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A Community-Based Study of Dementia: The Rotterdam Elderly Study

Key Words
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Risk factors

Abstract
The Rotterdam Elderly Study is designed as a community-based prospective follow-up study. The study population consists of almost 12,000 individuals aged 55 years and over who are living in an urban area in Rotterdam, the Netherlands. The objective of the study is to investigate the prevalence, incidence and determinants of neurogeriatric disorders, cardiovascular diseases, locomotor diseases and ophthalmologic diseases. In this paper we give a general outline of the Rotterdam Elderly Study, and a detailed description of the case finding and diagnostic procedures for the study of dementia. The risk factors for dementia that are assessed in the study are summarized.

Introduction and Objectives

The Rotterdam Elderly Study is a community-based prospective follow-up study, conducted by the Department of Epidemiology and Biostatistics of Erasmus University Medical School, Rotterdam, The Netherlands. The general objective of the study is to investigate prevalence, incidence and determinants of diseases in the elderly in order to detect preventable causes of these illnesses. In addition, specific intervention studies are conducted. The four main fields of interest in which specific research projects are being performed are: neurogeriatric disorders, cardiovascular diseases, locomotor diseases and

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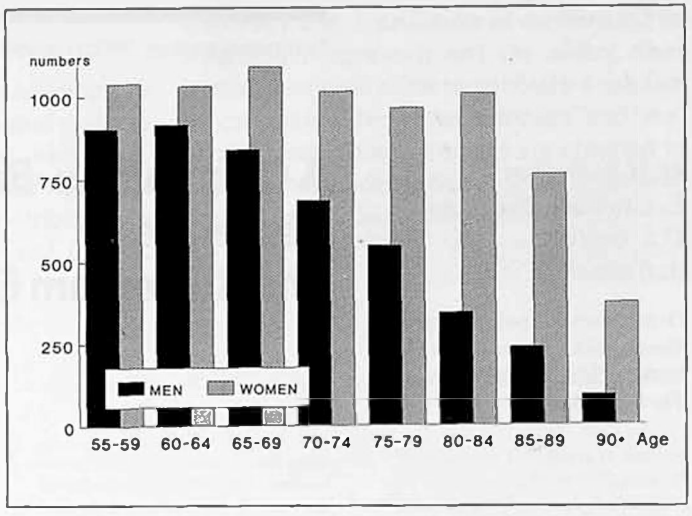

Fig. 1. The age and gender distribution of the study population.

ophthalmologic diseases. The research questions in neurogeriatrics relate to dementia, in particular Alzheimer's disease and vascular dementia, Parkinson's disease and epilepsy.

Study Design

All participants in the Rotterdam Elderly Study will undergo at least two examinations. At enrollment health status is ascertained and baseline data are collected. This cross-sectional survey will yield prevalence estimates of the disorders of interest. In the second survey 3 years after the initial examination, all participants are re-examined using identical procedures. Endpoints in the study are cause-specific mortality, incident morbidity, and changes in determinants taking place during the follow-up interval. Moreover, the study base offers the possibility to conduct nested case-control studies to investigate determinants of various disorders.

Study Cohort

The study area is Ommoord, a city district located in the north eastern part of Rotterdam with a total population of almost 30,000. This area has a relatively stable population, with few people moving out or into the area. Over 90% of the population is cared for by 12 GPs, who are supportive of the study and willing to collaborate. The study population is a fixed cohort defined by all inhabitants aged 55 and over who have lived for at least 1 year in the district at prevalence day, and who agree to participate. During the first survey, prevalence dates will shift every 6 months. Potential participants are invited in random clusters. Names and addresses are drawn from the municipal register which is reliable, complete and kept up to date weekly. The age and gender distribution of the study population is given in figure 1. The total number of eligible persons amounts to 11,850. This number is sufficient to study the incidence and determinants of the disorders of interest. As there are

several homes for the elderly and one nursing home in this district, institutionalized persons will be included, constituting 11% of the study population. The percentage of institutionalized individuals increases sharply with age, from 0% for age 55–59, to almost 80% for those over 90 years of age. For all age categories the percentage of women that are institutionalized is higher than that of men.

General Examination Schedule

In the cross-sectional study a two-stage design is used. Potential participants are informed by letter about the study before they are contacted in person. In the first stage the participants are visited at their home by trained research assistants who, after informed consent is obtained, conduct a computerized interview that takes about 1½ h to administer. The issues that are covered in the questionnaire are listed in table 1. At the end of the interview an appointment is made with the subject to visit the research centre for the second stage of the study. At this field centre, which is located centrally in the district, all study participants undergo an extensive set of investigations, ranging from simple anthropometry and blood pressure recordings, to more sophisticated examinations such as bone densitometry and duplex scanning of the carotid arteries. The examination is split in two parts and applied in two successive weeks directly following the interview at home. This offers the opportunity to integrate part of the clinical workup that is needed for subjects that are selected on the basis of various screening procedures, with the core survey.

Non-Responders

In the prevalence phase of the study information regarding age, gender and marital status of non-responders is available from the municipal register. All non-responders are asked about their reason for refusal, and consent is requested to obtain medical information from their general practitioners. For the prospective study the same sources of information are used to keep track of subjects that otherwise might become lost to follow-up. The municipal register records all deaths and changes of address. All collaborating general practitioners have automated records in their practices and notify all instances of mortality and intermediate morbidity of interest directly to the study.

Table 1. Information collected in home interview

Medical history
Current medical status
Cognitive screening test
Screening Parkinson's disease
Medication (prescriptions, actual use)
Socio-economic status
Level of education
Occupation history
Full pedigree information first-degree relatives
Family history of specified disorders
Instrumental activities of daily living

Time Schedule

From June to November, 1989 a pilot study was conducted. In January, 1990 the actual study was initiated, but full participant recruitment and complete data acquisition started in June, 1990. The cross-sectional survey will take 3 years and will be directly followed by the second survey. First incidence figures are to be expected by the end of 1993.

Case Finding and Diagnostic Procedures for Dementia

The screening for dementia follows the general design as outlined. Included in the home interview are cognitive screening tests, namely the MMSE and questions required

Table 2. Neuropsychological test battery

Intelligence	Groninger Intelligence Test
Attention	Digit Span
	Fluency
Memory	River Mead
	Word list learning
	Biber Figure
Language	Modified Boston Naming Test
Construction	Circle, parallellogram, overlapping rectangles, cube, clock face
Visuo-spatial	Line orientation
Reasoning/ planning/ sequencing	Stroop Trail Making Test

Table 3. Interview derived information for the study of risk factors for dementia

Family history
Full pedigree information 1st degree relatives
Family history of dementia, Parkinson's disease, Down's syndrome, epilepsy, stroke, psychiatric history

Medical history
Vascular determinants
Hypertension, angina, intermittent claudication, myocardial infarction, diabetes, stroke, TIA
Head trauma with loss of consciousness
Thyroid disease
Psychiatric history
Epilepsy
Parkinson's disease
Migraine

Socio-economic status
Family income
Education

Toxicological/dietary determinants
Occupational exposures
Smoking habits
Alcohol consumption
Food frequency questionnaire

Instrumental activites of daily living

Table 4. Investigations at research centre relevant to the investigation of risk factors for cognitive decline and dementia

Blood pressure
ECG
Doppler peripheral arteries
Duplex scanning carotid arteries
Glucose tolerance test
Neurologic examination
Laboratory tests
Storage of serum and cells

to reach a GMS organic level score using the AGECAT algorithm [1, 2]. Following EURODEM recommendations, those who score positive on either or both of these tests, using the cut-off of 25/26 for the MMSE and 0/1 for the GMS, are defined as screen-positive [3]. In addition to the routine examinations, screen-positives are seen during their first visit to the field centre by a trained physician who will administer the second phase of the dementia screening, consisting of a structured psychiatric diagnostic interview (CAMDEX), and more extensive neuropsychological testing (CAMCOG) [4]. This physician also conducts an interview with an informant. The physician classifies the subject as 'not demented' or 'suspected of dementia' using DSM-IIIR criteria [5] irrespective of the score on the CAMCOG. In addition, the presence of depressive symptomatology is assessed using the Hamilton Depression Rating Scale [6]. All subjects that have a score below 80 on the CAMCOG, as well as subjects with a score of 80 or higher on the CAMCOG but who were labeled as 'suspected of dementia', are examined by a neurologist during their second visit to the research centre. The neurologist

administers the Short Blessed Test [7] and carries out a complete neurological examination. Presence and severity of extrapyramidal symptoms is recorded separately using the motor examination part of the Unified Parkinson's Disease Rating Scale [8]. Based on all information available and using DSM-IIIR criteria the neurologist assesses whether a dementia syndrome is present. All subjects with a dementia syndrome are referred to the university clinic for neuroimaging (MRI and SPECT) and neuropsychological testing (table 2). Other subjects are also referred in case of doubt. The final diagnosis is made by a diagnostic panel consisting of the neurologist, the neuropsychologist and two physicians of the Rotterdam Elderly Study. This panel reviews the diagnosis of dementia syndrome using DSM-IIIR criteria, and makes a subdiagnosis. Alzheimer's disease is diagnosed using DSM-IIIR criteria as well as NINCDS-ADRDA criteria [9]. For the diagnosis of multi-infarct dementia DSM-IIIR criteria are used which permit the consideration of neuroimaging information. For all subjects an Ischemic Score according to Hachinski is calculated [10]. Severity is rated on both the Clinical Dementia Rating Scale [11] and the Global Deterioration Scale [12].

Assessment of Risk Factors for Dementia

Risk factors for dementia are assessed both by interview and by clinical measurements. Branching questionnaires are used to assess determinants for which subject given information is required. Most of this information is obtained in the home interview. For medical conditions that cannot be reliably assessed by medically naive interviewers only highly sensitive questions are included in the home interview. If answered positively, a physician will take a more detailed history during the first visit to the research centre. Possibly delicate topics such as previous psychiatric history are only investigated by the physician. The most important risk factors that are evaluated by interview are summarized in table 3. The clinical measurements at baseline are mainly of interest to study the relation of cardiovascular determinants with cognitive decline and dementia (table 4).

First Results

From June until November 1989 a pilot study was conducted. Examinations were completed for 222 independently living persons aged 65 and over, as well as for 150 persons residing in an elderly home. The response rate was 80% for the home interview, while the overall response was 75%. To obtain age specific estimates of the prevalence of dementia, the number of cases per number of screened subjects was recalculated to reflect the distribution of institutionalised persons in the population. The prevalence estimates of total dementia for the age groups 65–74 years, 75–84 years and 85 years and over, were 1.5, 6.9 and 40.8%, respectively. Results of this pilot study were contributed to the EURODEM Prevalence Study, a pooled analysis of estimates of the prevalence of dementia in several European countries [13].

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