

The Epidemiology of Dementia: GMS-AGECAT Studies of Prevalence and Incidence, Including Studies in Progress

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Summary. The paper reviews the main studies using the AGE CAT computerised diagnostic system for the diagnosis of dementia in community studies of prevalence and incidence. It is suggested that variations in reported rates may be due to the use of unstandardised methods, and the paper reviews the oldest established standardised interview: the Geriatric Mental State. The AGE CAT system is outlined, and the studies of its diagnostic validity indicated. Arguments are presented against the inclusion of cognitive tests in such instruments, and for the critical evaluation of the concepts of mild dementia. The use of AGE CAT in the US/UK Diagnostic Project, and in the Liverpool study of Continuing Health in the Community is described. In addition, preliminary information is given on the Liverpool ALPHA study, the MRC UK multi-centre study, studies organised by the Pan American Health Organisation (Argentina, Chile, Cuba), the Eurodem concerted action (based in Rotterdam) and the WHO multi-site studies. Individual studies in Spain and Portugal are also discussed.

Key words: Dementia – Prevalence – Incidence – AGE CAT – Geriatric Mental State

Introduction

Recent epidemiological studies of prevalence and incidence have tended to accept the need for some degree of standardization of methods, including diagnosis. The development of DSM-III has helped by providing simple rules for allotting subjects to disease categories. The loss may, however, have been greater than the gain as it is now all too easy for authors to report that they have used criteria, but it is rarely made clear how thoroughly the criteria were applied. Also the necessary simplicity of the rules themselves limits their application. The move towards standardization has itself resulted in an increasing number of different methods, which further frustrates comparison between different studies.

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Studies over the last decade in the United Kingdom have been no exception. Gurland et al. (1983) using the CARE interview, incorporating the Geriatric Mental State (GMS), reported levels of 2.3% for “pervasive dementia” amongst a random sample of subjects in London aged 65 years and over. Clarke et al. (1986) using the CAPE scales found 2.5% for a sample of subjects aged 75 and over, and Morgan et al. (1987) in Nottingham using the same instrument with psychiatric follow-up, 3.2% for a sample aged 65 and over. Using the Mini-Mental State Examination (MMSE) and the CAMDEX interview O'Connor et al. (1989) found 5.3% had moderate to severe dementia in an urban population in Cambridge aged 75 and over, and Brayne and Calloway (1989) assessed the levels for all types of dementia in a sample of women aged 70–74 (4.3%) and 75–79 (11.7%). Using scales from the CARE schedule, Lindesay et al. (1989) found 4.6% to be cognitively impaired in a sample aged 65 and over in Lewisham. Livingstone et al. (1990) recorded 4.7% of a population of similar age living in Gospel Oak to be demented according to the criteria of the Short CARE. When attempts are made to harmonize these results, the differences between them are probably less than those found in previous studies. Nevertheless it is still not possible to tell whether such differences are real or are artefacts of the methods.

Interest has moved from the study of the prevalence of illness in individual communities to studies of the distribution of illness between communities and to studies of incidence. Single studies provide data which may be helpful to administrators who plan health and social services, but they provide few answers which can be used to address scientific questions about risk factors and causal agents.

The Importance of Using Similar Standardized Methods

In order to be able to make satisfactory comparisons between different geographical areas for levels of illness, it is essential to use similar standardized methods. Henderson (1986) was able to show the wide discrepancies in

levels of dementia which existed in studies up to that date, which he attributed largely to a failure to standardize methods, especially interview techniques and definitions, not only of severity but also of diagnostic category. Black et al. (1990) have also drawn attention to the different levels of illness identified by different standardized methods. There are three clinical areas which must be standardized: the collection and recording of the subject's symptoms and signs, the differential diagnosis and the case of the illness.

The case level must, of course, be defined in a manner consistent with the aims of the study. If, however, this were taken too literally, there would be little consistency between studies, so a compromise must be found. The first attempts to standardize these aspects of the psychiatric interview were undertaken by Spitzer et al. (1970) and by Wing et al. (1974), for younger age groups.

GMS-AGECAT Package and Its Components

The Interviews

The GMS was formed originally from the Present State Examination (Wing et al. 1974) with considerable modification, both to make it suitable for use with older people and for investigating organic conditions such as dementia as well as functional illness. Later, it was modified for community use by analysis of the extensive data sets which had been accumulated by the US/UK Cross-national Diagnostic Project. Two forms of the community version are now in use: GMSA, which includes the assessment of all the major mental illnesses; and GMSB, which is used to assess only dementia and depression.

An interview for an informant, the History and Aetiology Schedule (HAS), which facilitates the collection of reliable data concerning the onset of the illness, family history, history of physical illness, risk factors for dementia, alcohol consumption and behavioural disorders, the Social Status Schedule (SSS) and the Secondary Dementia Schedule (SDS) to satisfy the NINCDS-ADRDA criteria (McKhann et al. 1984) were developed as the need arose and now form an integral part of the procedures.

The reliability of the measures has been assessed in a number of studies (Copeland et al. 1976; Henderson et al. 1983; Hooijer et al., in press) and found to be satisfactory.

AGECAT, the Computerized Psychiatric Diagnosis, Description and Validity

The standardization of the diagnostic process was introduced with the development of the AGECAT computerized differential diagnosis (Copeland et al. 1986; Dewey and Copeland 1986). This was developed as a decision tree method using clinical judgement and later tested against the extensive inpatient and community data sets.

Briefly, GMS-AGECAT condenses the items of the GMS into 157 symptom components and then divides these into "clusters" according to their importance for determining levels of diagnostic confidence on the diag-

nostic syndromes. There are eight syndromes, which start with organic states and proceed to schizophrenia/paranoid, mania and depression and then to the neurotic states, obsessional, hypochondriacal, phobic and anxious. All subjects are allotted to one of six levels of confidence of diagnosis on each of the eight syndromes, thus both the main and co-morbid syndromes are recorded. Psychiatrists seem to choose levels 3, 4 and 5 as case levels and levels 1 and 2 as subcase levels. In the second stage, GMS-AGECAT compares each of the levels one with another according to the hierarchy given above to emerge with a principal diagnosis, a subsidiary if appropriate, an indication of whether the diagnosis was a difficult one to resolve, for example, where a subject may score level 4 for organic disorders and level 4 for depression. At this stage the diagnosis is only a syndrome diagnosis, and level 3 and above is taken as representing case level, although investigators are free to choose whichever confidence level best suits their study.

The first set of validity studies was used to compare AGECAT-generated diagnoses against those of psychiatrists made on the same subjects (Copeland et al. 1986). Some modifications were made and the studies repeated (Copeland et al. 1988). Agreement proved satisfactory. Kappa values for organic states reached 0.80–0.88 and those for depressive states from 0.76 to 0.80.

Validation of GMS-AGECAT by outcome has now been reported and this will be discussed below as part of the results of the longitudinal studies.

HAS-AGECAT takes the diagnostic procedure one stage further. It aims to distinguish between delirium and dementia and to make a clinical distinction between the different types of dementia as well as recording the presence of some putative risk factors and a range of abnormal behaviour. It separates bereavement from depression and attempts to identify life-long intellectual impairment. Validity studies are at present in progress.

GMS-AGECAT has been compared with DSM-III diagnoses for dementia and depression made by psychiatrists on the same patients, showing good overall agreement (Copeland et al. 1990).

Assessing the severity of dementia is important and it is clear from the studies undertaken that the levels of confidence of diagnosis equate closely with severity levels as far as both dementia and depression are concerned.

The Problem of Psychological Tests in Epidemiology

Many investigators feel the need for a battery of psychological type tests for assessing dementia. However, such tests present serious difficulties, as they are particularly susceptible to both educational and cultural influences. The latter is such a major problem as to render tests used in the West unsuitable for use in other countries. Also the success of psychological tests has so far not been convincingly demonstrated in the areas where they would be expected to have their greatest use, namely in the early recognition of disease and in the differential patterning of deficits over time, which might lead to the recognition of different subtypes of dementia. As a consequence, although we have used psychological tests in most of our

studies, we have never included them as part of the package, preferring to allow investigators to use those which they find most fitting for their individual purpose.

The Problem of Mild Cases of Dementia

Another problem is that of so-called mild cases. Some investigators seem to call any subject who is slightly cognitively impaired a "mild case" of dementia. Such "cases" often do not progress and hardly fulfil the usual criteria for dementia. Some studies report large proportions of mild cases which could not possibly be the precursors of the small proportions of actual cases found. It must be borne in mind that even young adults make errors of inattention and memory when performing psychological tests, and that the results of such tests are affected by mood changes, drug and alcohol overdosage, distractions caused by ward staff and well-meaning relatives, physical conditions such as minor febrile illness, pain, deafness, failing sight and institutionalization. Given these sources of inaccuracy, it is surprising that many older persons perform as well as they do on these tests. It does make minor degrees of apparent cognitive impairment difficult to interpret and cases of early dementia difficult to identify on cross-sectional testing. Follow-up studies are usually essential. We report below on the outcome of subcases of organic states as part of the findings of our longitudinal studies in Liverpool.

Earlier Studies

The London/New York Comparisons

In the original US/UK Diagnostic Project study of random samples of 396 subjects in London and 455 subjects in New York aged 65 and over (Gurland et al. 1983), it was reported that whereas the levels of depression were not significantly different in the two cities, levels for dementia were twice as high in New York. Later, Copeland et al. (1987a) applied AGE CAT diagnosis to the original CARE schedules (incorporating a shortened version of the GMS) and confirmed the levels of dementia (New York, 8.4%; London, 4.3%). The levels were higher in New York for each half decade of life after the age of 65, for each level of diagnostic certainty on the organic syndrome, and for five out of six of the separately drawn random samples. The subjects were followed up at 1 year to confirm diagnosis and to demonstrate that the differences had not been caused by high death rate or institutionalization amongst the dementias in the London sample. The types of dementia were not recorded, but the prevalence of stroke in the sample was the same in both cities. No clear explanation has so far been forthcoming for this result.

Liverpool Studies of Continuing Health in the Community

In 1987, Copeland et al. (1987b) reported the prevalence of mental illness in their first Liverpool sample of con-

tinuing health in the community. This study consisted of a random sample of 1070 subjects aged 65 and over obtained from updated general practitioner lists and interviewed using a community version of the GMSA, simple psychological tests and demographic data. A proportion of the subjects was followed up at 1 year by psychiatrists, during which a physical examination and blood tests were undertaken and a further proportion of doubtful or uncertain cases of organic disorder received computed tomography. Three years later the sample was re-interviewed by psychiatrists in training using the GMS, the HAS and SSS. AGE CAT diagnoses were reported. At year 3 (Copeland et al., to be published), 83.3% of all organic cases (organic level 3 and above) had either died or were still demented; 11.9% had recovered and presumably had been in an acute confusional state at year 0. (The HAS had not been available for use at year 0, so it was not at that time possible to differentiate organic states further.) Of the organic subcases (levels 1 and 2) 41.7% were either dead or demented, although 47.2% had recovered. One case and two subcases had become cases of depression. These figures produce some validation of the AGE CAT organic syndrome according to outcome.

Levels of organic disorder in Liverpool were reported at 5.2%. When these subjects were followed up at year 3, however, it was possible to identify a number of subjects whose organic illness had not progressed to dementia. The figure for dementia at year 0 was re-assessed at 4.3%, identical to that found in London using the AGE CAT diagnosis. The figure for AGE CAT dementia in a rural random sample of 319 subjects aged 65 and over living in Nantwich and followed up in order to confirm diagnosis was 3.8% (Copeland et al., to be published).

There was a monotonic relationship between mortality and the AGE CAT confidence levels for organic disorders in the Liverpool study (Davidson et al. 1988). This sample was further interviewed at year 6, when incidence cases of organic disorder identified at year 3 were confirmed as dementing. An overall figure for the incidence of dementia in Liverpool was assessed at 9.2 per thousand per year, and using the HAS an attempt was made to derive incidence figures for subtypes, 6.2 for Alzheimer type dementia, 2.0 for multi-infarct dementia and 1.0 for alcohol-related dementia, per thousand per year. The incidence rate per thousand subjects for all dementias for those aged 65–74 was 2.8; for those aged 75–84, 11.9; and for those aged 85 and over, 29.2.

Studies in Progress

The GMS and some of its associated interviews have been translated into over 20 languages, as need arose. Many studies using these measures are ongoing. Below we report some of the larger investigations.

MRC-ALPHA Study

The Ageing in Liverpool Project-Health Aspects (ALPHA) is a Medical Research Council (MRC) supported study of 6000 elderly subjects which has been underway

since the summer of 1989. This 5-year longitudinal project is designed to estimate the age- and sex-specific incidence rates of dementia by subtype in those aged 65 and over living in the community. Additional objectives include elucidating the natural history and course of dementia and exploration of the relationship between clinical, psychological, brain imaging and neuropathological measures.

Centralized family practitioner committee records have been used to provide a sample frame, which includes all people aged 65 and over living within the city boundary area who are registered with a general practitioner. This includes individuals resident in institutions within the study area with the exception of those in long-stay hospital beds. A stratified random sample of sufficient size to yield 500 interviews in six 5-year age bands for each sex has been identified. Each subject will receive a core assessment at a minimum of two points in time separated by an interval of 2 years.

Laptop computers are employed for presenting the interviews to the interviewer and for data collection using a computerized questionnaire administration system developed and tested in the 6-year follow-up of the Liverpool Study of Continuing Health in the Community. This technique possesses considerable advantages over traditional paper and pencil methods employed in epidemiological studies and provides a cost-effective means of improving efficiency and quality control (Saunders and Glover 1990).

The core assessments are undertaken by trained nurses and include the GMS (community version A2), MMSE (Folstein et al. 1975) and a Basic Data Schedule which collects demographic details, social information including social support network type, putative risk factors for dementia and alcohol-related data. Prevalence and incidence rates for dementia and other psychiatric conditions will be based upon AGECAAT diagnoses from these core assessments received by the whole sample.

Additional in-depth assessments are being undertaken on selected subjects amounting to 20% of the sample. Selection criteria are based on AGECAAT organic syndrome levels recorded at the core interview and include all subjects achieving case level on the organic syndrome together with a random sample of subcases and individuals with no organic syndrome level. The first stage consists of a psychiatrist-administered interview and informant history using the full GMS-HAS-AGECAAT package providing further refinement of AGECAAT diagnoses in addition to clinical diagnoses according to DSM-III-R, ICD-10 and NINCDS-ADRDA criteria. Subsequent stages include detailed social network or psychological assessments and, where appropriate, neuroradiological and post-mortem investigations.

MRC Multi-site Study

The Liverpool ALPHA study now forms part of the subsequent MRC multicentre study on cognitive function and ageing. This consists of additional centres at Cambridge, Newcastle, Nottingham and Oxford. The Cambridge sample is a rural one, the others urban. In addition,

Liverpool will be co-ordinating a rural sample in Gwynedd. The data centre for the project is the MRC Biostatistics Unit at Cambridge, and the fieldwork coordination centre is Liverpool. Each of the additional samples will consist of 2500 interviewees contacted through general practitioner lists. The screening stage will be based on the AGECAAT organic level and the MMSE. Approximately 20% of the subjects will proceed to an assessment phase, in which the GMS, HAS and CAMCOG (Roth et al. 1986) will be administered. As in the ALPHA study, the entire sample will be re-screened 2 years later.

Zaragoza-Liverpool Study

The Zaragoza group (Lobo et al. 1990) has completed the interviewing of the sample of 1080 subjects using the GMS in the first phase, with GMS and HAS given to the putative cases in the second phase. Their analysis is proceeding. The group have plans for an incidence study as part of the EURODEM project (see below).

Pan American Health Organization Study

The Pan-American Health Organization is co-ordinating a series of studies in Santiago, Buenos Aires and Havana. This group is also using a two-stage design, in this case using the MMSE in the first phase, and the GMS in the second phase. The Chilean group have interviewed 468 people in the first phase, and 69 passed to the second phase. Analysis is proceeding. The Cuban group have interviewed 1630 people in the first phase, and data collection proceeds. The Argentinian group is still proceeding with phase 1 of their section of the study.

An extensive series of studies are being conducted by the group based at the University of Melbourne, into mental illness associated with institutional care.

The EURODEM Studies

The EURODEM concerted action based at the Department of Epidemiology, Erasmus University, Rotterdam is co-ordinating a series of incidence studies using the organic section of the GMS in the first phase. These include the MRC multi-centre study named above and that of the Zaragoza group. In addition a Portuguese group is preparing a similar study.

Two World Health Organization Multi-site Studies

Two multi-site studies are being conducted by the Division of Mental Health, World Health Organization. The first is a collaborative study on the development of evaluation instruments for the assessment of dementia. Centres include Kuopio, Gothenberg, Sofia, Moscow, Montreal, Madras and Liverpool. Samples of patients attending hospital are screened for possible dementia and then fully investigated in the usual way. In addition, a trained non-medical interviewer administers the GMS, additional cognitive items and the GBS Scale (Gottfries et al. 1982).

to the subjects, the HAS to an informant, and fills in the SDS. Diagnosis is made by GMS-AGECAT and HAS-AGECAT, and in addition ICD-10-AGECAT and NINCDS-ADRDA criteria for comparison with psychiatric diagnosis. Special attention will be given to the success of the non-medical interviewers' measures and computerized diagnosis in identifying and categorizing dementia and the value such measures should have when informed medical staff may not be available for research and clinical work. The influence, if any, of culture and education on the measures will be assessed and their sensitivity and suitability for use in multi-site psychopharmacological studies.

The second study is the WHO multi-site epidemiology study of the dementias and cognitive decline in older age. The collaborating centres include Madras, Ibadan, Jerusalem, Sao Paulo, Montevideo, Singapore, Hong Kong, Seoul, Beijing, Toronto, Edmonton, Zaragoza and Liverpool. Each centre contributes 1000 subjects randomly selected in the community who are interviewed by trained non-medical interviewers using the GMS as the principal interview schedule. Selected subsamples receive the HAS administered to an informant by a psychiatrically trained medical doctor. Comparison of diagnosis will be made using ICD-10-AGECAT, DSM-III-R-AGECAT and HAS-AGECAT. Of particular importance will be a comparison of the levels of dementia and cognitive impairment in the different populations and the influence of cultural factors on the results from the existing interviews. Modifications may be necessary to these interviews as a consequence of the studies. It is intended to re-interview the samples 2 years later in as many centres as possible in order to assess incidence levels for dementia. Interviewers for both studies have received training in the measures at the Department of Psychiatry and Institute of Human Ageing, University of Liverpool.

Conclusion

The reliability studies and, more importantly, the validity studies against psychiatric diagnosis in well over a thousand subjects and the validity by outcome indicate that the GMS-HAS interviewers successfully achieve their purpose and that the AGECAAT diagnosis can be relied upon as a satisfactory, and at least more consistent, alternative to psychiatrists' diagnosis. It is its very consistency which in our view makes it, up to now, unique for comparative epidemiological work. Its presentation on laptop computer makes for a considerable saving in costs and time. The use of these instruments and computer diagnosis obviates the need for expensively trained professional interviewers and allows the old-fashioned two-stage epidemiological technique with all its disadvantages to be either abandoned, or modified in order to maximize the collection of additional data. The fact that so many studies have now adopted these procedures will allow extensive data sets from many sources to be confidently compared for the first time.

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