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Hospitalisation and comorbidities in Parkinson's disease: A large Australian retrospect study

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5.0 CHAPTER 5 – METHODS

5.1 Study And Comparison Samples

The NSW Ministry of Health maintains a database, the Admitted Patient Data Collection (APDC), on all separations from public and private hospitals in NSW. All admission diagnoses are grouped according to the ICD-10 AM (International Classification of Diseases, Tenth Revision) Chapter headings. (60) In this study, all patients with either a principal diagnosis of Parkinson’s disease or a co-morbidity recorded as Parkinson’s disease (ICD-10-CM G20) who were separated from a NSW hospital (public or private) between the years 2008 and 2012 were included in the study sample.

Demographic and clinical characteristics of patients in the study sample were compared to those of a comparison group, which was comprised of a randomly selected sample of inpatients who did not have a code for Parkinson’s disease in any diagnostic field and was weighted according to the age and gender profiles of patients with Parkinson’s disease in the Australian population. (21) An in-depth discussion of the difficulties in selecting the comparison group is provided below in Chapter 6, section 6.2.

As the data was non-identifiable, with no patient names or addresses included, no patient consent was obtained. The study was approved by the University of Notre Dame, Human Research and Ethics Committee.

5.2 Inclusion / Exclusion Criteria

A number of inclusion and exclusion criteria were used to select a subset of admissions into the final samples that were used in the analysis.
5.2.1 Parkinson’s Disease Patients

All patients separated from a NSW hospital (public and private) between 2008 and 2012 with a diagnosis of Parkinson’s disease (Idiopathic Parkinson’s disease (ICD-10-CM G20)) as either the principal diagnosis or as a co-morbid diagnosis were selected into the study sample.

5.2.2 Random Sample Comparison Group

A randomly selected sample of patient records relating to admissions for any principal diagnosis other than Parkinson’s disease and without any recorded co-morbid diagnosis of Parkinson’s disease in 2008, representing 25% of all the admissions in that time period, was chosen as the comparison group. This sample selection was weighted according to the age and gender distribution of the most recent prevalence data of Parkinson’s disease in Australia. (21) The gender ratio was 1.10:1, male to female respectively. (21)

The proportions of each age group in comparison sample were: 6% - < 55 year olds, 12% - 55-64 year olds, 29% - 64-74 year olds, 33% - 75 – 84 year olds, and 20% - > 85 year olds.

5.2.3 Exclusion Criteria (Cases)

Admissions with other diagnoses of Parkinsonism, including atypical Parkinson’s disease, secondary Parkinson’s disease or Parkinson’s Plus Syndromes were excluded. Patients admitted for the purposes of inpatient rehabilitation, psychiatric treatment and dialysis were also excluded.

5.3 Sample Size Calculation

A power calculation determined that a sample size of 480 in each group (Parkinson’s disease patients and comparison sample) would have 80% power to detect a difference of 20% for a
given outcome variable (yearly admissions with pneumonia in Parkinson’s patients versus comparison sample) between the groups with an alpha level of 0.05.

5.4 Clinical Features For Investigation

The data requested from the APDC from the NSW Ministry of Health are described below. The subjects for inclusion in the study sample were defined as having idiopathic Parkinson’s disease as principal or co-morbid discharge diagnosis from any admission to a NSW public or private hospital from all admissions between 2008-2012 inclusive. The demographic variables that were included were: age, sex, marital status, health insurance status and country of birth. Admission details were also requested, which included: length of admission (inpatient stay), and whether the patient was classed as a private or public admission. The type of admission was also requested, including whether the admission was elective (planned); through an Emergency Department; whether it was a readmission (defined as less than two weeks from discharge from hospital).

The reasons for admission for both a principal and secondary diagnosis of Parkinson’s disease were also requested. Variables of significant clinical interest included: motor complications / reduced mobility, falls / fractures, pneumonia / aspiration pneumonia, cardiac issues / acute myocardial infarction / heart failure, syncope / orthostatic hypotension, genitourinary infections, gastrointestinal issues / constipation, encephalopathy / delirium / drug induced psychosis / psychosis, cancer / neoplasia, stroke / transient ischemic attack, dementia without psychosis, elective surgery / Deep Brain Stimulation, haematological disorders, venous thromboembolism / pulmonary embolism / deep vein thrombosis, chronic airflow limitation / chronic obstructive pulmonary disease, psychiatric problem / depression / anxiety, sleep disorders / restless leg syndrome, spinal arthritis / back pain, general medical problems, miscellaneous admissions and day procedures.

Treatment options including, use of Electroconvulsive Therapy during inpatient stay as well as Incident Information Management System / errors / notifications / medication errors during
admission. Surgical procedures performed during admission including, all coded procedures available, of clinical interest: Deep Brain Stimulation.


Discharge destination: inpatient / in hospital death, transfer to other hospital, inpatient rehabilitation, nursing home, home, other.

5.5 Development Of A Clinical Diagnosis From The International Classification of Diseases

From these ICD-10 Chapter headings, (60) our research project required appropriate clustering of diagnoses according to the clinical conditions related to Parkinson’s disease. As an example, cardiac diseases included myocardial infarction (I21) and conduction disorders (I44). Orthostatic hypotension (I95) and syncope and collapse (R55) were classified individually due to their specific relevance to Parkinson’s disease. Deep Brain Stimulation insertion was represented by procedure codes: 92036 (insertion of intracranial electrode via burr holes) and 39138 (insertion of intracranial electrode via craniotomy).

ICD coding also was able to demonstrate the type of allied health utilisation patients encountered during the admission, if any. Common ICD procedure codes for allied health intervention included, Physiotherapy (95550-03), Speech Pathology (95550-05) and Occupational Therapy (95550-02).

5.6 Statistical Analysis

The statistical analysis for this project was conducted using the SPSS – 20 software package. (61). A number of statistical approaches were undertaken as part of a very comprehensive analysis of the data. The results are presented as frequencies for dichotomous variables and as means or medians for continuous variables. Differences in the distribution of continuous variables between the groups were assessed using the two-sample t test for independent
variables. Where the data were highly skewed, such as the length of the inpatient stay, the Mann–Whitney U test was used to compare the distribution of the particular variable between the groups. $\chi^2$ tests were used to compare differences between categorical variables.

5.7 Statistical Modelling

Statistical modelling was undertaken to explore differences in admission outcomes for patients with Parkinson's patients as a primary diagnosis compared with patients whose Parkinson's patients was recorded as a secondary diagnosis. A similar approach was also used for patients in the Parkinson's patient group compared with patients in the comparison sample. The modelling allowed for determination of the influence of a number of predictor variables considered simultaneously on the outcome under consideration. In particular, the modelling was used to assess whether the effect of a particular variable persisted after controlling for the effect of other factors, such as age, gender, marital status, hospital type and LOS, on the outcome of interest. A 5% level of significance was used for all analysis within our study.

5.7.1 Purpose Of Statistical Modelling And Consideration Of The Model

Where several variables were significantly associated with the outcomes of interest in the study on bivariate analysis, statistical modelling was used to determine the effect of each of these variables after controlling for the effect of other variables that were predictive of a particular health outcome. As the outcome variables were dichotomous, logistic regression models were developed. To assess the influence of comorbidities on these outcomes, other predictor variables (such as age and sex) were forced into the model. The decision to include each comorbidity variable at each step was based on the Wald statistic, with $p < 0.05$ chosen as the cut off for statistical significance.

A series of logistic regression models were also constructed to evaluate differences in the presence of various health problems between the entire Parkinson’s disease sample and the
comparison group. Models investigated differences in a number of comorbidities, after controlling for the demographic variables including age, gender, marital status, hospital type and LOS.

5.7.2 Logistic Regression

The logistic method assumes that for each observation, the outcome variable is dichotomous and can take the value of 1 or 0 ("success" or "failure"). If we let $\mu$ represent the probability of "success" then the logit of $\mu$ (the log odds of "success") can be expressed as a linear combination of the explanatory variables. For $p$ explanatory variables ($\chi_1,...,\chi_p$), the model has the form:

$$\log \frac{\mu}{1-\mu} = \beta_0 + \beta_1 \chi_1 + \beta_2 \chi_2 + \beta_3 \chi_3 + ... + \beta_p \chi_p$$

where the coefficients ($\beta_0,...,\beta_p$) represent the coefficients to be estimated. The error distribution is assumed to be binomial.