Patterns of care for diabetes: risk factors for vision-threatening retinopathy

Neil John Orr

Bachelor of Arts (Hons), The Flinders University of South Australia
Master of Public Health, The University of Sydney

Thesis submitted in fulfilment of the requirements of the degree of doctor of philosophy

Faculty of Medicine
The University of Sydney

2005
Declaration

I hereby declare that the research data presented in this thesis are the result of original research conducted by myself except where otherwise acknowledged. This thesis has not previously been submitted for a degree at this or any other university.

Neil John Orr (30/08/05)
Acknowledgements

I would like to acknowledge the great love and support of my wife Merrin Thompson during the conduct of the thesis. Also to Associate Professor Steven Boyages for his skilful supervision, and to the Orr and Thompson families for their encouragement throughout the process of researching and writing.
## Contents

Tables and figures ........................................................................................................................................... 5

Abstract ......................................................................................................................................................... 9

Chapter 1 ...................................................................................................................................................... 10  
   The health problem

Chapter 2 ...................................................................................................................................................... 21  
   Literature review

Chapter 3 ...................................................................................................................................................... 137  
   Methods

Chapter 4 ...................................................................................................................................................... 177  
   The patterns of care as a risk factor for the development of vision-threatening diabetic retinopathy: a population-based matched case-control study using insurance claims (Medicare) data

Chapter 5 ...................................................................................................................................................... 195  
   Diabetes management across Australian states and territories: Do different models of tertiary care impact on the nature and effectiveness of diabetes management?

Chapter 6 ...................................................................................................................................................... 231  
   Across a national population, what is the most effective strategy for preventing diabetes complication: early diagnosis or improved diabetes management?

Chapter 7 ...................................................................................................................................................... 246  
   Does delayed diagnosis increase the risk of complications in Australia?

Chapter 8 ...................................................................................................................................................... 259  
   Does socio-economic status determine the risk of complications in people with diabetes?

Chapter 9 ...................................................................................................................................................... 287  
   Are geographically isolated patients at greater risk of complications because of poor access to health care?

Chapter 10 ..................................................................................................................................................... 315  
   Do the characteristics of GPs determine the risk of complications?

Chapter 11 ..................................................................................................................................................... 325  
   Discussion

References ...................................................................................................................................................... 353

Appendix: Publications from the thesis to August 2005.
Tables and figures

Table 2.1: Common insulin deficiency syndromes and diabetes complications ......................... 32
Table 2.2: The Principles of Care and Guidelines for the Clinical Management of Diabetes Mellitus ............................................................................................................................. 58
Figure 2.1: Chronic Care Model for improving outcomes in chronic illness ............................ 79
Figure 3.1: Patient database .................................................................................................... 144
Figure 3.2: Provider database .............................................................................................. 147
Table 3.1: Medicare items used in patterns of care studies (Chapters 4 to 9) ......................... 149
Table 3.2: GP characteristics used in Chapter 10 ................................................................. 156
Table 3.3: Year of earliest HbA1c test .................................................................................. 160
Table 3.4: The demographic and health utilisation characteristics of controls excluded from Chapter 6, compared to controls that were included in the study .................................. 165
Table 3.5: GPs in the provider database .............................................................................. 169
Table 4.1: Characteristics of study subjects ........................................................................... 183
Table 4.2: Year of earliest HbA1c test .................................................................................. 184
Table 4.3: Health care utilisation between 1993 and 1999 for cases and controls (%) .......... 187
Table 4.4: Health care utilisation between 1993 and 1999 for cases and controls (means) .. 188
Table 4.5: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 .......... 191
Table 5.1: Characteristics of study subjects by state and territory ....................................... 203
Table 5.2: GP attendances between 1993 and 1999 by state and territory (%) ...................... 205
Table 5.3: GP attendances between 1993 and 1999 by state and territory (means) .............. 206
Table 5.4: Specialist and consultant physician attendances between 1993 and 1999 by state and territory (%) ........................................................................................................ 209
Table 5.5: Specialist and consultant physician attendances between 1993 and 1999 by state and territory (means) ................................................................. 210
Table 5.6: HbA1c testing between 1993 and 1999 by state and territory (%) ......................... 212
Table 5.7: HbA1c testing between 1993 and 1999 by state and territory (means) .................. 213
Table 5.8: Logistic regression analysis predicting laser therapy in 2000 using state and territory characteristics, demographic characteristics, and health care utilisation between 1993 and 1999, Australia .......................................................... 215

Table 5.9: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, New South Wales.......................................................... 220

Table 5.10: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, Victoria ...... 221

Table 5.11: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, Queensland . 222

Table 5.12: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, Western Australia ........................................................................................................................... 223

Table 5.13: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, South Australia ........................................................................................................................... 224

Table 5.14: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, Tasmania .... 225

Table 5.15: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, Northern Territory ........................................................................................................................... 226

Table 5.16: Conditional logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999, Australian Capital Territory ................................................................................................................ 226

Table 6.1: Characteristics of study subjects ............................................................................... 237

Table 6.2: Health care utilisation between 1993 and 1999 for cases and controls (%) ............... 239

Table 6.3: Health care utilisation between 1993 and 1999 for cases and controls (means).......... 240

Table 6.4: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 ........................................ 243

Table 7.1: Characteristics of study subjects ............................................................................... 251

Table 7.2: Health care utilisation between 1993 and 1999 for cases and controls (%) ............... 253

Table 7.3: Health care utilisation between 1993 and 1999 for cases and controls (means).......... 253

Table 7.4: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 ........................................ 255

Table 8.1: Characteristics of study subjects by SEIFA............................................................. 266

Table 8.2: GP attendances between 1993 and 1999 for cases and controls by SEIFA (%) .......... 268
Table 8.3: GP attendances between 1993 and 1999 for cases and controls by SEIFA (means)...... 269
Table 8.4: Specialist and consultant physician attendances between 1993 and 1999 for cases and controls by SEIFA (%)................................................................. 271
Table 8.5: Specialist and consultant physician attendances between 1993 and 1999 for cases and controls by SEIFA (means) ................................................................. 272
Table 8.6: HbA1c testing between 1993 and 1999 for cases and controls by SEIFA (%)......... 274
Table 8.7: HbA1c testing between 1993 and 1999 for cases and controls by SEIFA (means) .... 275
Table 8.8: Conditional logistic regression analysis predicting laser therapy in 2000 using socio-economic status characteristics, demographic characteristics, and health care utilisation between 1993 and 1999................................................................. 278
Table 8.9: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (SEIFA 1) ............... 279
Table 8.10: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (SEIFA 2) .......... 280
Table 8.11: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (SEIFA 3) .......... 281
Table 8.12: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (SEIFA 4) .......... 282
Table 8.13: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (SEIFA 5) .......... 283
Table 9.1: Characteristics of study subjects by RRMA ......................................................... 294
Table 9.2: GP attendances between 1993 and 1999 for cases and controls by RRMA (%)....... 296
Table 9.3: GP attendances between 1993 and 1999 for cases and controls by RRMA (%) ...... 297
Table 9.4: Specialist and consultant physician attendances between 1993 and 1999 for cases and controls by RRMA (%) ................................................................. 300
Table 9.5: Specialist and consultant physician attendances between 1993 and 1999 for cases and controls by RRMA (means) ................................................................. 301
Table 9.6: HbA1c testing between 1993 and 1999 for cases and controls by RRMA (%) ........ 303
Table 9.7: HbA1c testing between 1993 and 1999 for cases and controls by RRMA (means) ... 304
Table 9.8: Conditional logistic regression analysis predicting laser therapy in 2000 using geographic isolation characteristics, demographic characteristics, and health care utilisation between 1993 and 1999................................................................. 307
Table 9.9 Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (RRMA 1) ............... 308
Table 9.10: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (RRMA 2) .......................... 309

Table 9.11 Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (RRMA 3) .......................... 310

Table 9.12: Logistic regression analysis predicting laser therapy in 2000 using demographic characteristics, and health care utilisation between 1993 and 1999 (RRMA 4) .......................... 311

Table 10.1: Characteristics of GPs and their practices ................................................................. 320

Table 10.2: Logistic regression analysis comparing case to control GPs using demographic characteristics, vocational registration and characteristics of principal general practice........... 321
Abstract

OBJECTIVES: In Australia, diabetes causes significant morbidity and mortality. Whilst the need to prevent diabetes and its complications has been widely recognised, the capacity of health care systems - which organise diabetes care - to facilitate prevention has not been fully established.

METHODS: A series of seven population-based case-control studies were used to examine the effectiveness of the Australian health care system and its capacity to manage diabetes. Six of the studies compared the patterns of care of patients who had developed advanced diabetes complications in 2000 (cases), to similar patients who remained free of the condition (controls) across Australia and for various risk groups. A secondary study investigated the role of treating GPs in the development of the outcome.

RESULTS: A strong relationship between the patterns of care and the development of advanced diabetes complications was found and is described in Chapter 4. In Chapter 5, this same relationship was investigated for each Australian state and territory, and similar findings were made. The study in Chapter 6 investigated whether late diagnosis or the patterns of care was the stronger risk factor for advanced diabetes complications, finding that the greatest risk was associated with the latter. In Chapter 7 the influence of medical care during the pre-diagnosis period was explored, and a strong relationship between care obtained in this period and the development of advanced complications was found. In Chapter 8, which investigated the role of socio-economic status in the development of advanced complications, found that the risk of advanced diabetes complications was higher in low socio-economic groups. Chapter 9 investigated geographic isolation and the development of advanced diabetes complications and found that the risk of advanced complications was higher in geographically isolated populations. Finally, Chapter 10, which utilised a provider database, found that some GP characteristics were associated with the development of advanced diabetes complications in patients.

CONCLUSION: A number of major risk factors for the development of advanced complications in Australia was found. These related to poorer diabetes management, later diagnosis, low socio-economic status and geographic isolation. Strategies must be devised to promote effective diabetes management and the early diagnosis of diabetes across the Australian population.