact on society and science are described.

Societal Impact

The challenges that the rising prevalence of type 2 diabetes and related comorbidities and complications presents to the healthcare system are clear (1–3). However, knowledge on healthcare utilization and expenditures is often limited to that of subgroups of patients, specific medical specialties, complications, or diabetes medication types. Consequently, prior insights are fragmented, have poor transparency, and findings vary widely (4,5). The all-payer claims database (APCD) used in *Chapter 2 and 3*, is unique in a sense that it covers 99.9% of the Dutch population. We were therefore able to identify the entire Dutch type 2 diabetes population and present a detailed and complete overview of population characteristics, healthcare utilization, and expenditures. This is the first database to present an entire disease population in the Netherlands, as such opportunities of the database were noticed. In addition to the research presented in this dissertation, research on bariatric surgery and amputations within the Dutch type 2 diabetes population were based on the same APCD (6,7). Moreover, the uniqueness of the complete insight was picked up by media. Regarding *Chapter 2 and 3*, an interview titled “Diversity in care consumption of diabetes patients asks for a tailored approach” was published in a Diabetes topic (April 2022) of a professional magazine for Dutch doctors (i.e. *Medisch Contact*) (8). As well as distributed in the Healthcare and Innovation Newsletter (9). The Dutch Journal of Medicine (*‘Nederlands Tijdschrift voor Geneeskunde’*, or *NTVG* in Dutch) published an article on their website regarding findings of *Chapter 3* (10). It focused on the finding that Dutch people with type 2 diabetes use surprisingly much, and a variety of, medical specialist care. Furthermore, findings of *Chapter 2 and 3* were presented for national stakeholders (health insurers, care givers, the National Health Care Institute etc.) in Dutch diabetes care at the Diabetes Care Round Table (*“Rondetafel Diabeteszorg”* in Dutch) that focusses on care improvement and appropriate medication and device use. While the current APCD impacts knowledge on type 2 diabetes population specifically, it may also

function as an example in forming similar databases for a variety of (disease) populations to enhance insight into their care and potential areas of improvement.

In 2022, parties from healthcare, social care, and welfare signed the Integral Care Agreement (*Integraal Zorg Akkoord*, in Dutch). This national agreement emphasizes the need for interdisciplinary collaborations to provide the right care in the right place at the right time. This entails bridging the existing gaps between healthcare, health promotion and prevention, social care, and welfare as one of the central aims is to look beyond the healthcare system for potential solutions (i.e. "slowing down medicalization") (11). Using real-life data of the entire type 2 diabetes population, this dissertation confirms the value of expanding the medical view from a patient-centered to a whole-person focus which includes their entire health status and Social Determinants of Health (SDOH). This dissertation is not only in agreement with current policy developments, it may additionally contribute to future decision making regarding policy, care planning, and equitable care. For instance, on the micro and meso levels, findings of *Chapter 6* may directly inform the development of tailored cardiovascular prevention initiatives. *Chapter 4* is valuable on the macro/system level in preventing inequities of pharmaceutical care within the type 2 diabetes population.

The majority of the work presented in this dissertation was performed while collaborating with a multidisciplinary consortium of researchers, clinicians, health insurers, data researchers, and a pharmaceutical company. Within the multitude of research opportunities of the APCD and integrative population-based data infrastructures, the consortium reached consensus about what research questions were most relevant to address. The researchers thereafter presented the results which were continually discussed from all different viewpoints. The close collaboration with practice (i.e. clinicians, health insurers, and pharmaceutics) meant that results could directly contribute to their insights to inform decision making and planning.

Scientific Impact

The findings of this dissertation contribute to research as it concerns unique methodologies and unexplored topics. *Chapters 2 and 3* are unique due to the high coverage rate of APCD enabling analysis of the entire national type 2 diabetes population. This is not only meaningful on a societal level, but also in terms of epidemiology and prevention. Providing detailed prevalence data enhances the scientific understanding of type 2 diabetes epidemiology. Identifying risk factors in type 2 diabetes can drive innovations in prevention as well as inform

where future research is needed. *Chapters 4 and 6* were unique in their use of integrative population-based data infrastructures. Such data infrastructures are on a rise, however, large datasets including data on medical factors as well lifestyle-, psychosocial-, socioeconomic- and demographic factors are still rare. The examples of two research opportunities with such data may inspire future research with or the development of these integrative population-based data infrastructures. Moreover, in *Chapter 6*, a Latent Class Analysis is performed which is a data-driven, person-centered analysis technique that identifies subgroups with similar patterns of variables. This is an analysis technique that originates from social science and has often been used to better understand risk profiles for specific behavioral outcomes and as such can be very helpful in PHM (12). It is now increasingly used in health services research (13); *Chapter 6* contributes to this development.

The findings of this dissertation additionally contribute to the ongoing discussion regarding the similarities and differences between integrated care and PHM. *Chapter 5* reveals how in care for type 2 diabetes, PHM is scarce and existing PHM initiatives are less extensive than what would be expected seeing the analytical framework of PHM (14). This adds to the ongoing discussion in the field as findings may inform the academic community about the current practical understanding of PHM and how it differs from the scientific perspective on the subject.

To share the knowledge gained by this dissertation for scientific purposes, *Chapters 2 to 6*, were submitted to international, peer-reviewed, high-impact journals. *Chapters 2, 3, and 5* have been published in open access journals such as BMJ Open and the International Journal of Integrated care. Furthermore, the findings of several studies were presented at international conferences, such as the North American Conference on Integrated Care (Canada) and Annual Research Meeting Academy Health (USA). Additionally, findings were disseminated within the Health Services Research and Health Economics study group of the European Association for the Study of Diabetes. This group consists of researchers from all over Europe who study in the field of diabetes with regard to health services research and health economics in conjunction with clinical research and practice.

References

1. WHO. Programmes and projects - Nutrition - Nutrition health topics. Available from www.who.int Accessed 13 November 2019 [Internet]. Available from: http://www.who.int/entity/en/

2. Williams R, Colagiuri S, Almutairi R, Montoya PA, Basit A, Beran D, et al. IDF Diabetes Atlas. Ninth edition 2019. International Diabetes Federation, Brussels; 2019. pp 12-21;34-61.

3. Williams R, Van Gaal L, Lucioni C. Assessing the impact of complications on the costs of Type II diabetes. Diabetologia. 2002;45(6):S13–7.

4. Kanavos P, Aardweg S Van Den, Schurer W. Diabetes Expenditure, Burden of Disease and Management in 5 EU Countries. LSE Heal London Sch Econ [Internet]. 2012;(January):1–113. Available from: http://eprints.lse.ac.uk/54896/1/__libfile_REPOSITORY_Content_LSE Health and Social Care_Jan 2012_LSEDiabetesReport26Jan2012.pdf

5. van Schoonhoven A V., Gout-Zwart JJ, de Vries MJS, van Asselt ADI, Dvortsin E, Vemer P, et al. Costs of clinical events in type 2 diabetes mellitus patients in the Netherlands: A systematic review. PLoS One [Internet]. 2019;14(9):e0221856. Available from: http://dx.doi.org/10.1371/journal.pone.0221856

6. Monpellier VM, Geurten RJ, Janssen IMC, Ruwaard D, Struijs JN, van Dijk PR, et al. Evaluation of Healthcare Utilisation and Expenditures in Persons with Type 2 Diabetes Undergoing Bariatric-Metabolic Surgery. Obes Surg. 2024 Mar 1;34(3):723–32.

7. Rosien L, Geurten RJ, Bilo HJG, Ruwaard D, Gans ROB, Oskam J, et al. Health care impact of lower extremity amputations in diabetes mellitus derived from Dutch insurance claims; design of the retrospective cohort study; Dutch diabetes estimate—amputation initiative (DUDE-8). Int J Surg Protoc [Internet]. 2024 Sep 24; Available from: https://journals.lww.com/10.1097/SP9.0000000000000027

8. Daniël Dresden. Diversity in care consumption of diabetes patients asks for a tailored approach ("Diversiteit in zorgconsumptie van diabetespatiënten vraagt om maatwerk") (Interview). Available in print. Diabetes Topic (Medisch Contact). 2022 Apr.

9. Geurten R, Elissen A. Type 2 diabetes care: diversity demands tailoring ("Type 2 diabeteszorg: diversiteit vraagt om maatwerk" in Dutch). 2022 Sep.

10. Lara Harmans. Diabetics use a surprising amount of medical specialist care ("Diabetici zoeken opvallend vaak tweedelijnszorg" in Dutch). 2022.

11. Ministerie van Volksgezondheid, Welzijn en Sport. (2022) Integraal Zorg Akkoord - Samen werken aan gezonde zorg [Integral Care Agreement] [Internet]. Den Haag; [cited 2023 Jul 16]. Available from: https://www.rijksoverheid.nl/onderwerpen/kwaliteit-van-de-zorg/documenten/rapporten/2022/09/16/integraal-zorgakkoord-samen-werken-aan-gezonde-zorg

12. Lanza ST, Rhoades BL. Latent Class Analysis: An Alternative Perspective on Subgroup Analysis in Prevention and Treatment. Prev Sci. 2013 Apr 1;14(2):157–68.

13. Rachid T, Abarda A, Hasbaoui A. Latent class analysis: A review and recommendations for future applications in health sciences. Procedia Comput Sci. 2024;238:1062–7.

14. Struijs JN, Drewes HW, Heijink R, Baan CA. How to evaluate population management? Transforming the Care Continuum Alliance population health guide toward a broadly applicable analytical framework. Health Policy (New York) [Internet]. 2015;119(4):522–9. Available from: http://dx.doi.org/10.1016/j.healthpol.2014.12.003