Exploring the cost effectiveness of the specialist Parkinson’s disease nurse position in the Mid North Coast Local Health District of New South Wales

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- The NSW Government Western NSW Local Health District Business Intelligence Unit and in particular, Dr Hilal Varinli, Manager of Health Outcomes for her expertise in constructing the program logic and data plan for the study.

Reporting Guidelines

To ensure robustness and rigor in the presentation of this report, the authors have followed the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) (Husereau et al., 2013a).
### Abbreviations/Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABF</td>
<td>Activity Based Funding System</td>
</tr>
<tr>
<td>ABM</td>
<td>Activity Based Funding and Management</td>
</tr>
<tr>
<td>AR-DRG</td>
<td><strong>Australian Refined Diagnosis Related Groups:</strong> Diagnosis Related Groups standardised to the Australian Health System</td>
</tr>
<tr>
<td>CHEERS Statement</td>
<td><strong>Consolidated Health Economic Evaluation Reporting Standards:</strong> A current reporting guideline developed to assist researchers reporting economic evaluations (Husereau et al., 2013a).</td>
</tr>
<tr>
<td>Cost-Benefit Analysis</td>
<td>‘An economic analysis in which both costs and outcomes of a program or intervention are expressed in monetary terms and compared’ (Polit &amp; Beck, 2017, p. 724)</td>
</tr>
<tr>
<td>Cost Effectiveness</td>
<td>An assessment or determination of the most efficient and least expensive approaches to health provision and prevention. Referring to an intervention that is considered financially optimal if there is no other available intervention that offers a clinically appropriate benefit at a lower cost.</td>
</tr>
<tr>
<td>Economic Evaluation</td>
<td>Defined in the CHEERS Statement as ‘The comparative analysis of alternative courses of action in terms of both their costs and consequences’ (Husereau et al., 2013b, p. 713)</td>
</tr>
<tr>
<td>HIE</td>
<td><strong>Health Information Exchange:</strong> Database used as reference tool to extract relevant patient information across healthcare sites and institutions.</td>
</tr>
<tr>
<td>IHPA</td>
<td><strong>Independent Hospital Pricing Authority:</strong> ‘an independent government agency established under Commonwealth legislation on 15 December 2011 as part of the National Health Reform Agreement (NHRA) reached by the Council of Australian Governments (COAG) in August 2011’ (<a href="https://www.ihpa.gov.au/">https://www.ihpa.gov.au/</a>)</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<td>-------------------------------------------</td>
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</tr>
<tr>
<td><strong>NWAU</strong></td>
<td><strong>National Weighted Activity Unit</strong>: A NWAU is the unit of measure for pricing healthcare activity used in the Activity Based Funding system, including SNAP. It is a single currency applied to all ABM hospital activity independent of settings</td>
</tr>
<tr>
<td><strong>Non-acute admitted patient care</strong></td>
<td>Support for a patient with impairment, activity limitation or participation restriction due to a health condition not requiring further complex assessment or stabilisation. The care type for non-acute is called maintenance.</td>
</tr>
<tr>
<td><strong>Occasions of Service</strong></td>
<td>Any examination, consultation, treatment or other service provided by a health service provider in a non-admitted setting to a client/patient on each occasion such service is provided.</td>
</tr>
</tbody>
</table>
| **SNAP**                                  | **Sub-acute admitted patient care**: Specialised multidisciplinary care where the primary goal is optimisation of the patient’s functioning and quality of care.  
There are 4 care types for sub-acute admitted patient care:  
- rehabilitation  
- palliative,  
- geriatric evaluation and management (GEM)  
- psychogeriatric |
Executive Summary

Brief background

Parkinson’s disease (PD) is a degenerative, complex and disabling neurological condition with no known cure. The prevalence of PD increases as the population ages with 80% of those with PD over 65 years of age. The high cost to individuals and societies of PD is such that World Health Organisation’s policy frameworks emphasise the need to implement best practice standards ensuring accessibility, quality and sustainability. To date these recommendations have not been implemented in Australia. Attention to best practice standards is particularly needed in regional, rural and remote areas. Limited access to specialist neurological services for people living with PD in rural and regional Australia has been shown to contribute to decreased health-related quality of life.

Parkinson’s NSW partnered with nursing researchers from Charles Sturt University to undertake a staged project. Findings from the integrative literature review (Bramble, Carroll, & Rossiter, 2018) and qualitative evidence (Rossiter, Bramble, Matheson, Carroll, & Phillips, 2019), identified the specialist Parkinson’s disease nurse as the ‘glue’ for the multi-disciplinary team and essential to continuity of care across services. Effective advocacy needs evidence of cost-effectiveness, thus this retrospective cost analysis of the position located in the Mid North Coast Local Health District (MNCLHD).

This study, a collaboration between Parkinson’s NSW, Charles Sturt University and the Mid North Coast Local Health District (MNCLHD), sought economic evidence to support advocacy for specialist Parkinson’s disease nurses in underserved rural and regional locations in Australia.

Contextual Challenges

Prior to this study, hospitalisation data (total PD patient admissions and total length of stay (LOS) from 2013 to 2017) found a decrease in LOS post introduction of the specialist nurse in 2015, compared with the year before. There were indications from the data that LOS decreased for patients who were admitted with a primary diagnosis of PD. The multi-layered and complex nature of the Australian health system presented
significant challenges to identifying total costs associated with people living with PD. Informed by this data and overviews from Deloitte Economics (2011, 2015) this study focused on hospital costs only, as a result of the intervention (specialist Parkinson’s disease nurse).

Research Design

The retrospective analysis compared PD patient outcomes pre and post the employment of the specialist Parkinson’s disease nurse in the MNCLHD. A representative sample was drawn from the target population of people with a diagnosis of PD identified in hospital medical records over a four-year period (2013-2014 and 2016-2017). A multiple regression approach and cost-benefit analysis were used to examine hospital costs related to length of stay.

Summary of Findings

The statistical findings demonstrate a reduction in hospital length of stay post the establishment of the specialist Parkinson's nurse role, thus reducing long term expenditure on hospital costs. Specifically, the cost benefit analysis showed a net dollar benefit, or savings in hospital costs, of up to $8,600.00 per person over a three year period, as a result of the specialist Parkinson's nurse intervention. In addition, the cost-benefit analysis employed across three hospital scenarios resulted in a ratio well above 1.0, supporting the net dollar benefit calculation associated with the employment of the specialist Parkinson's nurse. These cost-benefit ratios ranged from 5.34 to 7.82, significantly outweighing the total hospital cost for PD patient care and further supporting the statistical evidence reported for hospital length of stay.

Conclusions

These findings support advocacy for sustainable specialist Parkinson’s disease nurse positions and can be used to inform and influence policy and systemic changes within the health care system. Further prospective economic evaluation studies in regional and rural areas are essential to demonstrate the total costs of PD to society and the individual and to support sustainability of specialist Parkinson’s disease nurse positions.
Introduction:

In 2017 Parkinson’s NSW partnered with nursing researchers from Charles Sturt University to undertake a staged project. Findings from the integrative literature review (Bramble et al., 2018) and qualitative evidence (Rossiter et al., 2019), identified the specialist Parkinson’s disease nurse as the ‘glue’ for the multi-disciplinary team and essential to continuity of care across services. However, effective advocacy needs evidence of cost-effectiveness in addition to the qualitative findings, thus a retrospective cost analysis of the position located in the Mid North Coast Local Health District (MNCLHD) was designed.

This document provides a comprehensive report of the collaboration between Parkinson’s NSW, Charles Sturt University and the Mid North Coast Local Health District (MNCLHD), designed to access economic evidence that can be used to support the advocacy efforts for specialist Parkinson’s disease nurses in underserved rural and regional locations in Australia.

Background

Parkinson’s disease (PD) is a neurodegenerative, complex and disabling condition with no known cure. In Australia and worldwide, the prevalence of this condition compared to other neurological conditions is exceeded only by dementia. Reports from both Deloitte Economics (2011, 2015) and Parkinson’s Australia (Canning, Paul, & Nieuwboer, 2014) provide clear evidence of increasing prevalence as the population ages (80% of people living with PD are over 65 years). The remaining 20% of those living with PD are of working age (15-64). For this group, the capacity to work and live independently is lost with each person becoming increasingly dependent upon the support and care of family and caregivers. PD places a very high burden on the person with the disease, on the caregiver and family and on society (Mudiyanselage et al., 2017). In Australia, an estimated 89% of people with PD live most of their years at home, with the remaining 11% living in residential facilities. It is noteworthy that the high prevalence of PD is comparable to or exceeds that of a number of diseases and injuries identified as National Health Priority Areas (NHPAs) in Australia, such as cancer and cardiovascular disease (Deloitte Access Economics, 2015).
Parkinson’s disease and health system costs

In Australia, health system costs are the largest component of financial costs associated with PD, with the Federal government bearing 39% of costs and state governments 16% (Deloitte Access Economics, 2015). Of the total health system costs, aged care costs and hospital inpatient and outpatient costs make up more than 71% of the combined total (Deloitte Access Economics, 2015). Health expenditure per person with PD per year is relatively greater than for many other diseases including prostate cancer and breast cancer, in part this is due to the higher use of residential aged care (Deloitte Access Economics, 2015). The average annual financial cost per person living with PD in 2014 was around $15,400, an increase of 61% since 2005. While the median number of years lived with PD is 12.4 years, many people live with the disease for well over 20 years. For someone living with PD for 12 years, the average lifetime financial cost is around $161,300, which is on par with the average lifetime financial cost of cancer ($145,000) (Deloitte Access Economics, 2015). A prospective cohort study undertaken in Melbourne sought ‘to estimate the annual cost of PD from household, health system and societal perspectives’ (Mudiyanselage et al., 2017, p. 1). The costs were significantly greater than those reported by Deloitte Access Economics (2011, 2015). These researchers likewise noted that 69% of the health care system costs were related to hospitalisation with these costs markedly increased for those with more severe PD (Mudiyanselage et al., 2017, p. 1 & 5).

The financial cost of this disabling and degenerative neurological condition to individuals, their families/caregivers and the wider society demands positive and pro-active government policies that ensure equity and access to all Australians as outlined by the World Health Organisation publication, ‘Health in All Policies’ (2014).

The existing integrated health care system in the United Kingdom has enabled the development of a strong policy framework and national scope of practice for specialist Parkinson's disease nurses as a result of cooperation between government and nursing (Abendroth, Lutz, & Young, 2012). In contrast, the complexities of the Australian health system has contributed to the current absence of well-developed policies and coherent approach in relation to the provision of integrated specialist nursing care. This is particularly noticeable in regional, rural and remote areas. For people with PD living in these areas, lower
health related quality of life and poorer management of the condition compared to those living in urban areas have been identified.

Multiple reviews have been commissioned by many sectors seeking to draw on international experience with the express aim being to tailor lessons learnt from countries such as the United Kingdom, the Netherlands and the United States to the Australian context. Likewise, in seeking to learn from international experience in relation to PD, Bramble, Carroll and Rossiter examined evidence specific to evidence-based models of specialist nursing care for people living with PD (2018). However, when seeking to apply lessons learned, clinicians, health administrators and researchers are confronted by the challenges arising from the complexity of the Australian health care system.

**Australian health context**

Historically in Australia health systems have been structured to provide services for traumatic injury, infectious diseases and single diseases. Over recent decades, changing demographics (with an ageing population), a rapid increase in non-infectious chronic diseases coupled with an increasing demand for health services reveals a health service no longer fit for purpose. A 2019 review of Australian health services has concluded that whilst our health care systems perform well by international standards, they continue to fall short of providing equitable access to care for all Australians or to focus strongly on effective prevention and management of chronic diseases (Calder, Dunkin, Rochford, & Nichols, 2019). This situation has not been remedied by the introduction of Medicare in 1975, rather the complexity of the system has increased, particularly in relation to financing, and illustrated by the current inefficient arrangements between states, the Australian government, private health insurers and individuals (Calder et al., 2019).

The complexities of Australia’s health system are captured by the Australian Government Department of Health informatics Australia’s Health Landscape (see Figure 3, p.12). This diagram also emphasises the complexities of the two tiered system in Australia, in which financial responsibilities for services are either Australian (Federal) Government, State Government or a combination of the two through the Council of Australian Governments (COAG) (Australian Government & Department of Health, 2017).
Figure 1: Australia’s Health Landscape  https://beta.health.gov.au/resources/publications/australias-health-landscape-infographic
Health System Finances

To further inform the reader seeking to understand Australian health system finances, it is informative to review (Calder et al., 2019) firstly the WHO framework for Assessment of Health System Performance (World Health Organisation, 2000) demonstrating what is described as ‘a framework of discrete and interrelated building blocks of national health care systems’ (Fig, 2) (Calder et al., 2019).

![WHO Framework for Assessment of Health Care System Performance (2000).](image)

Figure 2: WHO Framework for Assessment of Health Care System Performance (2000).

Figure 3 presents the adapted framework for the Australian Health System which is separated into two tiers. The two diagrams reflect the complexities and structural challenges inherent in the system and the continuing need for better structures and new incentives to support and promote integrated chronic illness management (Productivity Commission, 2017). This includes ‘enabling’ the tier two building blocks identified in Figure 3 (health workforce, medical products and technologies and information and research) to ensure health services in Australia are affordable and meet best practice standards of accessibility, quality and suitability (Calder et al., 2019).
Figure 3: Adapted WHO Framework for Assessment of Australian Health System Performance (Calder, 2019).
Commonwealth/State Funding Streams relevant to this project

As identified in previous sections, the complexity of the Commonwealth and State health systems are such that, the funding and information streams related specifically to the specialist Parkinson’s disease nurse in the MNCLHD are likewise complex. Figure 4 seeks to highlight the lack of integration between the Commonwealth Department of Health; New South Wales Health; funding streams for allied health professionals and Community Services; Aged Care Services and the Primary Health Network (PHN) funding. These complex pathways present extreme challenges for those seeking to quantify the costs of a particular health professional role, in this instance the specialist Parkinson’s disease nurse (especially where this role works across a number of different settings, e.g. primary, acute and aged care). The lack of integration illustrated here also impacts on the ways in which patient information, care plans and continuity of care are enabled. Difficulties are particularly apparent between the separately funded PHN and Residential Aged Care services. These challenges appear to have further limited the capacity to develop and enable policy frameworks that could guide the implementation of effective specialist Parkinson’s disease nurse positions that would enable the nurse to work with people across the continuum of their journey living with PD.

1Figure 4: Flow of Information and Financial Inputs in Australian Health Care System

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1 Sources: Commonwealth Department of Health; NSW Ministry of Health, NSW Agency for Clinical Innovation
The NSW Department of Health has set up a NSW Register of Outcomes, Value and Experience (ROVE) Public Health Registry, which draws on linked patient data and Patient Reported Measures (PRMs) to capture the patient’s perception of their experience with health care or services. The Leading Better Value Care (LBVC) program is an initiative from the NSW Ministry of Health, supported by the NSW Agency for Clinical Innovation (ACI) and Clinical Excellence Commission (CEC) (New South Wales Health, 2019). The LBVC program represents a refocus for the NSW Health system, away from the traditional method of measuring volume and activity to measuring value, where value is defined as the health outcomes achieved per dollar spent (New South Wales Health, 2019).

The NSW Agency for Clinical Innovation has also developed and implemented clinician designed Models of Care (MoC), including a relatively new health economics and evaluation approach to ensure more efficient and effective use of health resources, with such questions as “is this the right thing to invest in to create more good”, “did we do the right thing?” and “is there a better alternative?” (NSW Agency for Clinical Innovation, 2013a, p. 3)

**Impetus for this study**

**Preliminary Patient Data – MNCLHD**

Patient data specific to the impact of the specialist Parkinson’s disease nurse position that had already been obtained prior to the initiation of the Parkinson’s NSW funded project provided the impetus for this component of the greater study. Previous to this study, hospitalisation data from the MNCLHD Health Information Exchange (HIE), which included the total number of PD patient admissions and total length of stay from 2013 to 2017, were coded and analysed by MNCLHD HIE staff\(^2\). Figure 5 below shows the trend of average length of stay (LOS) calculated for all cases of PD patients from 2013 to 2017 for the Coffs

\(^2\) Based on clinical documentation in patient health records extracted via the Clinical Coding process post-patient discharge from hospital. All inpatient episodes are coded using the ICD 10 – AM classification for all care types that is, as an acute patient or a SNAP (Sub and Non-Acute Admitted Patient) care type. The Parkinson’s disease caseload were extracted both as a Principal Diagnosis and also as a Secondary Diagnosis.
Harbour Health Campus (CHHC). The patients with PD were coded following admission with either a primary diagnosis or secondary diagnosis.

It is apparent from Figure 5 that when the specialist Parkinson’s disease nurse commenced service in 2015, LOS on average decreased by 13.6% (\(=\frac{6.805}{7.875} - 1\)) compared with the year before. For patients with acute symptoms of PD as their primary diagnosis, LOS decreased significantly by 42% (\(=\frac{4.64}{8} - 1\)).

![Figure 5: Average Length of Stay (LOS) 2013-2017](image)

Figure 5 shows the pre-2015 and post-2015 LOS, that is, before and after the intervention by the specialist Parkinson’s disease nurse in 2015. It is clear that LOS generally decreased after 2015. Again, the reduction in LOS is more prominently noted for patients with acute symptoms and sensory nerve defect as their primary diagnosis than those classified as secondary diagnosis; the reduction of 15.3% (\(=\frac{6.195}{7.31} - 1\)) for the former while a 4% reduction (\(=\frac{7.12}{7.415} - 1\)) is recorded for the latter. It is worth noting that the post 2015 data were collected following the development of a clinical guideline to ensure best practice management was available for patients with PD at presentation and admission to hospital (Carroll, Maunsell, & Andrews, 2017).
Figure 6: Average Length of Stay (LOS) Pre/Post Nurse Intervention

All cases: Acute & SNAP - primary diagnosis
All cases: Acute & SNAP - secondary diagnosis
Project Design

Background

A qualitative descriptive project, evaluating the impact of two specialist Parkinson’s disease nurse positions completed early in 2019 (Rossiter et al., 2019) provided multiple perspectives from two sites. (Fig 7).

![Coffs Harbour and Shoalhaven](Image)

<table>
<thead>
<tr>
<th>Neurological nurse</th>
<th>Consumer &amp; carer perspectives</th>
<th>Health professional perspectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Qualitative data</td>
<td>• Qualitative data</td>
<td>• Qualitative data</td>
</tr>
<tr>
<td>• Model of care</td>
<td>• Engagement with neurological nursing service</td>
<td>• Role of neurological nurse in management of neurological condition</td>
</tr>
<tr>
<td>• Clinican perspective</td>
<td>• Impact on disease management</td>
<td>• Reasons for referral</td>
</tr>
<tr>
<td>• Connection with support groups.</td>
<td>• Benefits</td>
<td>• Benefits of the specialist nursing role</td>
</tr>
<tr>
<td></td>
<td>• Possible improvements.</td>
<td>• Possible improvements.</td>
</tr>
</tbody>
</table>

Figure 7: Participant groups for qualitative project

The complexities of the Australian health system described earlier are such that undertaking an economic evaluation of the position located within the PHN was not feasible. Thus, this discrete component of the greater study is limited to one site only and explores the cost-effectiveness of the specialist Parkinson’s disease nurse position located in Coffs Harbour.
Figure 8: Study Sites for Qualitative and Quantitative projects.

**Intervention under evaluation**

Health economic evaluations are conducted to inform resource allocation decisions or to evaluate the consequences of a health intervention (Husereau et al., 2013a; NSW Agency for Clinical Innovation, 2013b). In this study, the health intervention under evaluation is:

- The employment of the specialist Parkinson’s disease nurse position in the MNCLHD.

**Study location and context**

The intervention evaluated (i.e. the implementation of a specialist Parkinson’s disease nurse) is a position embedded within the MNCLHD located on the Mid-North Coast of New South Wales. This region is rated as ‘Outer Regional’ on the accessibility/remoteness index (ARIA), which measures the remoteness of a point based on physical road distance to the nearest service facility in an urban centre (Australian Bureau of Statistics (ABS), 2018). Thus for people living within this region, the travel required to reach many specialist services is lengthy and as a consequence accessibility to specialist services such as those required by people living with PD is reduced.
The specialist Parkinson’s disease nurse position evaluated is situated on the Coffs Harbour Health Campus (CHCC), which is a major referral hospital for the Coffs Harbour and the Mid North Coast regions and is where the greater population with PD are admitted.
Research Aim

The overall purpose of the research (qualitative and quantitative) is to assist in making health practice decisions about funding to support both the specialist Parkinson’s disease nurse position in the MNCLHD and further additional PD specialist nurse positions in rural New South Wales.

The aim of this retrospective study is to explore the cost effectiveness of the nurse led position by comparing service usage data and hospital costs before and after employment related to:

1. Length of hospital stay
2. Frequency of admission/readmission to hospital.

Research Question

This study sought to answer the following question:

Does analysis of service usage data from the MNCLHD describe the economic impact of the specialist Parkinson’s Disease Nurse position on hospital costs?

Methodology

Development of program logic and data plan

An extensive consultative process was undertaken to develop a focused program logic (Appendix 4), identify the availability of data and process for access to the required data and formalize the design of study.

Study Design

The study design consists of two key components, one a retrospective comparison of LOS between the periods of 2013-2014 (pre the implementation of the specialist Parkinson’s disease nurse position and 2016-
2017 (the period when the position was established) and second being a cost-benefit analysis of services provided by the specialist Parkinson’s disease nurse (2016-2017) (Figure 10). The time horizon of two years pre intervention and two years post intervention was chosen so that the impact of the specialist Parkinson’s disease nurse could be identified (See Figure 10) and compared over the two time periods.

The data for both analyses were provided by the Health Information Exchange (HIE) for the MNCLHD, which is the data base that was used as the reference tool to extract the relevant ICD Codes and analysis of costs uses cost-benefit analysis (Harris & Fry, 2017; Harrison, 2010).

![Figure 10: Study Design](image)

**Scope and Constraints**

The preliminary analysis, informed by overviews from Deloitte Economics (2011, 2015) have provided a solid basis for conducting this retrospective study with the aim to identify hospital costs only, as a result of the intervention (the specialist Parkinson’s disease nurse).
The hospital costs evaluated in this study are retrospective and based on data available on patient length of stay and readmission. It has been determined that analysis of the costs associated with other service data identified in the study, for example services provided by the specialist Parkinson’s disease nurse and services provided by other health professionals, are complex and beyond the scope of this study.

**Target population and subgroups**

The population is described as all patients/clients with PD admitted to the Coffs Harbour Health Campus (CHCC), between the periods 1st January 2013 and 31st December 2014 and between 1st January 2016 and 31st December 2017. A purposive sample was drawn from the population of patients admitted to the Coffs Harbour Health Campus (CHCC), with a primary or secondary diagnosis of PD. These two time periods were identified to allow for comparison of length of stay and readmission rates before and after employment of the specialist Parkinson’s disease nurse.

The total client base across the MNCLHD was estimated to be approximately 500. A stratified sample from the total population was identified to ensure relationships between variables could be detected and to achieve statistical conclusion validity (Bloem et al., 2017; Faul, Erdfelder, Lang, & Buchner, 2007). The preliminary estimate for the study was calculated using the G*Power 3 power analysis program, resulting in a sample size of 32 patients per year pre intervention and 32 patients per year post intervention to ensure a medium effect size and an alpha level of 0.05 (Faul et al., 2007).

**Inclusion criteria**

- People who have a diagnosis of PD (where the diagnosis had been determined by a neurologist and/or geriatrician, rehabilitation or medical physician);
- Identified in the electronic medical record and/or hard copy records in the MNCLHD;
- Living either in the community or in an aged care facility in the MNCLHD;

**Exclusion criteria**

- Patient at end of life/reason for admission to hospital palliative (not acute)
- Patient admitted to mental health inpatient unit with drug-induced Parkinsonism
Estimating resources and costs

Quantitative data were analysed using Strata Analytics. Costs were attributed to resource allocation according to service category (See Appendix 6). All costs were reported in 2019 Australian dollars. Hospitalisation data, including number of admissions, readmissions and total length of stay (LOS) over a 12 month period were obtained from clinical documentation in the patient health record abstracted via the Clinical Coding process post patient discharge from hospital. All inpatient episodes were coded using the ICD 10 – AM classification for all care types that is, as an acute patient or a SNAP (Sub and Non-Acute Admitted Patient) care type. To estimate the cost of hospitalisation per participant, the mean cost of a hospital admission per day was calculated using the national average cost per weighted separation from the Independent Hospital Pricing Authority (IHPA) ($5,200 NSW) sourced from the National Hospital Cost Data Collection Round 22 (Independent Hospital Price Authority, 2018).

This cost is derived from the National Efficiency Price (NEP), used to calculate Commonwealth payments for public hospital services, and underpins the National Activity Based Funding system (Calder et al., 2019; Independent Hospital Price Authority, 2019).

Estimation Using Regression Analysis

In order to examine the impact of the specialist Parkinson's disease nurse services on the length of stay for the PD patients, a multiple regression approach is used. This approach allows us to study any statistical and economic significance that may exist between the length of stay and the selected independent variables: i.) Number of services provided by the specialist Parkinson's disease nurse; ii.) Number of services provided by other health professionals (Allied Health services) and iii.) Patient readmission.

To ensure robustness of test results, three models (M1, M2 and M3) are chosen for the analysis as follows:

- M1 is the basic model that regresses patient length of stay on the number of services provided by the specialist Parkinson’s disease nurse and other health professionals.
• M2 examines the impact of patient readmission on length of stay after controlling for services provided by the specialist Parkinson’s disease nurse and other health professionals.

• M3 extends M2 further by including an additional dummy variable that attempts to isolate the post specialist Parkinson’s disease nurse intervention period from the pre intervention period using all observations from the sample periods 2013, 2014, 2016 and 2017.

Multiple regression formulae:

\[ \text{LOS}_t = \alpha_0 + \alpha_1 \text{PDN}_t + \alpha_2 \text{OPN}_t + \varepsilon_t \]  
(M1)

\[ \text{LOS}_t = \alpha_0 + \alpha_1 \text{PDN}_t + \alpha_2 \text{OPN}_t + \alpha_3 \text{RAD}_t + \varepsilon_t \]  
(M2)

\[ \text{LOS}_t = \alpha_0 + \alpha_1 \text{PDN}_t + \alpha_2 \text{OPN}_t + \alpha_3 \text{RAD}_t + \alpha_4 \text{YRD}_t + \varepsilon_t \]  
(M3)

Where:

\( \alpha_0 \) = intercept term

\( \text{LOS}_t \) = Average length of stay (days) of PD patient over the sample period

\( \text{PDN}_t \) = number of services performed by the specialist Parkinson’s disease nurse

\( \text{OPN}_t \) = number of services performed by other health professionals (Allied Health)

\( \text{RAD}_t \) = dummy variable for readmission; RAD\(_t\) =1 if readmitted once or more, otherwise =0

\( \text{YRD}_t \) = dummy variable for intervention period. YRD\(_t\) =1 for the specialist Parkinson’s disease nurse intervention period (2016-2017) and 0 for non-intervention period (2013-2014).

The RAD\(_t\) dummy variable examines the impact of patient readmission on LOS in comparison with non-readmission. The intervention period effect on LOS versus non-intervention period is captured by the dummy variable YRD\(_t\).
Retrospective analysis

The retrospective analysis compared PD patient outcomes pre and post the employment of the specialist Parkinson’s disease nurse in the MNCLHD. A representative sample was drawn from the target population of people with a diagnosis of PD identified in hospital medical records over a four-year period (2013-2014 and 2016-2017).

A multiple regression approach and cost-benefit analysis were used to examine hospital costs related to length of stay.
## Results

### Demographics

<table>
<thead>
<tr>
<th>Diagnosis of PD (by neurologist and/or geriatrician, rehabilitation specialist, medical physician)</th>
<th>N=128</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>M=65%</td>
<td></td>
</tr>
<tr>
<td>F=35%</td>
<td></td>
</tr>
<tr>
<td><strong>Age on admission</strong></td>
<td></td>
</tr>
<tr>
<td>8.6% (45-64)</td>
<td></td>
</tr>
<tr>
<td>2.3% (65-69)</td>
<td></td>
</tr>
<tr>
<td>11.7% (70-74)</td>
<td></td>
</tr>
<tr>
<td>17.8% (75-79)</td>
<td></td>
</tr>
<tr>
<td>25.0% (80-84)</td>
<td></td>
</tr>
<tr>
<td>23.4% (85-89)</td>
<td></td>
</tr>
<tr>
<td>10.2% (90-94)</td>
<td></td>
</tr>
<tr>
<td>1.0% (95-99)</td>
<td></td>
</tr>
<tr>
<td><strong>Age &gt; 65 years</strong></td>
<td>91.4% of total</td>
</tr>
<tr>
<td><strong>Relationship status</strong></td>
<td></td>
</tr>
<tr>
<td>54.7% (Married/de facto)</td>
<td></td>
</tr>
<tr>
<td>30.5% (Widowed)</td>
<td></td>
</tr>
<tr>
<td>14.8% (Divorced/single)</td>
<td></td>
</tr>
<tr>
<td><strong>Country of birth</strong></td>
<td></td>
</tr>
<tr>
<td>84.4% (Australia)</td>
<td></td>
</tr>
<tr>
<td>15.6% (Outside Australia)</td>
<td></td>
</tr>
<tr>
<td><strong>Years since diagnosis</strong></td>
<td></td>
</tr>
<tr>
<td>55.6% (within past 4 years)</td>
<td></td>
</tr>
<tr>
<td>30.4% (5 to 9 years)</td>
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</tr>
<tr>
<td>12.4% (10-19 years)</td>
<td></td>
</tr>
<tr>
<td>1.6% (20 to 35 years)</td>
<td></td>
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<tr>
<td><strong>Residence at diagnosis</strong></td>
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<tr>
<td>88.3% (Home)</td>
<td></td>
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<tr>
<td>11.7% (Residential Care)</td>
<td></td>
</tr>
<tr>
<td><strong>Residence on admission</strong></td>
<td></td>
</tr>
<tr>
<td>64.8% (Home)</td>
<td></td>
</tr>
<tr>
<td>35.2% (Residential care)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 1: Summary of Demographic Data*
In the sample of 128 patients included in the study 65% were male and 35% female. The most common age group for the sample admitted to hospital was 80-84 (25.0%), 85-89 (23.4%), 75-79 (17.9%), 70-74 (11%) and 90-94 (10.2%). Those aged 65 and above constituted 89.2% of the total with 10.9% falling within the 45-64 age groups. The majority (54.7%) were married or de facto, with 30.5% widowed and 14.8% divorced of single. Most patients were born in Australia (84.4%) as compared to 15.6% born in another country. The highest percentage had been diagnosed within the last four years (55.5%), with 30.4% diagnosed within the last five to nine years, 12.4% diagnosed within the last 10-19 years and 1.6% diagnosed between 20 and 35 years ago. At the time of diagnosis most patients lived at home (88.3%) with 11.7% living in a residential care facility. At the time of admission to hospital the percentage living at home had decreased to 64.8% with a parallel increase to 35.2% of the total living in a residential care facility. (For the comprehensive breakdown of all demographic data see Appendix 6.)

**Statistical Sample Data - Summarized**

Descriptive statistics for the chosen variables are shown in Table 2. The full sample includes a total of 128 observations with 32 observations for each of the four subsamples. As expected, the number of services provided by the specialist Parkinson’s disease nurse (PDN) recorded a value of zero for the 2013 and 2014 subsamples since these services were not available prior to 2015. For the 2016 subsample, the average number of services provided by other health professionals (OPN) were lower than for the 2013 and 2014 subsamples. This contrasts with the 2017 subsample, which has the highest average OPN of 52.97 services.

For the dependent variable LOS, the average for the 2016 subsample was lower than the 2013 and 2014 subsamples. However, the mean LOS for 2017 is about one week longer than 2016. The higher OPN reported in 2017 may explain the higher mean LOS in 2017 since OPN is expected to be positively correlated with LOS; as more health services are needed by the PD patients in 2017, the average LOS tended to increase. Overall, this observation is consistent with the view that OPN is an important driver of LOS.
<table>
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<tr>
<th>Year</th>
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<th>Max</th>
<th>Min</th>
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<th>N</th>
</tr>
</thead>
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</tr>
<tr>
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<td>52.97</td>
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<td>12.48</td>
<td>32</td>
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<td>6</td>
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<td>32</td>
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<tr>
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<td>0</td>
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<td>32</td>
</tr>
<tr>
<td>2014</td>
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<td>0</td>
<td>0</td>
<td>32</td>
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<td>0.75</td>
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<td>0.44</td>
<td>32</td>
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<tr>
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<td>33.77</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>9.65</td>
<td>53</td>
<td>1.8</td>
<td>8.68</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>1.12</td>
<td>8</td>
<td>0</td>
<td>1.44</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>0.53</td>
<td>1</td>
<td>0</td>
<td>0.50</td>
<td>128</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legend</th>
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</thead>
<tbody>
<tr>
<td>PDN</td>
</tr>
<tr>
<td>OPN</td>
</tr>
<tr>
<td>LOS</td>
</tr>
<tr>
<td>RAN</td>
</tr>
<tr>
<td>RAD</td>
</tr>
</tbody>
</table>

Table 2: Statistical Data Summarized

---

3 Table 2 provides a summary of statistical data collected over the sample period 2013-14 and 2016-2017. A total of 128 individual PD patient records were collected. The monthly patient records are aggregated to provide estimates for number of services provided by the PD nurse and health services provided by other health professionals (Allied Health).
Analysis of Regression Results

The analysis first focuses on the post specialist Parkinson’s disease nurse intervention period (2016-2017). M1 and M2 are estimated for this sample period by aggregating data from the 2016 and 2017 subsamples. The pooled data provides an overall analysis of the effect of specialist Parkinson’s disease nurse intervention on the LOS. Since the specialist Parkinson’s disease nurse employment hours increased from 5 days per fortnight (in 2016) to 7 days per fortnight (in 2017), an additional analysis was also performed for the 2016 and 2017 subsamples separately in order to check for sensitivity of the test result in the subsamples. These results are reported in Table 3.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>M2</td>
<td>M1</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Intercept</td>
<td>5.887***</td>
<td>4.931***</td>
</tr>
<tr>
<td></td>
<td>[0.930]</td>
<td>[1.074]</td>
</tr>
<tr>
<td>PDN</td>
<td>-0.370**</td>
<td>-0.402**</td>
</tr>
<tr>
<td></td>
<td>[0.176]</td>
<td>[0.175]</td>
</tr>
<tr>
<td>OPN</td>
<td>0.186***</td>
<td>0.187***</td>
</tr>
<tr>
<td></td>
<td>[0.016]</td>
<td>[0.016]</td>
</tr>
<tr>
<td>RAD</td>
<td>2.329*</td>
<td>1.807</td>
</tr>
<tr>
<td></td>
<td>[1.368]</td>
<td>[2.053]</td>
</tr>
<tr>
<td>N</td>
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<td>64</td>
</tr>
<tr>
<td>Rsquared</td>
<td>0.695</td>
<td>0.709</td>
</tr>
</tbody>
</table>

NB: Standard errors are in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Table 3: Results for the Regression models (2016-2017) - dependent variable: LOS

In the second analysis, data for the pre (2013, 2014) and post (2016, 2017) intervention periods are combined to obtain the full sample of 128 observations. In addition to M1 and M2, M3 was also estimated to study the overall impact of the post intervention period on LOS. The impact of this period is captured by the
year dummy variable (YRD). The results are tabulated in Table 4. All regressions are estimated using an ordinary least squares (OLS) method.

**Full sample (2013-2017)**

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>7.372***</td>
<td>5.895***</td>
<td>7.355***</td>
</tr>
<tr>
<td></td>
<td>[0.773]</td>
<td>[0.979]</td>
<td>[1.149]</td>
</tr>
<tr>
<td>PDN</td>
<td>-0.598***</td>
<td>-0.595***</td>
<td>-0.413*</td>
</tr>
<tr>
<td></td>
<td>[0.203]</td>
<td>[0.199]</td>
<td>[0.210]</td>
</tr>
<tr>
<td>OPN</td>
<td>0.202***</td>
<td>0.201***</td>
<td>0.208***</td>
</tr>
<tr>
<td></td>
<td>[0.018]</td>
<td>[0.018]</td>
<td>[0.017]</td>
</tr>
<tr>
<td>RAD</td>
<td>2.829**</td>
<td>2.236*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1.186]</td>
<td>[1.193]</td>
<td></td>
</tr>
<tr>
<td>YRD</td>
<td>-3.029**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1.306]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>128</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.51</td>
<td>0.532</td>
<td>0.552</td>
</tr>
</tbody>
</table>

**NB**: Standard errors are in parenthesis *** p<0.01, ** p<0.05, * p<0.1

*Table 4: Results for the Regression models (full sample) - dependent variable: LOS*

**Length of Stay**

Results for the aggregate sample in Table 3 shows that M1 coefficients for PDN and OPN are statistically significant at the 5% and 1% levels respectively. The coefficient for PDN has a negative sign suggesting evidence that the intervention by the specialist Parkinson's disease nurse reduces LOS by 0.37 day, which is economically important: for every PD patient admitted, this translates to a reduction of $1924 (0.37×$5,200) per day using the estimates from IHPA. For M2, the coefficient is -0.402, which is marginally higher than M1. In Table 4, the full sample analysis shows a larger PDN coefficient, which ranges from -0.413 to -0.598.

For the 2017 subsample, the effect of the specialist Parkinson’s disease nurse services on LOS is even greater than the aggregate sample, evidenced by the PDN coefficients of -0.741 and -0.755 for M1 and M2.
respectively, which are statistically significant at the 1% level. In contrast, the results are not statistically significant in the 2016 subsample. Thus, it would appear that the findings are sensitive to the selected sample period, possibly driven by the more frequent specialist Parkinson’s disease nurse visits, particularly in the 2017 sample period. Nonetheless, the coefficient on PDN is statistically significant in the post intervention period as indicated in the aggregate sample.

Results for M3 as presented in Table 4 shows that the coefficient for YRD has a negative sign and is statistically significant at the 5% level. This would indicate that in the specialist Parkinson's disease nurse intervention period, the LOS is substantially lower than LOS for the non-intervention period by about 3 days. This result tends to support the overall findings that services provided by the specialist Parkinson’s disease nurse reduces the LOS in the 2016-2017 sample period.

In terms of goodness-of-fit of the regression models, models estimated from the 2017 subsample have the highest R-squared of 0.822 (M1) and 0.827 (M2) while the 2016 subsample has the lowest goodness-of-fit of less than 0.14. Thus, the estimated regression models fit the observed data substantially better in the 2017 subsample, explaining more than 80% of the variation in LOS. In other words, more reliable estimation can be obtained from the 2017 subsample.

**Number of Readmissions**

The effect of patient readmissions on LOS is captured by the dummy variable RAD introduced in M2. In Table 3, the estimated coefficient for RAD ranges from 1.807 to 2.329, suggesting readmission of once or more would increase LOS by approximately 1 to 2.3 days. The results for the 2016 and 2017 subsamples are not statistically significant although overall, the coefficient is marginally significant at the 10% level as indicated in the aggregate sample (see Table 3). The analysis based on the full sample as shown in Table 4 shows a similar result but the RAD has a larger coefficient of 2.829, which is significant at the 5% level. Comparison of the estimates obtained from the aggregate and full samples would suggest that the RAD has a smaller impact on LOS evidenced by the reduction in the coefficient by 0.529 (=2.829-2.3) to 1.829 days (=2.829-1) in the specialist Parkinson’s disease nurse intervention period.
Number of Services Provided by other Health Professionals

The estimated coefficient for OPN has a positive sign, suggesting that LOS increases with the number of services provided by other health professionals. Such a positive relationship is expected since as more services by other health professionals are required, the corresponding LOS should increase to reflect increased visits or treatments by different health professionals. Overall, an increase in the number of services by other health professionals increases LOS by 0.186 to 0.209 days as shown in Tables 3 and Table 4. In Figure 11, the univariate regression result for the 2017 subsample is presented. A positive relationship between LOS and OPN can be seen. The estimated R-squared for the regression line shows that 60.63% of the variation in LOS is attributed to OPN. This contrasts with the estimated R-squared in Figure 12, where PDN explains only 8.46% of the variation in LOS in 2017. This would suggest that OPN has a stronger predictive power than PDN in the prediction of LOS. Thus, it is important to consider OPN in the estimation of LOS.

![Graph showing the relationship between LOS and the number of services provided by other health professionals.](image)

Figure 11: Average Length of Stay (LOS) and No. of Health Services by Other Health Professionals (2017)
Cost-benefit Analysis

To facilitate decision-making concerning the intervention of a PD specialist Parkinson’s disease nurse, a comparison of benefits and costs is necessary in order to evaluate resources implication. If the role of the specialist Parkinson’s disease nurse is worth subsidising, the benefits must outweigh the associated employment costs.

All Acute Admitted Patient episodes following the ‘classification and counting’ for the patient episodes are costed via a Diagnostic Related Grouping wherein an NWAU (National Weighted Activity Unit) is applied. An NWAU is the unit of measure for pricing healthcare activity used in the Activity Based Funding system. This is a single currency applied in Australia to all ABM hospital activity independent of settings. Currently, 1.0 NWAU = $4,713 and is termed NWAU 18. For the purpose of this research, the NWAU 18 has been applied to the 2017 PD cases.

To obtain estimates for hospital cost per patient, the average total hospital cost per patient based on NWAU pricing is collected from the Activity Based Portal for the Mid-North Coast Local Health District. In Table 5, “Total hospital cost per patient” includes hospital costs for three Hospitals serviced by the PD specialist.
Exploring the cost effectiveness of the specialist Parkinson’s disease nurse in the Mid North Coast Local Health District of New South Wales

Nurse in the Coffs Harbour region. These are denoted as “Ex.1”, “Ex.2” and “Ex.3”. Under the Activity Based Funding system, the total cost per patient ranges from 1.5 to 2.1 MWAU. “Total specialist Parkinson’s disease nurse salary cost per patient” is estimated over the specialist Parkinson’s disease nurse service period from 2015 to 2017 ($1,110 per patient = $185,000 per year × 3 years / 500 patients, an average annual salary cost of $185,000 is assumed).

Three investment evaluation criteria under the cost-benefit framework are employed: i.) benefit-cost ratio, ii.) net present value (NPV) and iii.) profitability index (PI) (Brent, 2006). “Benefit per patient” is defined as the saving in total hospital cost resulting from the specialist Parkinson’s disease nurse intervention. For example, in the case of Ex.1, “Benefit per patient” amounts to $8,683 (= $9,793 - $1,110). “Benefit-cost ratio” is a ratio of benefit per patient to salary cost per patient; a ratio over 1.0 indicates a net gain and is thus desirable. NPV is the difference between the present value of benefits (calculated over the specialist Parkinson’s disease nurse intervention period) and salary costs incurred at the start of the specialist Parkinson’s disease nurse employment period. This criterion is calculated as the present value (PV) of future benefits over three years (2015 to 2017), minus the total specialist Parkinson’s disease nurse salary costs incurred at the beginning of the intervention period using an annual discount rate of 7 per cent (Harrison, 2010). For example, in Ex.1, the PV of future benefits for 500 patients over three years is $3,797,823 (= $9,793 - $1,110) × (500/3) × (1 - (1 + 7%)^-3) / 7%. The total salary cost of $555,000 over three year is then deducted from this amount to arrive at the NPV of $3,242,823 (= $3,797,823 - $555,000). PI is defined as the PV of benefits over three years divided by Total specialist Parkinson’s disease nurse salary costs (6.84 = $3,797,823 / $555,000). The same evaluation criteria are used in Ex.2 and Ex.3.

In Table 5, all three evaluation criteria show significant net gains resulting from the employment of the specialist Parkinson’s disease nurse, described as the intervention. Notably Ex.1 has the highest hospital cost of $9,793, which gives rise to the largest benefit of $8,683 as the salary cost per patient stays constant across all hospitals. Across all three Hospitals, the benefit-cost ratios are well above 1.0, which ranges from 5.34 to 7.82. This suggests that the benefits are 5 to 7 times greater than the costs. The NPV criterion shows positive values for all hospitals thus provides further evidence of net gains. Based on the PI criterion, Ex.1 has the highest PI since it also has the largest benefit. Again, this result is in line with those reported under
the benefit-cost ratio and NPV criteria. Overall, the cost-benefit approach offers further support for the statistical evidence previously reported in Tables 3 and 4.

<table>
<thead>
<tr>
<th></th>
<th>Ex. 1</th>
<th>Ex. 2</th>
<th>Ex. 3</th>
</tr>
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<tbody>
<tr>
<td>Total hospital cost per patient</td>
<td>$9,793</td>
<td>$8,047</td>
<td>$7,041</td>
</tr>
<tr>
<td>Total specialist Parkinson’s disease nurse salary cost per patient (1)</td>
<td>$1,110</td>
<td>$1,110</td>
<td>$1,110</td>
</tr>
<tr>
<td>Total hospital cost for 500 patients</td>
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<td>$4,023,500</td>
<td>$3,520,500</td>
</tr>
<tr>
<td>Total specialist Parkinson’s disease nurse salary cost for 500 patients</td>
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<td>$555,000</td>
<td>$555,000</td>
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<tr>
<td>Total benefits for 500 patients</td>
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<td>$3,468,500</td>
<td>$2,965,500</td>
</tr>
<tr>
<td>Benefit per patient (2)</td>
<td>$8,683</td>
<td>$6,937</td>
<td>$5,931</td>
</tr>
<tr>
<td>NPV for 500 patients over 3 years</td>
<td>$3,242,823</td>
<td>$2,479,147</td>
<td>$2,039,136</td>
</tr>
<tr>
<td>PI for 500 patients over 3 years</td>
<td>6.84</td>
<td>5.47</td>
<td>4.67</td>
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<td>Benefit-cost ratio [(2)/(1)]</td>
<td>7.82</td>
<td>6.25</td>
<td>5.34</td>
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**Legend**

<p>| | |</p>
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<thead>
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<tr>
<td>NPV</td>
<td>Net present value</td>
</tr>
<tr>
<td>PI</td>
<td>Profitability index</td>
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</tbody>
</table>

*Table 5: Cost-benefit outcomes for specialist Parkinson’s disease nurse intervention*

Overall, the impact of the specialist Parkinson’s disease nurse intervention results in a decrease in LOS ranging from 0.37 day ($1924) to 0.755 day ($3926) after controlling for services performed by other health professionals and patient readmission.
Limitations

The overall complexity of the Australian health system and more specifically the complexity of the financial and information streams described in the Background to this report (pages 10-17) indicate the challenges that were likely to be encountered in undertaking this research. Difficulties in making valid inferences between the services provided by the specialist Parkinson’s disease nurse as an outcome of this complexity resulted in a number of limitations in data analysis. The main limitations of this research relates to the complexity of the data, financial and information streams. The limitations experienced in this research have also been identified in the work by Deloitte Economics and other similar studies (Deloitte Access Economics, 2015; Mudiyanselage et al., 2017).

As a data linkage research project, certain limitations are also inherent in the governance of data accessible to the researchers, including those associated with missing data, and variations in coding. The study design incorporated a statistical algorithm to identify the stratified sample from the total population of approximately 500 clients with PD to ensure statistical validity for the conclusions drawn from the study. Inclusion criteria required a diagnosis of PD (diagnosis determined by a geriatrician, rehabilitation and medical physician) identified in the electronic medical record and living either in the community or in an aged care facility in the MNCLHD. To control for confounding factors and other vulnerabilities in the data set that had the potential to introduce bias, the program logic process conducted prior to design of the study identified the framework for the data analysis. This approach also ensured a clear definition of the data classifications entered into the information system.

The introduction of electronic records part way through the time period covered in this study required manual collection of data for paper-based records from 2013 to 2014. This was not only time consuming but also introduced the potential for human error in identifying and transcribing the required data.
Discussion

In Australia and world-wide there is evidence to suggest that regional and rural living is negatively associated with lower health related quality of life and poorer management of PD compared to that of those who live in urban areas. This is predominantly attributed to lower incomes, less access to healthcare with fewer health care providers as well as fewer specialists located regionally, resulting in people with PD needing to travel to the major cities for their specialist care. In order to address these issues for people with PD in the Mid North Coast Local Health District (MNCLHD) in NSW, a specialist Parkinson’s disease nurse position was initiated through a collaboration between Parkinson’s NSW and the LHD. The aim of this study was to explore the cost effectiveness of the specialist Parkinson’s disease nurse model of care, where little current evidence exists, and where one size of service does not fit all.

In this cost-effectiveness study, we have presented statistical findings that demonstrate a reduction in hospital length of stay for patients with PD following the establishment of the specialist Parkinson’s disease nurse position in the MNCLHD. The statistical findings demonstrate a reduction in hospital length of stay post the establishment of the specialist Parkinson’s disease nurse role, thus reducing long term expenditure on hospital costs. Specifically, the cost benefit analysis showed a net dollar benefit, or savings in hospital cost, of up to $8,600.00 per person over a three year period, as a result of the specialist Parkinson’s disease nurse intervention. In addition, the cost-benefit analysis employed across three hospital scenarios resulted in a ratio well above 1.0, supporting the net dollar benefit associated with the employment of a specialist Parkinson’s disease nurse. These cost-benefit ratios ranged from 5.34 to 7.82, significantly outweighing total hospital costs for PD patient care and further supporting the statistical evidence reported for hospital length of stay.

This research was undertaken in response to a request for evidence to support advocacy endeavours undertaken by Parkinson’s NSW. These findings are also sought by potential service providers considering the possible introduction of a specialist Parkinson’s disease nurse position. The findings clearly illustrate that
the net dollar benefit associated with the employment of a specialist Parkinson’s disease nurse outweighs the total hospital admission cost for a PD patient.

Other data that was collected as part of this study i.e. the community data, (occasions of service in the community by the specialist Parkinson’s nurse) although not measured from a cost effectiveness perspective do have both an important economic and social focus.

Although the research findings in regard to cost effectiveness only show the acute sector benefits (i.e. reduced hospital length of stay) it is important to acknowledge that anecdotally there is most likely a greater cost benefit to be explored within the community due to early and timely intervention by this specialist Parkinson’s nurse model that services both acute and community settings, including residential care. This model, where the specialist Parkinson’s disease nurse is embedded in the LHD, ensures services are provided to the community as well as the acute sector care and enables early intervention and prevention of untoward events, such as infections, symptom deterioration and deterioration in mental health.

This study has provided strong evidence of benefit compared to costs in the acute sector, however lack of financial and data information flows to the community and Primary Health Network PHN precluded drawing similar conclusions. Given the complexity of PD, the researchers recommend a prospective study whereby occasions of service by the specialist Parkinson’s disease nurse are captured over a period of time in the primary health/community care sector, with the aim to illustrate how these costs of care may be reduced.

Each state in Australia continues to develop their own service delivery strategies, however in NSW the focus is on sustainable nurse-led models to address the impacts of the ageing population and increasing prevalence of chronic illness.
Conclusion

In this cost effectiveness study the employment of the specialist Parkinson's disease nurse in the MNCLHD has resulted in significant savings in hospital costs as a result of reduced length of hospital stay. The findings support advocacy for sustainable specialist Parkinson's disease nurse positions and can be used to inform and influence policy and systemic changes within the health care system. Prospective economic evaluation studies in regional and rural areas are essential to demonstrate the total costs of PD to the individual, their extended support network and community and to support sustainability of specialist Parkinson's disease nurse positions.

Although a small scale project, this study constitutes important research in that it begins to address the gap in the available evidence as to the cost benefits of interventions for people with PD. It is expected that the results of the study will contribute to the creation of similar nurse-led models of care for people with PD and their family and/or carers across rural and regional LHDs. In the long-term it is hoped that this type of specialist Parkinson’s disease nurse model will help to consolidate a sustainable specialist Parkinson’s disease nurse care network, which will better support the needs of people with PD and their families. In rural and regional areas such effective early interventions and timely response to worsening symptoms has the potential to improve quality of life for the person and slow the trajectory of PD.
Funding for this project

This cost-effectiveness project is a component of a larger project funded by Parkinson’s NSW. This organisation is the primary funding and commissioning body for the project. Significant in-kind contributions of time and expertise from the Charles Sturt University research team and senior management staff from the MNCLHD have further supported this project to its successful completion.

The time and resource intensive nature of the data collection for this project was such that Vincent Carroll and Debbie Schwebel applied for one of the funding opportunities available to employees in the Mid-North Coast Local Health District, specifically The Research Support Grant Program which is designed:

- To build a culture of research within the MNLCHD
- To increase research capacity and capability within the Mid North Coast
- To develop and conduct locally relevant research projects to improve patient outcomes and health service delivery models
- To gain first-hand experience of the grant writing process

An application was submitted for funding to the 2018 MNCLHD Research Support Grant Program, and $19,200.00 was provided to support a research officer to collect the relevant data.
Appendices

Appendix 1: Ethics approval - Charles Sturt University Human Research Ethics Committee

Appendix 2: Ethics approval – North Coast NSW Human Research Ethics Committee

Appendix 3: Notification of Funding from MNCLHD

Appendix 4: Health Intelligence Unit Western NSW Program Logic and Data Plan

Appendix 5: MNCLHD Costing and Salary Frameworks

Appendix 6: Complete demographic data
Appendix 1: Charles Sturt University Human Research Ethics Approval

27 November 2018

A/Professor Marguerite Bramble
Email: mbramble@csu.edu.au

Dear A/Professor Bramble,

Thank you for advising the Charles Sturt University Human Research Ethics Committee that your research proposal has been approved by Mid North Coast NSW HREC.

The Charles Sturt University Human Research Ethics Committee is constituted and operates in accordance with the National Health and Medical Research Council’s National Statement on Ethical Conduct in Human Research (National Statement) and as such, accepts only fully constituted Human Research Ethics Committee’s determinations.

Consequently, I am pleased to advise the Committee has approved your research proposal. Please see below details of your approved research project:

Project Title: Exploring the cost effectiveness of the specialist Parkinson’s disease nurse in the Mid North Coast Local Health District of New South Wales: A pilot retrospective analysis

Approved until: 28 November 2020 (subject to annual progress reports being submitted)

Protocol Number: H18250 (to be included in all correspondence to the Committee)

Progress Report due by: 28 November 2019

You must report to the Committee at least annually, and as soon as possible in relation to the following, by completing the ‘Report on Research Project’ form:

- any serious and/or unexpected adverse events or outcomes which occur associated with the research project that might affect participants, therefore, the ethical acceptability of the project;
- amendments to the research design and/or any changes to the project (Committee approval required);
- extensions to the approval period (Committee approval required); and
- notification of project completion.

This approval constitutes ethical approval in relation to humans only. If your research involves the use of radiation, biochemical materials, chemicals or animals, separate approval is required by the appropriate University Committee.

Please contact the Governance Officer on (02) 69334213 or ethics@csu.edu.au if you have any queries.

The Committee wishes you well with your research.

Sincerely,

Ms Ellen Hannigan
Governance Officer
on behalf of Associate Professor Catherine Allan
Presiding Officer, HREC

cc: A/Professor Rachel Rosenthal, Dr Annabel Matheson

www.csu.edu.au

The Commonwealth Register of Institutions and Courses for Overseas Students (CRICOS) Provider Number for Charles Sturt University is 00064A. ABN 82 004 786 359
Appendix 2: North Coast NSW Human Research Ethics Committee

North Coast NSW Human Research Ethics Committee

Date of Decision Notification: 29 Aug 2018

Dear Marguerite Bramble,

Thank you for submitting the following Human Research Ethics Application (HREA) for HREC review;

2018/ETH00278: Exploring the cost effectiveness of the Parkinson’s nurse specialist position in the Mid North Coast Local Health District of NSW: A pilot retrospective analysis

This project was considered by the Chairperson, North Coast NSW Human Research Ethics Committee on 29/08/2018 and was determined to meet the requirements of the National Statement on Ethical Conduct in Human Research (2007).

This project has been Approved to be conducted at the following sites: Coffs Harbour Health Campus, Mid North Coast Local Health District

The following documentation was reviewed and is included in this approval:

- Project Registration
- Cover Letter for Resubmission dated 07.08.2018
- Research proposal Stage 2b dated 06.08.2018

It is noted that the North Coast NSW Human Research Ethics Committee is constituted in accordance with the National Statement on Human Conduct in Research, 2007 (NHMRC).

The approval is for a period of 5 years from the date of this e-mail (29 Aug 2018), on condition of the submission of Annual Reports.

This HREC is constituted and operates in accordance with the National Statement on Ethical Conduct in Human Research (2007). The processes used by this HREC to review multi-centre research proposals have been certified by the National Health and Medical Research Council.

Please contact us if you would like to discuss any aspects of this process further, as per the contact details...
below. We look forward to managing this application with you throughout the project lifecycle.

Kind regards,

Rebecca Lavery  
Acting Executive Officer | NCNSW HREC (NNSW and MNC LHDs)  
Email: EthicsNCNSW@ncahs.health.nsw.gov.au  
Telephone: 02 6672 0269
Appendix 3: Notification of funding from Mid-North Coast Local Health District

Mr Vincent Carroll

22nd August, 2018

Dear Mr Carroll,

On behalf of the Governing Board and Chief Executive of the Mid North Coast Local Health District, I would like to take this opportunity to once again thank you for your recent application to the MNCLHD Research Support Program (RSGP).

A total of 15 applications were received for review. The review panel assessed the applications according to the criteria and MNCLHD strategic directions and research priorities. The questions and assessment criteria was based on the Ministry of Health’s Translational Research Grant Scheme (TRGS) application form. The Review Panel consisted of Senior Executive/Senior MNCLHD Management to provide the LHD perspective for feasibility, alignment with the strategic directions and the need within the MNCLHD as well as independent University Academics to provide comment on the methodological rigour of the application.

Projects were selected based on their merit, strategic significance to our local community and the MNCLHD.

I am pleased to advise you that your application has been successful to be made upon the following terms and conditions:

1. The Chief Investigator is Vincent Carroll. The project title is “Exploring the economic benefit of the Parkinson’s nurse specialist position in the Mid North Coast Local Health District of NSW: A pilot retrospective analysis”.
2. The total project grant award for the period 22nd August, 2018 to 21st August 2020 is $19,200 (Year 1: $19,200, Year 2: $nil). Note that six months’ worth of the budget will be allocated initially and a further six month’s funding will be provided upon receipt of the first progress report (six months’ post notification).
3. As a recipient of the Research Grant you must agree to the Conditions of the Grant (Attachment 1).
4. To accept the funding and its conditions please complete and return Attachment 2. The reporting templates and project administration forms will be provided upon receipt of your acceptance of the conditions and funds.
5. Project specific conditions (these must be addressed via email to MNCRsearch before allocation of funding):
   a. The project duration is 18 months; however, all funding is to be distributed within the first 12 months. Please confirm that this is correct.
   b. Ensure that a health economist is included as part of the research team.
   c. Due to the delay in funding notification, a revision of the timelines is required. Include North Coast NSW HREC submission and approval.

The review panel discussed each application and have provided feedback specific to your project (Attachment 3) and general feedback (Attachment 4). Please take the time to review this feedback.

Please advise the Manager, Research Operations, Nicole Raschke by completing the ‘Research Grant Acceptance’ and ‘Transfer of Funds’ forms and returning Attachments 1 & 2 via email to MNCRsearch@mnclhd.health.nsw.gov.au of your acceptance of this grant no later than two weeks after notification.
### Appendix 4: Health Intelligence Unit Western NSW Program Logic and Data Plan for Data Collection

#### Background Analysis

<table>
<thead>
<tr>
<th>OUTCOME/IMPACT</th>
<th>MAIN DATA TYPE</th>
<th>MEASURE / DATA / COLLECTION TOOL</th>
<th>FREQUENCY OR TIMEFRAME</th>
<th>DATA SOURCE/S</th>
<th>VARIABLES</th>
<th>ANALYSIS</th>
<th>COMMENTS</th>
</tr>
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<tbody>
<tr>
<td>No. of service by specialist Parkinson’s disease nurse</td>
<td>Quantitative</td>
<td>Total No. of occasions of service and type provided by specialist Parkinson’s disease nurse for each patient Recorded on electronic medical record from May 2016, hard copy medical record previously Phone, face to face, case management</td>
<td>Calendar Years 2013-Pre 2014-Pre 2016-During 2017-During</td>
<td>MNCLHD Data from three sources, hard copy and electronic medical record (eMR/ CHOC) and CHAPP (community health occasions of service database)</td>
<td>This is a total count for specialist Parkinson’s disease nurse activity.</td>
<td>Total count per type of service per patient over a period</td>
<td>See specialist Parkinson’s disease nurse monthly report of manual report Will need to see if CHAPP database is accessible.</td>
</tr>
</tbody>
</table>

| No. of service by other health professionals to PD patients | Quantitative | Total No. of services provided for each patient Pre and post the commencement of the specialist Parkinson’s disease nurse | Calendar Years 2013-Pre 2014-Pre 2016-During 2017-During | As above | This is a total count for services provided to the PD patients. | Total count per type of service | As above |

To be measured pre and post the commencement of the specialist Parkinson’s disease nurse
### Cost Effectiveness Outcomes

<table>
<thead>
<tr>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
<th>OUTCOME/IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stay (LOS) for PD</td>
<td>Quantitative</td>
<td>Total No. of bed days for each patient for all four sites: Coffs Harbour, Bellingen, Dorrigo and Macksville</td>
<td>Pre and Post specialist Parkinson’s disease nurse appointment: Over 4 calendar years 2013/2014/2016/2017</td>
<td>MNCLHD</td>
<td>Dependent variable (DV) (continuous/discrete) Length of time since diagnosis</td>
<td>Average bed days for PD patients before and after specialist nurse position. Comparison pre and post</td>
<td>Aiming for comparison pre and post commencement of specialist Parkinson’s disease nurse position at each site. Main body of improvement work has been undertaken at the Coffs hospital. The initiatives are being progressed at the other three sites: Bellingen, Dorrigo and Macksville since August 2018</td>
</tr>
<tr>
<td>Number of patient hospital readmissions</td>
<td>Quantitative</td>
<td>Total No. of hospital admission/s in a year/per patient</td>
<td>Pre and Post specialist Parkinson’s disease nurse appointment: Over 4 calendar years 2013/2014/2016/2017</td>
<td>MNCLHD</td>
<td>Dependent variable (DV) (continuous/discrete) No. admissions Different sites Length of time since diagnosis</td>
<td>Review distribution first Average number of admissions for PD patients pre and post</td>
<td>Main body of improvement work has been undertaken at the Coffs hospital. The initiatives are being progressed at the other three sites: Bellingen, Dorrigo and Macksville since August 2018</td>
</tr>
<tr>
<td>Number of referrals made by the specialist Parkinson’s disease nurse</td>
<td>Quantitative</td>
<td>Number of PD patients referred to another service and identify the service Cost the nursing time to undertake indirect processes</td>
<td>2 calendar years 2016/2017</td>
<td>MNCLHD</td>
<td>Longitudinal study to look at pattern of services used by the patients in the program.</td>
<td>Total count and type of services available since commencement of the specialist Parkinson’s disease nurse</td>
<td>Data OOS are categorised on the eMR, consistent classifications utilised by specialist Parkinson’s disease nurse</td>
</tr>
</tbody>
</table>
Appendix 5: MNCLHD Costing and Salary Frameworks

All Acute Admitted Patient episodes following the ‘classification and counting’ for the patient episodes are costed via a Diagnostic Related Grouping (DRG) wherein a National Weighted Activity Unit (NWAU) is applied. An NWAU is the unit of measure for pricing healthcare activity used in the Activity Based Funding (ABF) system. It is a single currency applied to all Activity Based Funding and Management (ABM) hospital activity independent of settings. Currently, 1.0 NWAU = $4,713 and is called NWAU 18.

For the purpose of this research, the NWAU 18 has been applied to the 2017 PD cases.

**Acute Episodes:**

**Principal Diagnosis of PD**
- Sitting in a complex DRG (A grouping) has been costed to an average of 2.8 NWAU or $13,196
- Sitting in an uncomplicated DRG (B, C or D grouping) has been costed to an average of 1.1 NWAU or $5,184.3

**Secondary Diagnosis of PD**
- Sitting in a complex DRG, has been costed to an average of 2.1 NWAU or $9,897
- Sitting in an uncomplicated DRG, has been costed to an average of 2.3 NWAU or $10,840

**Emergency Attendance:**
Emergency Attendance at Hospital Emergency Department (patient goes home – not admitted) with a recorded diagnosis of PD is grouped to an Urgency Related Group, costing to an average of 0.08 NWAU or $377.
## Appendix 6: Complete demographic data

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<tr>
<th>Characteristics of PD Patients</th>
<th>2013 N (%)</th>
<th>2014 N (%)</th>
<th>2016 N (%)</th>
<th>2017 N (%)</th>
<th>Total N (%)</th>
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<td><strong>Gender</strong></td>
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<tr>
<td>Male</td>
<td>24 (75.0%)</td>
<td>23 (71.8%)</td>
<td>18 (56.3%)</td>
<td>18 (56.3%)</td>
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<td>Female</td>
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<td>14 (43.7%)</td>
<td>14 (43.7%)</td>
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<td>90 - 94</td>
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<td>4 (12.5%)</td>
<td>6 (18.8%)</td>
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<td>13 (10.2%)</td>
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<tr>
<td>85 - 89</td>
<td>9 (28.1%)</td>
<td>5 (15.6%)</td>
<td>6 (18.8%)</td>
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<td>30 (23.4%)</td>
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<td>80 - 84</td>
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<td>75 - 79</td>
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<td>70 - 74</td>
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<td>60 - 64</td>
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<td>6 (4.7%)</td>
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<td>55 - 69</td>
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<td>50 - 59</td>
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<td>45 - 49</td>
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<td>0 (0.0%)</td>
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<td><strong>Total</strong></td>
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<td>32</td>
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<td>13</td>
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<td>Single or Divorced</td>
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<td>19 (14.8%)</td>
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<td>Widowed</td>
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<td>14 (43.8%)</td>
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<tr>
<td><strong>Total</strong></td>
<td>32</td>
<td>32</td>
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### Country of Origin

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<th>22 (68.8%)</th>
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<th>27 (84.4%)</th>
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<td>20 (15.6%)</td>
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<tr>
<td>Total</td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
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### Years since diagnosis

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<th>5 – 9 years</th>
<th>10 – 14 years</th>
<th>15 – 19 years</th>
<th>20 – 24 years</th>
<th>25 – 29 years</th>
<th>30 – 35 years</th>
<th>Total</th>
</tr>
</thead>
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<td>18 (56.3%)</td>
<td>9 (28.1%)</td>
<td>1 (3.1%)</td>
<td>2 (6.3%)</td>
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<tr>
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<td>14 (44%)</td>
<td>12 (37.5%)</td>
<td>1 (3.1%)</td>
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<td>0 (0.0%)</td>
<td><strong>32</strong></td>
</tr>
<tr>
<td></td>
<td>24 (75.0%)</td>
<td>5 (15.6%)</td>
<td>2 (6.3%)</td>
<td>1 (3.1%)</td>
<td>2 (6.3%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td><strong>32</strong></td>
</tr>
<tr>
<td></td>
<td>15 (46.9%)</td>
<td>13 (40.6%)</td>
<td>6 (4.6%)</td>
<td>10 (7.8%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>1 (0.8%)</td>
<td><strong>32</strong></td>
</tr>
<tr>
<td></td>
<td>71 (55.5%)</td>
<td>39 (30.4%)</td>
<td>3 (9.4%)</td>
<td>15 (11.7%)</td>
<td>1 (0.8%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td><strong>128</strong></td>
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</table>

### Place of residence at time of Diagnosis

<table>
<thead>
<tr>
<th></th>
<th>28 (87.5%)</th>
<th>29 (90.6%)</th>
<th>27 (84.4%)</th>
<th>29 (90.6%)</th>
<th>113 (88.3%)</th>
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</thead>
<tbody>
<tr>
<td>RACF</td>
<td>4 (12.5%)</td>
<td>3 (9.4%)</td>
<td>5 (15.6%)</td>
<td>3 (9.4%)</td>
<td>15 (11.7%)</td>
</tr>
<tr>
<td>Total</td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>128</strong></td>
</tr>
</tbody>
</table>

### Place of residence at Admission

<table>
<thead>
<tr>
<th></th>
<th>22 (68.8%)</th>
<th>19 (59.4%)</th>
<th>27 (84.4%)</th>
<th>15 (46.9%)</th>
<th>83 (64.8%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACF</td>
<td>10 (31.2%)</td>
<td>13 (40.6%)</td>
<td>5 (15.6%)</td>
<td>17 (53.1%)</td>
<td>45 (35.2%)</td>
</tr>
<tr>
<td>Total</td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>128</strong></td>
</tr>
</tbody>
</table>
Researchers

Associate Professor Marguerite Bramble

RN; BN (Hons); BEc; PhD; GAICD; GradCertStratMark; GradCertResMgmt

Clinical Chair in Aged Care Practice Innovation

School of Nursing, Midwifery & Indigenous Health

Charles Sturt University

Panorama Avenue

Bathurst, NSW 2795

As an advanced practice Registered Nurse Marguerite’s extensive clinical, education and research expertise is in chronic care nursing with a focus on neurological conditions affecting the older population, such as dementia and PD. Marguerite has a strong scholarly track record in linking nursing theory and evidence based models of care to curriculum development in undergraduate, postgraduate nursing and interprofessional programs. She has national recognition for her expertise in managing and implementing innovative, evidence based models and clinical trial interventions, working collaboratively on projects with industry stakeholders, managers, health professionals, clients and families. This expertise is supported by her previous experience in the corporate sector, both as a consultant, an educator and a manager.

In her current position with CSU, part of Marguerite’s role is as Clinical Chair with aged care provider Catholic Healthcare Limited. This role is focused on providing leadership in aged care practice innovation and includes working collaboratively with health professionals across disciplines, developing best practice nursing models and clinical guidelines to improve care quality, with the aim to achieve excellence in this crucial area of health care.
Dr Alfred Huah-Syn Wong

PhD (Finance), MFM (Financial Management), BCom (Accounting), FRM.

Lecturer

School of Accounting and Finance

Faculty of Business, Justice and Behavioural Sciences

Charles Sturt University

Alfred is a lecturer in the Discipline of Finance at the School of Accounting and Finance, Charles Stuart University, Bathurst. His expertise is in financial management, financial risk management, portfolio management, banking and health economics. He has won several teaching and research awards and published in peer-reviewed academic journals. Prior to his teaching career, he worked as an accountant in the banking industry where his primary responsibility was to prepare financial reports for the banking group’s senior management.

Vincent Carroll

RN, BHlthSc(Nursing), GradDipBusAdmin, MSc(Dementia Care)

Parkinson’s Disease Clinical Nurse Consultant

Mid North Coast Local Health District

Coffs Harbour, NSW 2450

Vincent’s extensive nursing experience includes 20 years in hospital and health administration roles in New South Wales and 16 years clinical nursing experience in the United Kingdom and in Australia. Vincent’s work as a Clinical Nurse Consultant has resulted in significant service delivery improvements for people with PD living in the MNCLHD. His strong commitment to clinically-based research informs his practice and his engagement with Parkinson’s NSW.
Debbie Schwebel

RN; DipSc; BaNursing; MHM; MBA

*District Nurse Manager Clinical Practice*

*Mid North Coast Local Health District*

Working in the public health system since 1990 Debbie has an extensive clinical and management background in nursing. Since 2006 Debbie has worked in a variety of senior management positions within the Nursing & Midwifery Directorate in regional NSW, Australia. Debbie has completed postgraduate qualifications with a Masters of Business Administration, a Masters in Health Management and a BA in Nursing. In recent years Debbie has given oral presentations at the International Practice Development Conference in Edinburgh (2016) and the Patient Experience Symposium Sydney (2017 & 2018). In 2017 Debbie was awarded an Edith Cavell Scholarship which acknowledged her commitment to the translation of research and evidence based initiatives as they relate to professional nursing practice and the delivery of health care.

Associate Professor Rachel Rossiter

RN, NP, CMHN, BHlthSc (Nursing), BCounselling, MCounselling, MN(NP), HScD, GradCertPTT, FACMHN

*Associate Professor of Nursing*

*School of Nursing, Midwifery and Indigenous Health*

*Faculty of Science*

*Charles Sturt University*

*Orange, NSW 2800*

As a clinician with more than 30 years' experience and more recently as an academic and researcher, Rachel’s work focuses on building registered nurse capacity for advanced practice in a range of different contexts.
Her academic and research activities are informed by wide-ranging clinical experience across several decades, including work in primary health care in Madagascar and the Solomon Islands and clinical, teaching and research experience in public health, general practice and mental health settings in urban and rural areas of New South Wales, Australia. Rachel continues clinical practice as a credentialed mental health nurse and therapist at the Orange Aboriginal Medical Service.

As an academic at the University of Newcastle, Rachel developed and implemented the curriculum for a Master of Mental Health Nursing (Nurse Practitioner) program and revised the Master of Nursing (Nurse Practitioner) program. She then led these programs through the accreditation process required by the Australian Nursing and Midwifery Accreditation Council for graduates to be eligible for endorsement to practice as Nurse Practitioners. She has extensive experience in subject and course development at several universities, including the University of Sharjah and now at Charles Sturt University.

Rachel’s research activities in Australia, Thailand, Egypt, East Africa and the United Arab Emirates include capacity building activities in cross-cultural settings, health promotion and early intervention, mindfulness-based interventions (MBSR and DBT), competency-based nursing curriculum, developing nursing capacity for advanced practice, clinical practice development, mental health literacy and mental health workforce development. As a researcher, her activities continue to focus on the role of nurses in the provision of specialist care, and the translation of evidence-based practice into effective health care delivery.
### Individual contributions to research

<table>
<thead>
<tr>
<th>RESEARCHER</th>
<th>CONTRIBUTION</th>
</tr>
</thead>
</table>
| **Associate Professor Marguerite** | ● Project lead  
| Bramble                           | ● Development of study design  
|                                   | ● Data review and analysis  
|                                   | ● Preparation of final report                                              |
| **Associate Professor Rachel**    | ● Preparation and submission of abstract for conference presentation  
| Rossiter                          | ● Preparation of final report                                               |
| **Vincent Carroll**               | ● Preparation and submission of the successful MNCLHD grant funding data collection for the study  
|                                   | ● Oversight of MNCLHD Data Collection  
|                                   | ● Preparation of final report                                               |
| **Dr Alfred Wong**                | ● Development of framework for quantitative data analysis  
|                                   | ● Quantitative data analysis  
|                                   | ● Preparation of final report                                               |
| **Debbie Schwebel**               | ● Assist in the preparation of the successful MNCLHD grant funding data collection for the study  
|                                   | ● Systems and data base expertise  
|                                   | ● Advice re protocol development  
|                                   | ● Preparation of final report                                               |
Research Governance Advisory Committee Working Group

Parkinson’s Disease Research (Cost-Effectiveness Study)

Advisory committee working group members:

- Associate Professor Marguerite Bramble, Chief Investigator, Clinical Chair in Aged Care Practice Innovation, Charles Sturt University
- Associate Professor Rachel Rossiter, School of Nursing, Midwifery & Indigenous Health Faculty of Science Charles Sturt University
- Vincent Carroll, Parkinson’s Clinical Nurse Consultant, Coffs Clinical Network, MNCLHD
- Cassie Carswell, Manager Brain Injury Unit, MNCLHD
- Debbie Schwebel, District Nurse Manager Clinical Practice, MNCLHD
- Jo-Anne Reeves, Chief Executive, Parkinson’s NSW
- Trevor Lyons, Consumer, Younger Person’s Parkinson’s Support Group, Coffs Harbour
- Liz Hay, Director, Economic and Analytics, Strategic Reform Branch, NSW Ministry of Health
- Sue Sharrad, Parkinson’s disease Nurse Consultant, Country Health SA Local Health Network, Government of South Australia
- Ann Dodd, Clinical Nurse Consultant for Neurological Service, Primary Health, Tasmanian Health Service - North West Region
- Paula Nonnemacher, Health Information Manager, MNCLHD

Executive Sponsor

- Vicki Simpson, Executive Director of Nursing, Midwifery and Workforce, MNCLHD

Support staff

- Dr Hilal Varinli, Manager of Health Outcomes | Health Intelligence Unit, WNSWLHD
- Yalchin Oytam, Principal Biostatistician (Health Analytics Capability Lead) NSW Ministry of Health
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Exploring the cost effectiveness of the specialist Parkinson’s disease nurse in the Mid North Coast Local Health District of New South Wales


