THE UNIVERSITY
OF BIRMINGHAM

Literature Search for
Sudden Death in the Elderly

Aggressive Research Intelligence Facility
West Midlands Health Technology Assessment Collaboration

September 2005

For the Drivers Medical Group
DVLA
Swansea

ARIF

WMHTAC

West Midlands
HTA Collaboration

About ARIF and the West Midlands Health Technology Assessment Collaboration

The West Midlands Health Technology Assessment Collaboration (WMHTAC) is an organisation involving several universities and academic groups who collaboratively produce health technology assessments and systematic reviews. The majority of staff are based in the Department of Public Health and Epidemiology at the University of Birmingham. Other collaborators are drawn from a wide field of expertise including economists and mathematical modellers from the Health Economics Facility at the University of Birmingham, pharmacists and methodologists from the Department of Medicines Management at Keele University and clinicians from hospitals and general practices across the West Midlands and wider.

WMHTAC produces systematic reviews, technology assessment reports and economic evaluations for the UK National Health Service's Health Technology Assessment (HTA) programme, the National Institute for Health and Clinical Excellence (NICE). Regional customers include Strategic Health Authorities, Primary Care Trusts and regional specialist units. WMHTAC also undertakes methodological research on evidence synthesis and provides training in systematic reviewing and health technology assessment.

The two core teams within WMHTAC are the Aggressive Research Intelligence Facility (ARIF) and the Birmingham Technology Assessment Group (BTAG)

ARIF provides a rapid on-demand evidence identification and appraisal service primarily to commissioners of health care. Its mission is to advance the use of evidence on the effects of health care and so improve public health. The rapid response is achieved by primarily relying on existing systematic reviews of research, such as those produced by the Cochrane Collaboration, the National Institute for Health and Clinical Excellence (NICE), the NHS Centre for Reviews and Dissemination, and the NHS Health Technology Assessment (HTA) programme. In some instances, longer answers to questions are required in which case mini rapid reviews of existing systematic reviews and key primary studies are compiled, typically taking 1-2 months to complete.

Occasionally a full systematic review is required and then topics are referred to BTAG who coordinate the production of systematic reviews for several customers under a number of contracts. ARIF is intrinsically involved in the production of these systematic reviews.

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Warning

This is a confidential document.

Do not quote without first seeking permission of the DVLA and ARIF.

The information in this report is primarily designed to give approved readers a starting point to consider research evidence in a particular area. Readers should not use the comments made in isolation and should have read the literature suggested. This report stems from a specific request for information, as such utilisation of the report outside of this context should not be undertaken. Readers should also be aware that more appropriate reviews or information might have become available since this report was compiled.

1 Aims

The aims of this report were to address the following questions submitted by the Driver Medical Group:

1.1 Primary Questions

(a) What are the rates per annum and causes of

(i) sudden death and
(ii) sudden collapse in the elderly.

After discussion this question was reformulated to:

Are older people at intrinsically higher risk of events, which might make them liable to a motor vehicle accident, where sudden death is a suitable marker for such events?

The suggested approach to address this question was to focus on literature on sudden death to try to provide absolute numbers / rates of sudden death in various age groups of the general population, ideally from studies showing the relationship between age and rates of death or alternatively studies of relative risk of sudden death between age groups. Specific literature on sudden death whilst driving was also sought.

1.2 Secondary questions

(b) What are the specific rates in the elderly for sudden death / collapse due to:

(i) Sudden cardiac events – arrhythmias / ischaemic heart disease
(ii) Strokes/CVA
(iii) Other vascular events- ruptured aortic/femoral aneurysm

(e) If possible what:
(i) Is the risk of an event in the next years at any given age of 70 – five year cohorts, (if yearly too specific).
(ii) Are the key risk factors, e.g. preceding history of sudden event before 70, diabetes, hypertension, AF

Tackling these secondary questions was beyond the resources available for this report and therefore these are not specifically addressed.

Further details are given in the request submitted by the Drivers Medical Group (Appendix 1 – Details of Request)

2 Background

Background information is given in the documentation supplied by the Drivers Medical Group contained in Appendix 1 – Details of Request.

3 Methods

Outline methods were submitted to the Drivers Medical Group by email and acceptance confirmed by email (Appendix 2 – Outline methods).

Briefly these were:

- To undertake a search for studies reporting the rates of sudden death.
- To initially search for existing systematic reviews. Searches were then to be extended to look for primary studies in MEDLINE.
- To start by searching for articles published 1999-2005, and then work backwards in time or using other databases as required in order to address the questions but also to ensure manageability of the task. Citations in key articles will be used to identify further relevant articles.
- To concentrate on primary studies that follow a defined cohort of subjects and measure outcomes directly related to sudden death, and in which rates of these events are/ can be derived.
- Methodological quality of such studies was to be commented upon.
- Where appropriate and possible, data on relevant outcomes was to be extracted and tabulated.
- Data analysis would depend on information identified.

3.1 Searches

3.1.1 Existing Reviews.

Searches to identify existing systematic reviews on this topic were performed utilising the well-established ARIF search protocol (Appendix 3 – Search strategies)

3.1.2 Primary Studies

Searches were undertaken for primary studies in Ovid MEDLINE. The search strategy employed MeSH headings and text terms for sudden death, sudden death cardiac, morbidity and a filter to identify aetiological studies. The strategy was developed iteratively and modified accordingly.

Searches were initially conducted from 1999-2005 and then extended back to include publications from 1966-1998.

The detailed search strategies are shown in Appendix 3 – Search strategies.

An information specialist undertook searches. The initial search results were scanned by the information specialist for systematic reviews or meta-analyses, general overviews, reviews and primary studies relating to sudden death, and/ or sudden death and driving.

A research reviewer subsequently assessed the scanned search results for relevance based on information in the title and abstract. Articles that adhered to the broad criteria below were obtained in full for further assessment.

- **Inclusion:**
  Study design:
  (i)   Systematic reviews / meta-analyses
  (ii)   Cohort or longitudinal studies with follow up of a defined cohort of patients
  (iii)   Cross-sectional surveys
  (iv)   Studies of sudden death in relation to driving irrespective of study design
  Population: any (no age restriction but ideally including 50 years and older as main population or subgroup)
  Outcome: mortality (sudden or unexpected)

- **Exclusion:**
  Population: subjects who had undergone, or were undergoing, an invasive cardiac procedure, had obvious trauma or intoxication leading to death, or were in the terminal phase of a chronic disease
  Misc: Articles relating solely to Japanese or Far East populations
  Articles requiring translation (due to the time frame available for this report).

Full text articles were assessed for their match to the primary questions being addressed (external validity). Data from the most informative articles was extracted and is discussed below.

The reference lists of the most relevant articles were also checked in order to identify further relevant papers.

General overviews and non-systematic reviews were utilised as background information and as a potential source of further data and / or further studies.

4 Results

4.1 Articles Identified

No relevant systematic reviews or meta-analysis were identified

Searches for primary studies for the years 1999-2005 identified over 850 articles. Further articles were identified from MEDLINE searches from 1966-1998. The titles and abstracts were assessed for general relevance and potential to meet the inclusion criteria. Articles meeting the inclusion criteria fell within two categories: those reporting to sudden death (including those reporting sudden death only due to coronary causes) and those reporting sudden death at the wheel.

4.1.1 Sudden Death

Data from some of the studies in this category is outlined in Table 1. It should be noted that as this report is not a systematic review these studies are not a comprehensive list but provide a snapshot of some of the available evidence to indicate the type of studies undertaken and the type and nature of the data available.

What is evident is that the definition of sudden death, whilst reasonably consistent amongst a number of the studies, encompasses a potentially longer time frame than would ideally be required in order to address the question of risk of sudden death at the wheel (see section 4.2.1 below). Many of the studies do not break down risk of sudden death by age band and those that do, do not cover the elderly age range or do not subset this range. Even those that do subset by age are somewhat heterogeneous in the age bands chosen.

The study designs encountered were predominantly those following a cohort of patients over time or surveys reporting identified events in relation to the total population from which the event sample was derived. The populations followed in the cohort studies were often male and middle aged at time of enrolment and whether the population was selected to be free of cardiovascular disease was another variable. Follow-up period of many of the cohort studies was insufficient for the population to reach much beyond 75 years of age at the most.

Perhaps the most useful studies are those derived from the Framingham Heart Study and the British Regional Heart Study. The Framingham study appears to have been serial reported when additional follow-up data was available. Perhaps the most useful paper so far located is that by Kannel et al, which reports on the 34 year follow up of the original cohort of over 5000 participants. Age specific incidents rates for sudden death are given for both males and females, detailing a dramatic increased risk with increasing age up to the age of 70, the limit of the reporting.

Further data from the Framingham Heart Study published by Fox in abstract form in 2002 suggested that the overall risk of sudden cardiac death had decreased by 50% since 1950. This trend was seen in subjects both with and without CHD and it may mirror the decline in CHD mortality in recent decades.

The British Regional Heart Study covers a much narrow age range (40-59years) than the Framingham, shorter follow-up (8 years) and only includes males. Detailed comparison between these two studies and the event rates reported has not been undertaken for the reasons outlined in section 4.2 below. For the same reasons the remaining studies in Table 1 and the wider articles identified will not be commented on in detail here.

However, the narrative review by Myerburg et al (1993) on sudden cardiac death also makes interesting reading as it highlights a number of key issues with regard to assessing death rates and the utilization of historical data. It cites an overall estimated incidence of 0.1-0.2% sudden deaths per year for the adult US population. The absolute number of sudden death events per year has reduced in parallel with a decrease in overall cardiovascular mortality in recent decades, however, the proportion of cardiovascular deaths that are sudden or unexpected has remained constant at approximately 50%.

One thing that is apparent from a number of the studies is a common perception that the majority of victims of sudden death to some extent cannot be readily identified before the event.

4.1.2   Articles on Sudden Death at the Wheel

A selection of the studies identified on sudden death and driving are given in Table 2. At this time these have not been assessed in detail, however, there are a number of issues in these studies that warrants scrutiny. Further appraisal of these studies is one route for progressing this topic, possibly through a comprehensive systematic review.

4.2   Utilisation of Identified Studies

There are number of issues which need to be taken in to consideration when looking at the evidence on this topic and these impact on usefulness of the evidence in the context of sudden death/collapse of drivers of motor vehicles. These are highlighted below.

4.2.1   Definition of Sudden Death

The definition of sudden death varies between studies or is not defined at all. Sudden death was most commonly defined as natural death occurring within 1 hour of onset of symptoms. Generalising the findings from studies using such a definition to sudden death/collapse at the wheel could be misleading, as the definition gives no indication of the severity/acuteness of symptoms or immediacy and severity of disability. Thus the loss of control of any motor vehicle being driven cannot be inferred. Furthermore it would not include collapse that does not lead to death, or collapse and subsequent death outside this time frame.

Many of the studies identified primarily concentrate on sudden cardiac deaths and generalising from these studies should be undertaken with caution for several reasons. Whilst estimates appear to suggest cardiac

related events account for the vast majority (around 90%) of sudden natural deaths, these studies do not include all sudden deaths. What is classed as a cardiac/coronary related sudden death to some extent varies from study to study. Some studies include a specific definition whilst in others the definition can be wide and include cerebrovascular events, or not defined at all.

Ascertainment of the cause of death, and whether the death was sudden or not (however defined), is obviously crucial. Depending on how data is collected (e.g. death certificates, autopsies), coding for sudden death or cause of death may be imprecise. Information on death certificates for coronary heart disease can be reasonably accurate but other causes of sudden death (particularly in the younger age group) may be misclassified. Some studies relied on information from survey respondents regarding symptoms and events immediately prior to death. Recall bias may be an issue for such studies even where the respondent was a first-degree relative.

In addition to factors outlined above, data from studies containing death rates where the deaths occurred decades ago may not be generalisable to the present day due to amongst other factors, advances in emergency medicine – particularly higher profile of the 'golden hour' which given the definition of sudden death used in many studies may impact on rates measured.

4.2.2   Age as a Predictor of Sudden Death

Generalising age stratified sudden death/collapse rates to the driving population and the elderly driving population in particular is problematical as age may be a poor predictor of sudden death/collapse at the wheel in the elderly for several reasons. The self-certification of continued good health to enable continued driving every 3 years beyond 70 years of age, along with notifications of ill health, may act to select a healthier elderly driving population compared to the general elderly population. Actuarial survival should also be considered in that if you survive to a certain age you still have a reasonable life expectancy. Furthermore, the frequency and duration of driving is almost certainly lower in elderly. These factors should ideally be taken into consideration in extrapolating general population sudden death data to model sudden death/collapse at the wheel and comparing likely rates across age groups.

In short, elderly drivers are a select population and as such extrapolation of data from an age matched general population (even if quality data exists) to infer likely sudden death/collapse rate at the wheel is fraught with problems. To go even further and consider other risk factors responsible for sudden death / collapse is likely to compound these problems and generate further ones.

4.2.3   Issues Relating to Study Design

Cross-sectional studies provide a snapshot of the prevalence of an outcome at a particular point in time. Complete ascertainment of the factor of interest (sudden death) in the total population is required to obtain precise event rates. Longitudinal variation/anomalies in event rates are not detected unless the study is repeated.

Cohort studies follow a group of individuals over a period of time to study the development of one or a number of outcomes. Prospective cohort studies generally suffer less from recall or selection bias. Attrition bias may influence the findings if large numbers of subjects cannot be followed up for the outcome of interest.

4.2.4   Death at the Wheel

With regard to those studies that attempted to assess sudden death rates related to driving, a number of the above factors with regard to ascertainment and recall bias also hold true. Furthermore, there is a wider issue with regard to the comprehensiveness of the ascertainment of all relevant cases. As the numbers involved are generally small only a few missing cases could have an impact on any findings. However what these studies seem to highlight is that accidents caused by collapse at the wheel are not as common as one might expect and that the severity of any accidents is generally less than expected. However, this in turn does mean that a serious accident could not occur.

Perhaps the best way to determine risk of sudden death/collapse at the wheel and any resulting accident rates would be direct measurement of such events in the UK/English/Welsh population, either through the establishment of a prospective study or a retrospective study utilising existing data sources to identify such events. A study following a cohort of drivers (ideally all licensed drivers) to derive rates of sudden death / collapse would probably be the ideal, with predetermined sub-group analysis as required. Irrespective of study design, (Depending on the method of ascertainment of cause/nature of death, one issue might be that coroners inquests are less likely to occur in cases where there is no traumatic cause of death or where no injury is caused to other road users.)

4.3   Limitations of this report

Further searches were not carried out to identify articles from the EMBASE and other bibliographic database due to time constraints.

In-depth analysis of the identified studies measuring rates of sudden death / sudden cardiac death was not undertaken because of the limitations of using the findings in generalising to sudden deaths at the wheel.

In-depth analysis of the identified studies reporting sudden death in relation to driving has not been undertaken as we feel a comprehensive assessment of the evidence from the UK context would be the most appropriate and useful exercise, however this is beyond the remit of this report.

5   Conclusion

There are a number of articles that report on sudden death and sudden death in relation to driving. It is not easy to generalise the findings of these studies to the UK elderly population and in particular, to those who drive in this population. This is due to the limitations of the studies themselves, the nature of the outcome(s) measured and difference between the populations studied and the population of interest.

Table 1 – Included studies reporting rates of sudden death*

Study	Design	Population	Year of recruitment/ length of follow up	N	Definition of sudden death	Sudden death rate	Comments
Kannel 1990 Framingham Heart Study	Prospective cohort study	US population 30-62 years at time of recruitment	1948- 34 years	5209 (2336 male)	Sudden death defined as persons dying within 1 hour of onset of symptoms without another probably cause of death suggested by medical history	Ten year age specific incidence rates (/1000) of sudden death after 28 year follow up for males and females (171 and 80 deaths respectively) 35-44yrs 7.6 males 2.5 females 45-54yrs 25.5 & 3.6 55-64yrs 41.3 & 13.3 65-70yrs 84.5 & 20.3 35-70 combined 25.7 & 6.7	Follow up rate greater than 86% Gives relative risk for risk factors for sudden death.
Wannamethe e, 1995 (British Regional Heart Study)	Prospective cohort study	British males aged 40-59 yrs from general practice registers in 24 towns in England, Wales and Scotland	1978-1980 8 years	7735	Death occurring within 1 hour after the onset of symptoms.	117 sudden cardiac deaths Sudden cardiac deaths by age subgroups - Rate per 1000 per year (No. events): 40-44yrs n=1838 0.4 (6) 45-49yrs n=1898 1.3 (19) 50-54yrs n=1974 2.1 (33) 55-59yrs n=2025 3.6 (59) All n=7735 1.9 (117) No preexisting IHD n=5792 rate (n) per 1000 per year = 1.0 (46)	99% followed up n=5792 had no preexisting evidence of IHD
Colditz, 1991	Prospective cohort study	US male health professionals aged 40-75 yrs, free of reported cardiovascular disease	1986 2 years	45317	Death within an hour of the onset of symptoms with no previous illness, in whom no more plausible cause than CAD could be found	49 MI or sudden deaths	72,454 person-years of follow-up

Jouven, 1999 (Paris Prospective Study I)	Prospective cohort study	Native French males employed by Paris Civil Service aged 43-52 yrs, free of IHD (MI or angina)	1967-1972 Follow up 1994 (22-27 years, mean 23 years)	7079	Natural death occurring within 1 hour of onset of acute symptoms.	118 sudden deaths (cardiovascular). 2083 deaths overall. Sudden deaths in subjects <65yrs n=93	
De Vreede-Swagemakers, 1997	Population/ census data (Central Statistical Office)	Inhabitants of Maastricht area, Netherlands aged 20-75 yrs	Jan 1991-Jan 1994	Approx 133000	Not clear	24-44yrs n=? 19 sudden deaths 45-54yrs n=? 36 sudden deaths 55-64yrs n=? 116 sudden deaths 65-74yrs n=? 204 sudden deaths 1991-1994 total of 2030 deaths, 375 were sudden deaths. Total population unclear.	
Escobedo, 1996	Population/ census data	US 1986 National Mortality Followback Survey and US Bureau of the census	1986	18733	Sudden coronary death defined as persons dying within 1 hour of onset of cardiovascular symptoms	Sudden coronary death n=1608 Estimated 251000 sudden coronary deaths (95% CI 238000- 263000) in the US (possible because the study sample was representative of all coronary disease deaths in 1986). 1608 sudden coronary deaths out of 4729 coronary heart disease deaths (483 could not be coded). Breakdown of sudden coronary disease death rate per 100 000 population (sudden n=1608): 25-44yrs 5.6 45-64yrs 74.7 65-74yrs 311.4 75-84yrs 622.4 ≥85yrs 1355.5	National Mortality Followback Survey is a stratified, random sample of approx 1% of deaths of US residents 25yrs and above in 1986. Unable to classify 483 coronary deaths as sudden/ not.

Due to the nature of this report the searches were not comprehensive and as such this list should not be seen a complete representation of all the available literature but as a guide to the type of studies that have been undertaken.

Table 2 Selected studies reporting on sudden death at the wheel*

Buttner et al report the incidence of sudden natural death at the wheel as 147 of 34,554 drivers registered in the autopsy files at the Institute of Legal Medicine, Munich.   **Buttner A, Heimpel M, Eisenmenger W. Sudden natural death 'at the wheel': a retrospective study over a 15-year time period (1982-1996). Forensic Science International 1999; 103:101-112**
Halinen et al examined the number of fatalities caused by collision following sudden death of a driver. The authors concluded that accidents caused by sudden incapacity of the driver were rare, and difficult to predict, in Finland (1.5% of all traffic deaths) and Vaud, Switzerland (3.4% of all traffic deaths).   **Halinen MO, Jaussi A. Fatal road accidents caused by sudden death of the driver in Finland and Vaud, Switzerland. European Heart Journal 1994; 15: 888-894**
Schmidt et al reviewed 39 autopsy cases of sudden death at the wheel. Most subjects were aged 51-60 years with deaths attributed to cardiovascular diseases.   **Schmidt P, Haarhoff K, Bonte W. Sudden natural death at the wheel- A particular problem of the elderly? Forensic Science International 1990; 48:155-162**
Copeland reported on the numbers of sudden natural deaths 'at the wheel' in Dade county Florida 1980-4, including cause of death and some post mortem assessment of cardiac disease. Numbers of deaths are given by in 5-year age bands up to the age of 75 years.   **Copeland AR. Sudden natural death 'at the wheel' – revisited. Med Sci Law 1987 27(2):106-113**
Osrom and Eriksson report on the cases of natural death in relation to vehicle usage (car, bicycle, snow mobile etc) from autopsies in Umea, Northern Sweden (1980-85). Of the 69/126 that were car drivers, most were male, most cases were 60-70 years of age (14/69 occurred in 70-80year old [the same number as 50-60 year olds] 1/69 in 80+ age group. COD in two third of case was MI and the majority of the remained were due to other cardiovascular disease. Only 3/66 car death involved another vehicle and other road users were not injured in any of the cases.   **Ostrom M, Eriksson A. Natural death while driving. Journal of Forensic Sciences. 1987; 32(4): 988-998**
Antecol presents analysis of cases at a single pathology center in USA. 30 cases included including those who died whilst driving or were found deceased in a stationary/parked vehicle. Study concentrates on state of the heart in these cases. Most were male and age ranged from 21-69 yrs. No injuries occurred occupants of the vehicle, other vehicles or pedestrians.   **Antecol D, Roberts W. Sudden death behind the wheel from natural disease in drivers of four-wheeled motorized vehicles. American Journal of Cardiology 1990; 66:1329-1335**
Christian reported a prospective 10 year study to assess the incidence and implications of sudden death in road users at a single UK A&E centre. 5064 cases were drivers of cars or bigger vehicles. 3 were motorcyclists. This paper covers all road sudden deaths including suicides. The majority of deceased were maleand 36/64 were aged 61-89 years. Only one incident in 64 deaths resulted in death of another road user, and that person was not wearing seat belt. The paper concludes that based on the results *sudden natural death occurring in road users does not present an appreciable hazard to other road users.* A critical appraisal is required to assess if this conclusion is justified   **Christian M. Incidence and implications of natural deaths for road users. British Medical Journal 1988; 297:1021-1024**

*Due to the nature of this report the searches were not comprehensive and as such this list should not be seen a complete representation of all the available literature but as a guide to the type of studies that have been undertaken.

6 References

6.1 Main References

Colditz, G.A; Rimm, E.B; Giovannucci, E; Stampfer, M.J; Rosner, B; Willet, W.C. A prospective study of parental history of myocardial infarction and coronary artery disease in men. The American Journal of Cardiology 1991; 67:933-938

De Vreede-Swagemakers, J.J; Gorgels, A.P; Dubois-Arbouw, W.I; Van Ree, J.W; Daemen, M.J; Houben, L.G; Wellens, H.J. Out-of-hospital cardiac arrest in the 1990's: A population-based study in the Maastricht area on incidence, characteristics and survival. Journal of American College of Cardiology 1997; 30:1500-1505

Escobedo, L.G; Zack, M.M. Comparison of sudden and nonsudden coronary deaths in the United States. Circulation 1996; 93:2033-2036

Fox C, Evans J, Larson M, Kannel W, Levy D. Decreasing risk of sudden cardiac death: a role for both primary and secondary prevention [Abstract] Journal of American College of Cardiology 2002; 39:suppl 1 459-460

Jouven, X; Desnos, M; Guerot, C; Ducimetiere, P. Predicting sudden death in the population. The Paris Prospective Study I. Circulation 1999; 99:1978-1983

Myerburg, R.J; Kessler, K.M; Castellanos, A. Sudden cardiac death. Annals of Internal Medicine 1993; 119: 1187-1197

Wannamethee, G; Shaper, A.G; Macfarlane, P.W; Walker, M. Risk factors for sudden cardiac death in middle-aged British men. Circulation 1995; 91:1749-1756

7 Appendices

7.1 Appendix 1 – Details of Request

ARIF REQUEST FORM

Date of Request | 8 June 2005 |

Lead Medical Adviser Issuing request	Name – Dr Heather Major Senior Medical Advisor

Contact details	Drivers Medical Group DVLA Sandringham Park Swansea Vale Llansamlet Swansea SA7 OAA ██████████ ███████████████

1. Without worrying about the structure of the question, state in full the nature and context of the problem.

(a) We need to know the rates per annum and causes of

    (i)   sudden death and
    (ii)   sudden collapse in the elderly. Specifically,

(b) Sudden cardiac event - arrhythmias
                            Ischaemic heart disease

(c)   Strokes/CVA

(d)   Other vascular events- ruptured aortic/femoral aneurysm

(e)   We need to identify, if possible,

(f)   A risk event in the next years at any given age of 70 – five year cohorts, (if yearly too specific).

(g)   Identify the key risk factors, e.g. preceding history of sudden event before 70, diabetes, hypertension, AF

2. Please give a background to the question. Why has DMG raised this problem?

DMG have recently dealt with a case where an 87 year old had applied for (and been granted) a C1/D1 licence despite his cardiac condition (atrial fibrillation). As a result of the D1 entitlement, this means that the licence holder could drive a minibus full of people - as he planned to do as a driver for his pensioners outings club.

Although he meets the letter of the cardiac (and other) standards individually, there is uncertainty about his

overall age-related risks in the cardiac area in particular.

Additionally, Group 2 licences (buses/lorries) have no upper age limit providing the standards are met - but is there an age above which the average "healthy" (i.e. no previous history) person will have a per annum risk of sudden collapse/death of 2% or greater? If so, what is this age, is it male/female specific, are there other relevant factors? If other conditions exist but no cardiac history (e.g. diabetes) how does that affect the premium risk?

3. Giving references where appropriate, briefly detail the sources you have used to obtain background information on the *options* and *issues*, which might be important for the problems, you describe.

(a) Chapter 1 Neurological Disorders - At A Glance guide to the current Medical Standards of Fitness to Driver February 2005.

(b) Chapter 2 Cardiovascular Disorders – At A Glance guide to the current Medical Standards of Fitness to Driver February 2005.

(c) Minutes of the Secretary of State for Transport's Honorary Medical Advisory Panel on Driving and disorders of the Cardiovascular System held on 28 April 2004.

(d) Minutes of the Secretary of State for Transport's Honorary Medical Advisory Panel on Driving and Disorders of the Cardiovascular System held on 21 October 2003.

(e) Minutes of the Secretary of State's Honorary Medical Advisory Panel Chairmen's Meeting 12 February 2004.

4. Please give name and contact details of any expert or clinical contact e.g. relevant Panel Chairman/ expert Panel member.

Dr H Swanton (Chairman)
MB BChir MRCP MA MD FRCP FESC
Consultant Cardiologist
The Heart Hospital
Westmoreland Street
London W1 G 8PH

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███████████████
███████████

Prof Charles Warlow (Chairman)
Prof of Medical Neurology
Dept of Clinical Neurosciences
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████████████████
██████████

5. What is the nature of the target population of the issue detailed above? E.g. age, profile, vocational drivers, young drivers, other co-morbid features.

The target age profile is age 70 plus.

Co-morbid features - life-style risk factors, which renders them a high-risk group for cardiovascular disease including hypertension, diabetes, smoking history, B.M.I. Existing dysrhythmia and symptomatic IHD

6. What are the outcomes you consider particularly important in relation to the question posed? What decisions rest on these outcomes?

Identify the overall age-related risks in the cardiac and stroke area.

Identify the possibility of a risk of event in the next year - above/below 2% and 20% risk levels.

Identify the key risk factors

If possible, their appropriate measurement e.g. blood pressure > 180/100 (as an example). Glycaemic control.

Can this be stratified to show if the risk increases/reduces/stays the same over time e.g. a 3 year (duration of normal review licence for drivers over 70 years of age.).

| What is the latest date that an ARIFresponse would be of value | 10 September 2005 |

Please either:

Fax this form to: 0121 414 7878 marking FAO ARIF

E-mail as a word document or pdf attachment to: ███████████████

Post to:-   Dr David Moore
Senior Research Reviewer and Analyst
Aggressive Research Intelligence Facility
West Midlands Health Technology Assessment Collaboration
Department of Public Health
University of Birmingham
Edgbaston
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B15 2TT

Please ring 0121 414 3166 or 6767 if you have any queries, or you want to check the progress with your request.

7.2 Appendix 2 – Outline methods

From: Esther H Albon
Sent: 08/08/05 10:50:47
To: ████████████████████████
Cc: David Moore
Subject: Search request Sudden death and sudden collapse

Dear Heather

Thank you for the infomation supplied for the DVLA request - Sudden death and sudden collapse in the elderly. Our plan of action is briefly outlined below.

*   This report will focus specifically on the question of sudden death.

*   A search will be conducted for articles reporting sudden death or sudden cardiac death combined with a search term to identify studies likely to provide information on rates of sudden death in various age groups.

*   The search strategy will use the ARIF search protocol to identify existing reviews in the first instance. A scoping search has shown that a systematic review was published in 1987. Other studies will be sought in MEDLINE using index and text words appropriate to the subject. The strategy will develop iteratively and will be extended to other databases if appropriate. Citations in key articles identified will be used to identify further relevant articles.

*   Searches will initially be conducted for publications 1999-2005. This will then be extended backwards as necessary and will depend on the volume of relevant literature.

*   Articles will be selected that follow a defined cohort of subjects and measure outcomes directly related to sudden death, and in which rates of these events are/ can be derived.

*   Methodological quality of selected studies will be discussed.

*   Data on relevant outcomes will be extracted and tabulated.

*   Data analysis will be dependent on availability of information.

Please do not hesitate to contact ARIF to discuss the above using the contact below or David Moore ████
██████

Best regards

Esther

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Dr Esther Albon
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7.3   Appendix 3 – Search strategies

7.3.1   ARIF Reviews Protocol

SEARCH PROTOCOL FOR ARIF ENQUIRIES
(Feb 2005)

In the first instance the focus of ARIF's response to requests is to identify systematic reviews of research. The following will generally be searched, with the addition of any specialist sources as appropriate to the request.

A.   Cochrane Library
- Cochrane Reviews
- Database of Abstracts of Reviews of Effectiveness (DARE)
- Cochrane Central Register of Controlled Trials (CENTRAL)
- Health Technology Assessment (HTA) database

B.   ARIF Database
- An in-house database of reviews compiled by scanning current journals and appropriate WWW sites. Many reviews produced by the organisations listed below are included.

C.   NHSCRD (WW Web access)
- DARE
- Health Technology Assessment Database
- Completed and ongoing CRD reviews

D.   Health Technology Assessments and evidence based guidelines(WW Web access)
- NICE appraisals and work plans for TARs, Interventional Procedures and Guidelines programmes (NCCHTA work pages:www.ncchta.org/nice/)
- Office of Technology Assessment
- NHS Coordinating Centre for Health Technology Assessments
- Canadian Co-ordinating Office for Health Technology Assessment
- New Zealand Health Technology Assessment
- Wessex STEER Reports
- Agency for Healthcare Research and Quality (AHRQ)
- National Horizon Scanning Centre
- SIGN (Scottish Intercollegiate Guidelines Network)

E. Clinical Evidence

F. Bandolier

G. TRIP Database

H. Bibliographic databases

- Medline - systematic reviews
- Embase - systematic reviews
- Other specialist databases.

I. Contacts

- Cochrane Collaboration (via Cochrane Library)
- Regional experts, especially Pharmacy Prescribing Unit, Keele University (&MTRAC) and West Midlands Drug Information Service (url: www.ukmicentral.nhs.uk) for any enquiry involving drug products

7.3.2 Primary studies protocol

Database: Ovid MEDLINE(R) <1966 to July Week 3 2005>
Search Strategy:
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1   sudden death/ (864)
2   sudden death cardiac/ (0)
3   or/1-2 (864)
4   epidemiology/ (1069)
5   3 and 4 (0)
6   limit 3 to "etiology (optimized)" (305)
7   exp morbidity/ (83869)
8   3 and 7 (47)
9   from 8 keep 16,38,42-43 (4)
10   limit 3 to "etiology (specificity)" (50)
11   from 10 keep 5,25 (2)
12   9 or 11 (6)
13   from 12 keep 1-6 (6)