3 Method

3.1 Setting and design

3.1.1 Setting

All data came from Evangelisches Geriatriezentrum Berlin (EGZB) during January 2003 to December 2004. EGZB is one of geriatric centers in Germany. The clinical department is operated by a multidisciplinary team including geriatricians, neuro-psychologists, physiotherapists, occupational therapists, specialists of speech, voice and deglutition, nutritionists, social workers, nurses and administrative workers. The number of patients treated at EGZB is around 2500 annually. About 80% patients were transferred from other speciality hospitals for further geriatric treatment and early rehabilitation of physical functions. The average age of patients was 76.8±10.0 years. One of the apparent characteristics of the patients in EGZB is that most of them had an extensive range of multiple functional deficits and suffered from multiple medical conditions and some of them were in the severe and terminal medical stages. These patients needed comprehensive interventions for acute medical conditions as well as early rehabilitation of various physical functions.

3.1.2 Design

This is a two-year retrospective study based on medical records in a clinical setting.

3.2 Data collection

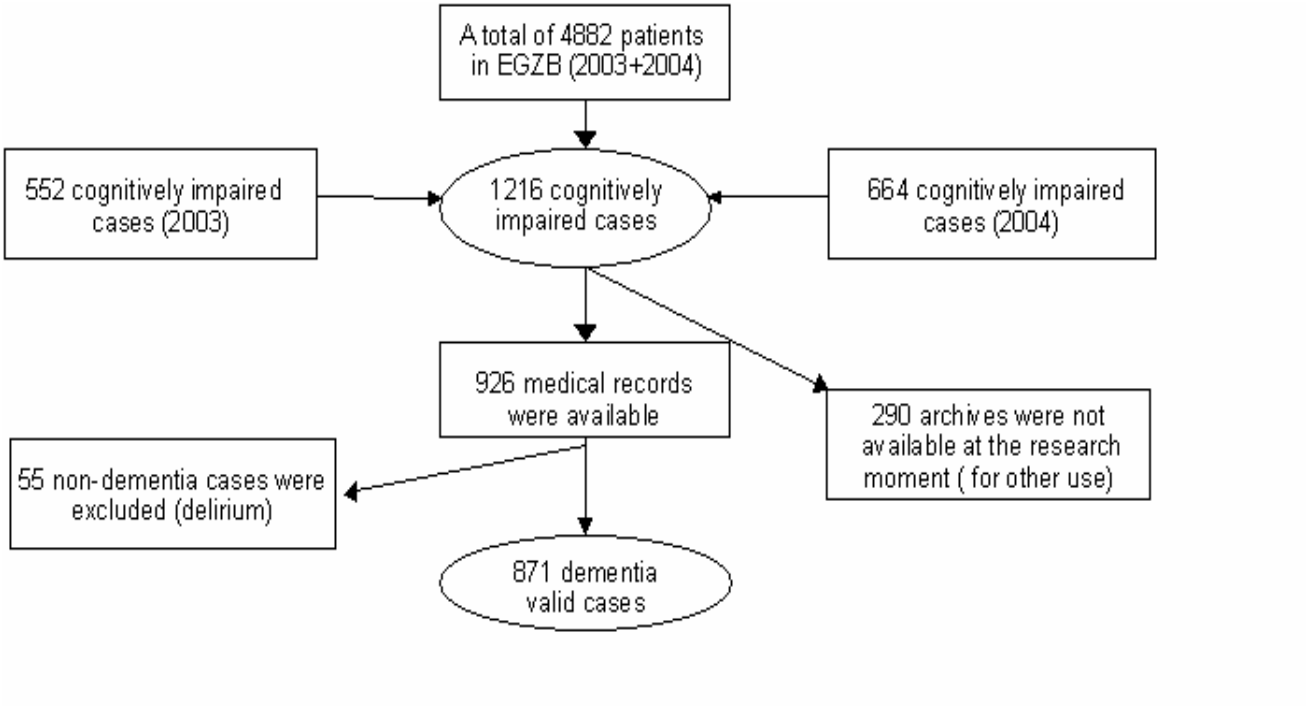
3.2.1 Method

A total of 926 Medical records that met ICD-10 [147] criteria for clinical diagnosis of cognitive impairment were reviewed systematically and according to a research protocol designed to extract the socio-demographic data, clinical features, cognitive, physical functional measures and basic ADL measures for the present study. All data were analyzed by statistical software package of SPSS (12 Version). Descriptive statistic, univariate correlation, Pearson partial correlation, multiple regression, one-way ANOVA, crosstabs Chi-Square test, Mann-Whitney U test and 2 Independent Samples T test, were performed to analyze the data.

3.2.2 Case validation procedure

Out of a total of 4882 patients treated at EGZB from January 2003 to December 2004, 1216 cases were diagnosed to have clinical cognitive impairment according to the ICD-10 criteria for clinical diagnosis of cognitive impairment. During the study 926 medical records were available and remains 290 medical records were used for other purposes. Of 926 cases, 55 cases were excluded due to cognitive impairment attended by delirium and other medical conditions. A total of 871 cases met the ICD-10 criteria for clinical diagnosis of dementia. All 871 medical records were reviewed systematically. Case validation procedure is showed in Figure 1.

Figure 1. Cases validation procedure



3.2.3 Data collecting procedure

Each medical record consists of a medical history, physical examination (including systematic neurological examination), basic geriatric assessment, neuro-psychological assessment, physiotherapy assessment, occupational-therapy assessment, nutrition assessment, social work and nursing records. This was completed by geriatricians, neuro-psychologists, physiotherapists, occupational therapists, nutritionists, social

workers and nurses during the patients' stay in the hospital. Fairly detailed information about the functional assessment of patients with dementia was available for the present study. All the data used in the present study were extracted through the use of a designed research protocol.

3.2.4 Diagnosis process

The clinical diagnosis of dementia and its subtype were established through a comprehensive evaluation by both geriatricians and neuro-psychologists by using the German version of ICD-10 criteria for clinical diagnosis of dementia during the patients' stay in the hospital.

3.3 Measurements used in the present study

3.3.1 Cognitive function and depressive symptom

1. Mini Mental State Examination (MMSE): MMSE is one of the most widely used screening instruments of cognitive function. The MMSE served as a brief global cognitive measurement. Quantitative estimates of presence and severity of cognitive impairment were made by screening seven domains of cognitive functions: time orientation (5 points), spatial orientation (5 points), and registration of three words (3 points), attention and calculation (5 points), recall of the three words (3 points), language (8 points), and visual construction (1 point). The score is the sum of all the correct answers and ranges from 0 to 30. The lower score indicates more severe cognitive impairment, the higher score indicates the better cognitive function. A score of less than 24 indicates the presence of cognitive impairment. The MMSE can be administered in 5 to 10 minutes and has been demonstrated to have a high validity (r=0.68-0.96) and reliability (r=0.80-0.95) [35, 96,119]. In the present study, cognitive impairment was classified into four different levels of very mild, mild, moderate and severe cognitive impairment according to the MMSE scores of ≧ 24, 18-23, 11-17, and less than 11 respectively [33,80,137].

2. The Geriatric Depression Scale (GDS): GDS used in the present study is the shortened version of the Geriatric Depression Scale (15-item). It is a self-rating inventory that assesses the presence of depression in the elderly. It is administered to patients by a neuro-psychologist. Each item scored 1 point and the maximum score is 15. The higher

score indicates severer depression. The GDS is standardized specifically for the elderly population [136].

3.3.2 Mobility measurements

1. Timed “up and go” (TUG): TUG is a basic test of mobility. Patient sits in a standard armchair (approximate seat height of 46 cm, arm height 65 cm), the back straight against the chair-back, resting both arms in natural position at the sides. A walking aid could be used if necessary. After being asked to start walking, the patient stands up and starts walking at normal pace in a straight line. The time taken by the patient to stand up from the armchair and walk a distance of 3 meters (approximately 10 feet), turn, walk back to the chair, and sit down again is measured in seconds. The mobility of patients in the present study is classified into five different levels of: walking normally, walking with mild problem, walking with moderate problem, walking with severe problem and unable to walk according to the TUG test. The corresponding time in seconds: less than 11, 11-19, 20-29, more than 29 second, not possible to test. It has been proved that TUG is a reliable and valid test for quantifying functional mobility (interrater reliability r=0.96) [94,137].

2. Tinetti-Balance-Test: Tinetti-Balance-Test is used to measure the ability of a patient to maintain body balance on a support. For good balance, multiple systems must interact flawlessly and automatically, providing accurate and exact information to the nervous systems. Tinetti-Balance Assessment Tool is a simple test to administer that measures a patient’s ability of sitting balance, arising, immediate standing balance, feet side-by-side standing balance, standing with eyes closed, turning 360º, nudged, and sitting down. Eight items are scored with a scale of 0 to 4. A score of 0 represents the highest degree of impairment, while a score of 4 would represent independence of the patient. Maximum balance assessment score is 16 points [94,123,137].

3. Tinetti-Gait-Test: Tinetti Gait test is a standardized performance-oriented assessment of gait. Different aspects of gait performance are systematically observed while the patient is walking. This includes initiation of gait, step height, step length, step symmetry, step continuity, path, trunk, walking stance. These 8 items of the performance are rated 0-2 each, the maximum overall score is 12 [32, 94,137]. The higher score indicates the better gait performance.

4. Tinetti-Total: Tinetti-Total is a sum score of Tinetti-Balance and Tinetti-Gait. It has been regarded as a predictor of falls in elderly people. A total score of less than 18 indicates a high risk of falls, 19-23 indicates moderate risk of falls, and equal or greater than 24 indicates a low risk of falls [94,108,137].

3.3.3 Basic Activities of Daily Living (ADL)

1. Barthel Index (BI): The Barthel Index is used to assess the ability to independently perform the basic activities of daily living in 10 different self-care domains (eating, bed to chair transfers and back, grooming, toilet use, bathing, mobility, climbing stairs, dressing, stool control, bladder control) [70]. Each domain is rated on a scale of 0, 5, 10 or 15 (dependent, partial dependence, needs some help to be independent, or independent, respectively). Participants scoring 100 are regarded as independent, and those scoring between 85 to 95 need some help to be independent, those scoring between 60 to 80 are partially dependent and a score of less than 55 that the patient is dependent [31,137]. It is a performance-based measurement carried out by nurses when the patients are admitted to and discharged from the hospital. The data used in the present study were obtained at discharge. It is more objective and reliable in reflecting to a patient's ability to perform the activities of daily living.

3.3.4 Comorbidity and medication use

1. Total number of coexisting medical conditions: According to literatures, a variety of assessment techniques have been used for measurement of comorbidity, however, the most basic measurement of comorbidity is the total number of coexisting medical conditions [129]. So in the present study, comorbidity was measured on the basis of the total number of coexisting medical conditions according to the German version of ICD-10 code (including both medical diseases and medical conditions), because for geriatric patients, medical diseases and medical conditions are equally important [129]. Comorbidity in the present study was more objective and accurate, since all the medical conditions were coded by geriatricians, neuro-psychologists, and nurses during the patients' stay in the hospital. Comorbidity data is therefore less dependent on the information provided by dementia patients.

2. Total number of medication taken: In the present study the amount of medication use was simply measured by counting the total number of medications taken by the patients as prescribed by physician at the time of discharge, the poly-pharmacy was defined as the use of more than five medications daily for more than two weeks [134,145].

3.4 Valid and missing data

3.4.1 Barthel Index

Of 871 valid cases, 858 (98.5%) cases were assessed by Barthel Index at the time of discharge. For the distribution of BI score see Figure 3 and for details of the task score see Table 6.

3.4.2 Mini Mental State Examination (MMSE)

Of 871 valid cases, 607 cases had complete MMSE assessment and 264 cases lack a MMSE score. Of these, 66 patients had dementia that was too severe to be tested, 143 cases were in critical or poor medical conditions which made the testing impossible. 55 cases lack a MMSE score for medical reasons. We assigned the 66 severe dementia cases into the severe dementia group with MMSE score less than 11. A total of 673 (77.3%) cases had a valid MMSE score. However, of 871 valid cases, only 352 (40.4%) cases were successfully assessed by the Geriatric Depression Scale (GDS) due to the fact that a large number of patients had advanced cognitive impairment (difficulty to understanding the questions) and were in poor medical conditions. The explanations of missing data of MMSE are given in Figure 2.

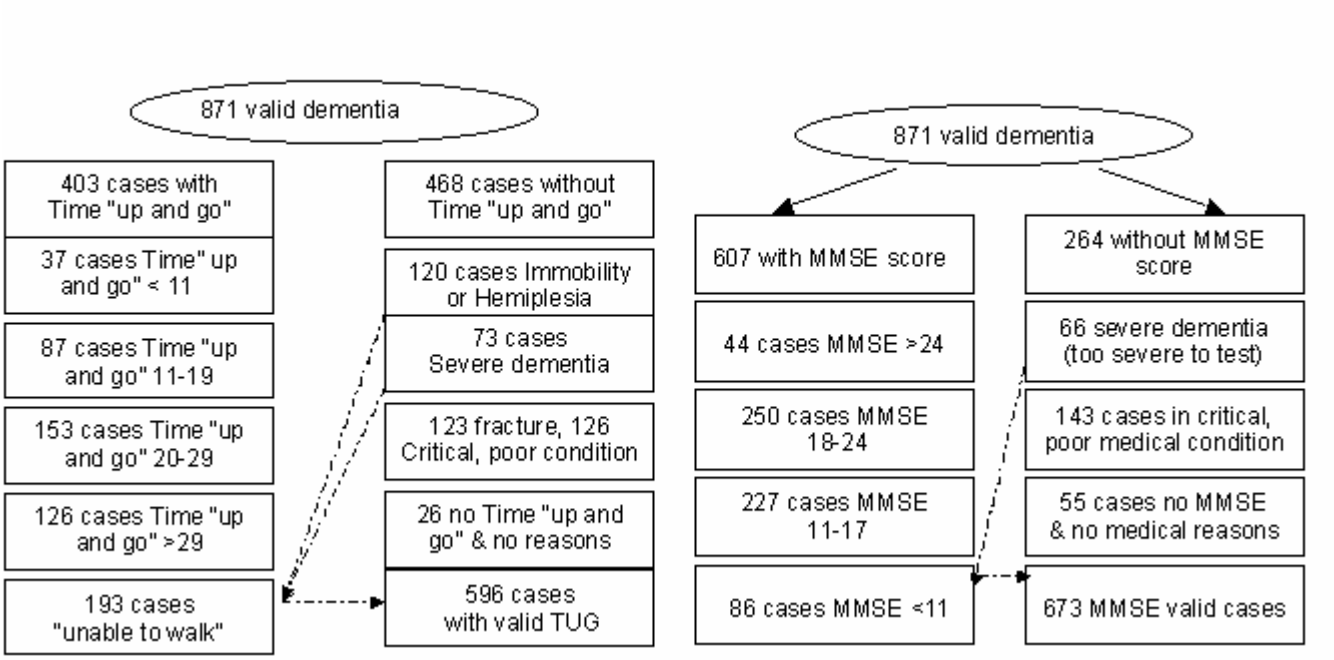
3.4.3 Timed"up and go" (TUG)

Of 871 valid cases, 403 cases completed the TUG assessment and 468 cases lack of TUG, of which 120 cases were immobility or hemiplegia cases, 73 dementia cases were too severe to be tested, 123 cases were fracture cases, 126 cases were in a critical or poor medical condition, which made the TUG assessment impossible. Another 26 cases were without TUG and without medical reasons. We classified immobility, hemiplegia and severe dementia patients into "unable to walk" subgroup because this subgroup of patients had lost the ability to walk permanently. A total of 596 (68.4%) cases had valid TUG. The explanations of missing data of Timed "up and go" are given in Figure 2.

3.4.4 Tinetti Total test

Of 871 valid cases, 607 (69.7%) cases completed the Tinetti Balance Test, 601 (69%) cases completed the Tinetti Gait Test, and 606 (69.6%) cases had Tinetti Total score. The reasons for missing data of Tinetti Total Test are similar to those for the missing data of TUG assessment.

Figure.2 The explanations of missing data of MMSE and Timed “up and go” assessment



3.5 Groups of patients covered by the present study

3.5.1 Dementia subtype group

According to the clinically confirmed diagnosis of Alzheimer’s disease (AD), vascular dementia (VD) and dementia syndrome (DS), the cases were classified into three dementia subtype groups. Dementia syndrome subgroup included all other types of dementia and some later-stage, dementia cases of unclear origin.

3.5.2 MMSE group

According to the MMSE score of more than 24, 18-24, 11-17 and less than 11, dementia cases were classified into very mild, mild, moderate and severe cognitive impairment subgroups [137]. In order to better use the available data, in the present study, cognitive function measurement (MMSE) was using the MMSE category in stead of MMSE original

score, which included 66 dementia cases that were too severe to be tested. From the MMSE category 1 to 4, the lower MMSE category indicates better cognitive function and the higher MMSE category indicates the worse cognitive function.

3.5.3 Barthel Index group

According to the Barthel Index scores of 0-55, 60-80, 85-95, and 100, the cases were classified into basic ADL dependent, partial dependent, need some help to be independent, independent subgroups, respectively [137].

3.5.4 Timed “up and go” group

TUG performance classification is based on the following times: less than 11 seconds, 11-19, 20-29, and more than 29 seconds and unable to walk. The corresponding performance definitions are: walking normally, walking with mild problem, walking with moderate problem, walking with severe problem and unable to walk subgroups [137]. In order to better use the available data, in the present study, mobility measure (TUG) was using TUG category in stead of TUG original score. From TUG category 1 to 5, the lower TUG category indicates the better ability to walk and the higher TUG category indicates the worse ability to walk.

3.5.5 Tinetti-Total group

According to the Tinetti-Total score of less than 18, 19-23, more than 24, the cases were classified into high, moderate and low risk of falls subgroups [94,108,137].

3.5.6 Age group

The patients were classified into five age subgroups of less than 65 years old, 65-74, 75-84, 85-94, older than 95 years old.

3.5.7 Comorbidity group

A total of 871 dementia cases were classified into five comorbidity subgroups according to the total number of coexisting medical conditions of 1-5, 6-10, 11-15, 16-20, >20.