# Ambulatory blood pressure measurement as a predictor of outcome in an Irish population: methodology for ascertaining mortality outcome

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***Background*** **Ambulatory blood pressure monitoring (ABPM) has proven to be a superior predictor of morbid events when compared to clinic or office blood pressure measurement (CBPM). The purpose of this study was to evaluate the predictive value of ABPM in a sample of 14 414 people referred for management of cardiovascular risk.**

***Methods*** **In this paper we describe the methodology required to examine mortality outcome in the absence of a national unique identifier.**

***Results*** **Using a computerized database of deaths we were able to establish that 1348 people had died by the end of the follow-up period (30 September 2002). Sixty-four percent of deaths were cardiovascular and in 207 subjects who had post-mortem examinations, 78% were cardiovascular.**

***Conclusions*** **The accurate identification of the cause of death in a large population will allow comparison of the relative predictive power of APBM and CBPM in an Irish population.** ***Blood Press Monit*** **8:143–145**


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## Introduction

The higher the blood pressure according to clinic or office blood pressure measurement (CBPM), the greater the morbidity and mortality from coronary heart disease, stroke, heart failure, and renal disease. This positive continuous relationship between blood pressure and cardiovascular events has been identified in both men and women, in younger and older adults, in different racial and ethnic groups, and in those with and without coronary heart disease [1]. There is an ongoing debate concerning the relative value of systolic and diastolic pressures as prognostic indicators. In subjects older than 50 years, at any given level of systolic blood pressure, Framingham investigators have reported an inverse association between diastolic blood pressure and cardiovascular risk [2]. However, in the most recent largest meta-analysis, both systolic and diastolic blood pressures were found to be independently predictive of stroke and coronary mortality [3].

There is now evidence that ambulatory blood pressure monitoring (ABPM) may be a better predictor of outcome than CBPM. However, despite considerable supportive data the role of ABPM is often restricted to certain clinical situations such as suspected white-coat hypertension or resistant hypertension [4]. Several outcome studies on the prognostic value of ABPM have been published [5–19], all of which indicate that ABPM may further enhance the assessment of cardiovascular disease. The objective of this study is to further examine the relative predictive value of different measures of blood pressure by accurately defining outcome mortality.

## Methods

The Blood Pressure Unit (formerly located at the Charitable Infirmary and now based at Beaumont Hospital, Dublin) has been in operation for over 20 years. Using *dabl*® software (ECF Medical Ltd, Blackrock, Co. Dublin, Ireland; www.ecfmedical.com) ABPM recordings are available on 14 414 people referred for assessment and management of cardiovascular risks. Clinic or office blood pressure measurement was measured prior to ABPM by a nurse in accordance with current recommendations [20]. Ambulatory blood pressure was measured using validated devices, mostly the SpaceLabs 90207. In addition to ABPM, electrocardiography (ECG),

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urinalysis, biochemistry and measures of target organ damage were also performed. This information together with detailed analysis of ABPM parameters is recorded in the *dabl*® program.

In Ireland there is no unique identifier to permit ready identification of subjects on the death register. To overcome this deficiency, the following approach was used. The recently completed computerized database of the General Register Office, from the Department of Health and Children which includes names, age at time of death, date of death and also a copy of the death certificate of the deceased person, was used to calculate an approximate date of birth for each person who had died in Ireland over the past 23 years. Patients on the *dabl*® database were matched with potential matches on the death registry database using name and similar dates of birth. A number of further measures were introduced to increase accuracy; when a first name had different versions, each name was entered and matches with a calculated date of birth within one year either side of a patient on the *dabl*® database were also entered.

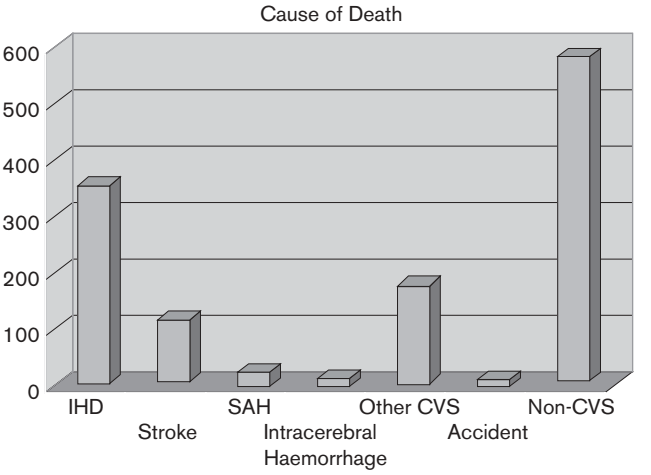
This search generated 2813 people from the original 14 424 patients on the *dabl*® database, who could be matched to 7225 death certificates. People not matched to any death certificate were considered to be still alive at the end of the follow-up period (30 September 2002). People matched to death certificates were further examined by including information from hospital records and family doctors to confirm that death was not attributed to somebody else of the same name and similar date of birth.

The cause of death was available on each death certificate and for those subjects confirmed as dead, the cause of death was classified in accordance with the International Classification of Diseases. Where there was doubt as to the cause, two physicians (A.S. and P.McC.) independently reviewed the death certificates and agreed how death should be classified.

## Results

Of the 2813 people matched to death certificates 1348 were confirmed as dead, 1387 were confirmed as alive and 78 people were excluded because of insufficient information to ascertain their status. Overall cause of death was cardiovascular in 64% of cases. Two hundred and seven people (15%) had post-mortem examinations of which 78% were deemed to be a cardiovascular death. The causes of death are illustrated in Figure 1.

**Fig. 1**




Causes of death. IHD, ischaemic heart disease; SAH, subarachnoid haemorrhage; CVS, cardiovascular.

## Discussion

The large number of deaths in this study will allow powerful detection of associations with blood pressure parameters and mortality outcome. However, the study has its limitations. First, the difficulties in determining the predictive value of investigative variables on a clinical database with mortality outcome, in the absence of a national identifier, are considerable. However, a methodology permitting extraction of mortality data for analysis alongside a clinical database in the absence of a national unique identifier is described. Though we are certain that 1348 people died, there is probably some error in the classification of cause of death; for example, 78 subjects were excluded because of insufficient information and it is likely that some deaths were not recorded because of emigration or changes of name through marriage.

Having determined mortality outcome, the next step is to evaluate ABPM compared to CBPM in predicting cardiovascular mortality in a large cohort of patients with cardiovascular disease.

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