Getting evidence to and from general practice consultations for cardiovascular risk management using computerised decision support

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Abstract

Background

Cardiovascular disease (CVD) has an enormous impact on the lives and health of New Zealanders. There is substantial epidemiological evidence that supports identifying people at high risk of CVD and treating them with lifestyle and drug-based interventions. If fully implemented, this targeted high risk approach could reduce future CVD events by over 50%. Recent studies have shown that a formal CVD risk assessment to the systematically identify high risk patients is rarely done in routine New Zealand general practice and audits of CVD risk management have shown large evidence-practice gaps. The CVD risk prediction score recommended by New Zealand guidelines for identifying high CVD risk patients was derived from the US Framingham Heart Study using data collected between the 1960s and 1980s. This score has only modest prediction accuracy and there are particular concerns about it's validity for New Zealand sub-populations such as high risk ethnic groups or people with diabetes.

Aims

The overall aims of this thesis were to investigate the potential of a computerised decision support system (CDSS) to improve the assessment and management of CVD risk in New Zealand general practice while simultaneously developing a sustainable cohort study that could be used for validating and improving CVD risk prediction scores and related research.

Methods

An environmental scan of the New Zealand health care setting's readiness to support a CDSS was conducted .The epidemiological evidence was reviewed to assess the effect of decision support systems on the quality of health care and the types and functionality of systems most likely to be successful. This was followed by a focused systematic

review of randomised trials evaluating the impact of CDSS on CVD risk assessment and management practices and patient CVD outcomes in primary care.

A web-based CDSS (PREDICT) was collaboratively developed. This rules-based provider-initiated system with audit and feedback and referral functionalities was fully integrated with general practice electronic medical records in a number of primary health organisations (PHOs). The evidence-based content was derived from national CVD and diabetes guidelines. When clinicians used PREDICT at the time of a consultation, treatment recommendations tailored to the patient's CVD and diabetes risk profile were delivered to support decision-making within seconds. Simultaneously, the patient's CVD risk profiles were securely stored on a central server. With PHO permission, anonymised patient data were linked via encrypted patient National Health Index numbers to national death and hospitalisation data. Three analytical studies using these data are described in this thesis. The first evaluated changes in GP risk assessment practice following implementation of PREDICT; the second investigated patterns of use of the CDSS by GPs and practice nurses; and the third describes the emerging PREDICT cohort and a preliminary validation of risk prediction scores.

Results

Given the rapid development of organised primary care since the 1990's, the high degree of general practice computerisation and the New Zealand policy (health, informatics, privacy) environment, the introduction of a CDSS into the primary care setting was deemed feasible. The evidence for the impact of CDSS in general has been moderately favourable in terms of improving desired practice. Of the randomised trials of CDSS for assessing or managing CVD risk, about two-thirds reported improvements in provider processes and two-fifths reported some improvements in intermediate patient outcomes. No adverse effects were reported.

Since 2002, the PREDICT CDSS has been implemented progressively in PHOs within Northland and the three Auckland regional District Health Board catchments, covering a population of 1.5 million. A before-after audit conducted in three large PHOs showed that

CVD risk documentation increased four fold after the implementation of PREDICT. To date, the PREDICT dataset includes around 63,000 risk assessments conducted on a cohort of over 48,000 people by over 1000 general practitioners and practice nurses. This cohort has been followed from baseline for a median of 2.12 years. During that time 2655 people died or were hospitalised with a CVD event. Analyses showed that the original Framingham risk score was reasonably well calibrated overall but underestimated risk in high risk ethnic groups. Discrimination was only modest (AUC 0.701). An adjusted Framingham score, recommended by the New Zealand Guideline Group (NZGG) overestimated 5-year event rates by around 4-7%, in effect lowering the threshold for drug therapy to about 10% 5-year predicted CVD risk. The NZGG adjusted score (AUC 0.676) was less discriminating than the Framingham score and over-adjusted for high risk ethnic groups. For the cohort aged 30-74 years, the NZGG-recommended CVD risk management strategy identified almost half of the population as eligible for lifestyle management +/- drug therapy and this group generated 82% of all CVD events. In contrast the original Framingham score classified less than one-third of the cohort as eligible for individualised management and this group generated 71% of the events that occurred during follow-up.

Implications

This research project has demonstrated that a CDSS tool can be successfully implemented on a large scale in New Zealand general practice. It has assisted practitioners to improve the assessment and management of CVD at the time of patient consultation. Simultaneously, PREDICT has cost-effectively generated one of the largest cohorts of Māori and non-Māori ever assembled in New Zealand. As the cohort grows, new CVD risk prediction scores will be able to be developed for many New Zealand sub-populations. It will also provide clinicians and policy makers with the information needed to determine the trade-offs between the resources required to manage increasing proportions of the populations and the likely impact of management on preventing CVD events.

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Dedication

Every hour of every day in New Zealand, someone dies from or is admitted to hospital with cardiovascular disease. This thesis is dedicated to these people and their families.

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List of Abbreviations

ACC	Accident Compensation Corporation
AUC	Area under the curve
BP	Blood pressure
CDSS	Computerised decision support system
CHD	Coronary heart disease
CHE	Crown Health Enterprise
CHF	Congestive heart failure
CI	Confidence interval
CMDHB	Counties Manukau District Health Board
CPOE	Computerised physician order entry
CSC	Community Services Card
CVD	Cardiovascular disease
DHB	District Health Board
DBP	Diastolic blood pressure
EHR	Electronic Health Record
EMR	Electronic Medical Record
FTE	Full time equivalent
GMS	General Medical Benefits System
GP	General Practitioner
HDL	High-density lipoprotein
HPI	Health Practitioner Index
HUHC	High Use Health Card
ICD	International Statistical Classification of Disease
ICVD	Ischaemic cardiovascular disease

IPA	Independent Practitioner Association
IT	Information Technology
LDL	Low density lipoprotein
LOINC	Logical Observations, Identifiers, Names and Codes
NHI	National Health Index
NMDS	National Minimum Data Set
NZDep	New Zealand Deprivation Index
NZGG	New Zealand Guidelines Group
NZHIS	New Zealand Information Health Service
NZNO	New Zealand Nursing Organisation
PHO	Primary Health Care Organisation
PMS	Patient Management System
RNZCGP	Royal New Zealand College of General Practitioners
ROC	Receiver-Operating Characteristics
SAS	Statistical Analysis System
SBP	Systolic blood pressure
SD	Standard deviation
SE	Standard error
SNOMED-CT	Systematized Nomenclature of Medicine — Clinical Terms
TC/HDL	Total cholesterol to high density lipoprotein ratio
XML	Extensible Markup Language