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Using computer modelled life expectancy to evaluate the impact of Australian Primary Care Incentive programs for patients with type 2 diabetes

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ABSTRACT

Aims: To evaluate the impact of enhanced primary care and practice incentive programs on the care of patients with type 2 diabetes in the Australian primary care setting using routinely collected data and computer modelling software.

Methods: Primary care patient data were electronically extracted from practices and inputted into the United Kingdom Prospective Diabetes Study (UKPDS) Outcomes model. A retrospective cohort study design was employed with predicted life expectancies compared between patients who had a recorded diabetes cycle of care (DCoC) and those who did not. Changes in glycosylated haemoglobin (HbA1c) were also analysed using a mixed-effects regression model. Potential life expectancy gains were estimated by inputting theoretical risk factors data consistent with current guidelines.

Results: Twelve primary care practices were recruited and suitable data were available for 559 people with type 2 diabetes. Two hundred and twenty five patients (40%) were identified as having completed at least one DCoC and as a group had a predicted additional life expectancy of 0.65 years (95% CI, -0.22 to 1.5). However, once this was adjusted for comorbidities the difference reduced to 0.03 years. There was no significant difference in HbA1c levels attributable to the intervention. An estimated 0.5 year of additional life expectancy was predicted should all patients have complied with current risk factor guideline recommendations.

Conclusions: Computer modelling using routinely collected primary care data can be used to evaluate the effectiveness of primary care programs. However, there are some data availability and linkage limitations in the Australian setting.

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1. Introduction

More than a decade ago the potential of computer models to supplement clinical trials in the study of diabetes economics was highlighted [1]. Further acknowledgement of computer modelling in medicine as an important tool to guide clinicians' and policy makers' decision making for diabetes management has occurred since that time [2]. A major attraction is its ability to evaluate interventions using outcomes such as mortality that would normally take many years of follow up to detect and as such it can provide an alternative to the traditional tightly controlled clinical trial design that uses changes in intermediate clinical parameters such as glycated haemoglobin (HbA1c), serum lipids and blood pressure to evaluate interventions [3,4].

The United Kingdom Prospective Diabetes Study (UKPDS) Outcomes model [5,6] is a computer model formulated from the UKPDS cohort to predict clinical outcomes for patients with type 2 diabetes. The model has been validated against both the original UKPDS data and data from other populations [7–9]. The UKPDS Outcomes model has the ability to predict risk based upon annual changes in clinical parameters and considers interdependency of clinical states [6], hence utilising much of the data recommended to be collected as part of normal medical monitoring of patients with type 2 diabetes [10,11].

The Australian Primary Care system is based upon a universal "fee for service" structure which is itemised through the Medicare Benefits Schedule (MBS). In 1999 the Australian Government introduced the Enhanced Primary Care (EPC) program and the Practice Improvement Program (PIP) to improve the multidisciplinary care of patients with chronic or complex conditions through a series of non-fee-for-service payments to primary care practitioners and practices [12]. Diabetes Mellitus was among the conditions targeted by these programs with financial incentives provided for primary care practices to create patient registers and recall systems, and for the completion of annual Diabetes Cycles of Care (DCoC) for patients with type 2 diabetes [12]. Chronic disease management MBS items for primary care management plans and team care were also introduced in 2005 [13,14]. The uptake of these measures by primary care practitioners in Australia has been relatively modest with only 18% of Australians with diabetes in the year 2009–10 having completed an annual DCoC based upon MBS payments data [15].

Recent Australian studies have suggested improvements in process and clinical outcomes following the introduction of primary care initiatives aimed at improving the management of people with type 2 diabetes [16,17]. However it remains unclear how generalisable these benefits are and whether they have or will lead to improvements in outcomes such as increased life expectancy. By providing electronic access to routinely collected clinical data the almost universal use of electronic medical records in the Australian primary care sector potentially allows the use of computer models to help answer these questions [12].

This study aims to demonstrate a methodology that could be widely applied to the primary care setting using routinely collected data to evaluate whether primary care initiatives

designed to improve the management of patients with type 2 diabetes have had an impact. It uses the recording of the completion of a DCoC in patients' electronic records as a measure of improved care (the intervention) and changes in modelled life expectancy as the outcome.

2. Subjects, materials and methods

2.1. Study design and patient eligibility

A retrospective cohort study design was used with patient recruitment occurring between 2002 & 2011. Patients were deemed to have entered the study at the time their first recorded HbA1c level was available in their clinical record and followed up until the end of 2012. Consequently, patients entered the study at various points in time over a 10 year period and were followed up for variable lengths of time up to 10 years.

To be eligible for recruitment a patient must have had a recorded diagnosis of type 2 diabetes or a recorded diagnosis of diabetes without a type specified and not receiving exogenous insulin in their electronic medical record, been a regular patient (seen at least 4 times per year for at least 2 years by the same general practice), been aged between 45 and 64 years at time of diagnosis (as required by the UKPDS Outcomes model) and have sufficient data [23] available from their electronic medical record to provide input parameters for the UKPDS Outcomes Model.

2.2. GP practice recruitment

Patients were recruited using a cluster sample technique based upon the general practice they regularly attended. General practices were recruited from within the geographical area covered by the Northern Sydney Local Health District with the assistance of a government funded local primary care organisation that has a membership of 148 primary care practices (the Northern Sydney Medicare Local).

To be eligible to be part of the study a practice was required to have been using the medical records program "Best Practice" [18], receiving results electronically via Health Language 7 (HL7) from their pathology provider, have been operating for at least 5 year and had sufficient recorded information for input into the UKPDS Outcomes model for at least 20% of their regular type 2 diabetic patients.

2.3. Best Practice software & data collection

Best Practice is a commercially available electronic medical record software specifically designed for use in the Australian primary care setting. It has the ability to record detailed structured clinical notes, manage HL7 messages and create medication prescriptions. Clinically relevant data for input into the UKPDS Outcomes Model were extracted from primary care computer systems "on-site" by a series of Structured Query Language (SQL) queries using an Open Database Connectivity (ODBC) data extractor [19]. This process produced a series of data text files that were manipulated using the statistical program STATA [20] to produce the input files required by the UKPDS Outcomes model.

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