AN INVESTIGATION OF SERVICE MIX WITHIN THE HOME AND COMMUNITY CARE PROGRAM

Abstract

Given Australia's ageing population, the demand for Home and Community Care services is expected to escalate to unprecedented levels. A skilled and flexible aged care workforce, together with other broader aged care workforce planning needs, has become a priority at both the national and state levels. This study examined the Australian government's Home and Community Care program to identify regional differences in service hours received by clients and associations between services. Analysis was based on the Minimum Data Set of 2007/08 and confined to Queensland clients aged 18 and over. Investigations revealed that clients residing in regional and remote areas were more likely to receive nursing services but less likely to receive allied health services compared to those residing in a major city. This reflected the specific health professional to population ratio of the area. For clients residing outside the city, an inverse relationship existed between allied health and nursing hours. Possibly certain categories of staff supplemented the shortfall in other skilled labour present in regional and remote areas. The findings are part of the initial steps in examining the potential opportunities available to government in implementing skill mix reforms within the health sector.

Key words: Allied health, Health workforce, Home and Community Care, Health services, Nursing.

JEL Codes: I12, J14, J22, R3

1 Introduction

The Home and Community Care (HACC) Program is an integral part of the health system and central to the Australian Government's aged care policy. The Program aims to provide a comprehensive, coordinated and integrated range of basic maintenance and support services for frail aged people, those with a disability and their carers. Specifically it is designed to support these people to live independently at home, thereby enhancing their quality of life and delaying institutionalisation.

Given Australia's ageing population, the demand for HACC services is expected to escalate to unprecedented levels. A skilled and flexible aged care workforce, together with other broader aged care workforce planning needs, have been recognised as a priority at both the national and state levels (Productivity Commission 2005; COAG 2009). In many countries, including Australia, there is an increasing focus on exploring alternative ways of managing available staff as well as increasing total numbers and improving retention through better practice and workplace conditions (Duckett 2005a; Duckett 2005b; Stevens 2002; Armstrong et al 2007).

One relatively controversial strategy to tackle workforce shortages within the health sector involves labour substitution. In 2005 Stephen Duckett published a list of tasks and associated professions which could be usefully substituted by less qualified and more available staff (Duckett 2005b). A year later Duckett (2006) responded to the Productivity Commission's report on 'Australia's Health Workforce' (2005) by suggesting skill mix reform that covers a wider range of practitioners.

There is evidence within the health care literature of firms altering their mix of services in response to changing incentives and market conditions. Investigations in the US nursing home sector by Cawley et al (2006) and Grabowski and Hirth (2003) showed that higher nursing home wages was associated with greater uses of psychoactive drugs and lower quality outcomes. Due to imperfect information, cognitive impairment, and transaction costs, residents were less likely to shift away from a lower quality nursing home when quality of service decreased (Cawley et al 2006). Other overseas studies have also found evidence of factor substitution and lower quality outcomes in nursing homes. Higher labour costs have been found to be associated with greater receipt of prescription sedatives (Weisbrod 1998) and greater use of catheters, physical restraints and feeding tubes (Zinn 1993).

Similar investigations within the home care sector remain scant. An investigation by Stevens and Vecchio (2009) of an Australian agency found an inverse relationship between allied health and nursing time, after controlling for client and carer characteristics. The higher labour turnover among allied health staff compared with the nursing staff implied a substitution of labour between the two professions to ensure that the needs of clients were met.

Several studies relating to home care have focused on the factors associated with the use of formal home care services. Kipp and colleagues (2002) reported links between client characteristics within the home setting and care services. Their study, based on work in New Zealand and the United States, found that the rehabilitation status scale, functional independence measure and diagnosis predicted the amount of professional in-home care (Granger et al. 1990; Marek KD. 1996). Diwan's (1999) study undertook a more focused research approach, evaluating the role of client characteristics, informal caregiver characteristics and provider/service system characteristics to predict case management time. Client behaviours, functional ability, informal care and professional service support were found to be significant predictors of higher use of case manager time. Snell's (1985) research supported the findings that the costs of community care were significantly explained by both physical and mental characteristics of the older clients. Gender and area of residence were

also important factors. Research involving a sample of older Australians living in the community found that informal care and community service use were predicted predominantly by disability, with disease providing little additional prediction (Broe et al. 2002).

Further study of the same sample by Edelbrock and colleagues (2003) concluded a compensatory relationship existed between professional community services and informal care provided by family and friends. Van Houtven and Norton's (2004) investigation led them to conclude that informal care by adult children reduced the use of home care and delayed nursing home entry. Others have noted a complementary relationship between paid home care and support by informal carers (Langa et al. 2001; Liu et al. 2000). Spillman and Pezzin (2000) demonstrated that while informal care and formal care may be substitutes in general, they are complements among the severely disabled.

2 Background and conceptual framework

HACC is a joint Commonwealth, State and Territory cost-shared program. Within the HACC program the government purchases various service types from agencies. At present the government as a purchaser of health services makes predictions for resource requirements based on broad demographic data. It relies on service providers tendering for contracts based on their experience of resource utilization. Approximately 50% of HACC funds are derived from the Commonwealth Government with the remainder being funded by state and local government or through user charges. HACC funding is allocated on a planned basis. The program aims to achieve equitable provision of HACC services across Australia. Even so, there is considerable variation between and within states for many of the target areas (Duckett 2000).

The HACC program monitors the delivery of domestic assistance, personal care and social support services based on the combined total funding and outputs of the service types contracted. This allows service providers more discretion to respond to the fluctuating needs of an individual client for these service types. For example a client may normally receive domestic assistance from HACC on a weekly basis and other support (e.g. social support) from either a family or friend. On an occasion when family or friends are unable to provide this other support the client and service provider may negotiate and plan to utilise the allocated domestic assistance to undertake these tasks. On these occasions the activity is recorded as social support. The HACC program can expect a variation of up to 25% between contracted services and reported activity for each of these service types (Queensland Government 2006 p3-4).

2.1 Objectives of the Study

HACC funded agencies offer a mix of services to provide care to clients within their own home. These services are based on government funding and distributed to clients on a priority basis.

This study has two primary objectives:

1. Identify the regional differences in service hours offered by HACC funded agencies.
2. Identify associations (e.g. complement or substitute relationship) among the services provided by agencies.

Regional Differences in service hours

There is evidence in the Australian research that location is an important factor in the availability of health services (AGDHA 2008; Vecchio 2008; Productivity Commission 2005; Armfield et al. 2006; Snell 1985). Those residing in rural and remote regions are less likely to access health services. The first aim of this study is to investigate the impact of location on the quantity of government funded home care service hours received by clients. Provision of HACC services is dependent on a client's need and the capacity of the agency to respond within existing resources (Queensland Government 2006).

It is difficult to unravel horizontal equity (equal use of services for equal needs) from vertical equity (appropriately different use of services for different needs) when investigating the distribution of HACC services. This is particularly so given the multiple services typically received by individual clients. These needs are complex in the home care setting because client needs not only relate to issues of health but also independent living arrangements. The aim of this study is to provide an understanding of service mix and how this mix differs by urbanicity. The difficulty in identifying issues of equity is acknowledged.

Associations among the HACC services

As with any firm, HACC agencies respond to incentives and changes in the availability of raw materials (e.g. labour and capital). The mix of services offered by a HACC agency reflects these trade-offs as agencies attempt to meet client needs by adjusting their use of labour. If scarcity arises for a particular type of labour, holding all else constant, the theory of factor substitution implies that an agency will seek to meet the needs of clients by using more of another type of labour.

In Queensland, Australia, the service type offered by a home care agency contracted by the government is not based on the qualifications of the worker providing the service but the service itself (Queensland Government 2006 p3). That is, funding is based on the services offered, not the type of health professional used to deliver the service. The contract specifies a particular output (service) but does not specify the qualifications of the service provider. This allows agencies to substitute certain levels (registered nurse and nurse's aide) and categories (nursing and allied health) of labour in order to provide a certain service type to meet their contract obligations. For example if a registered nurse provides personal care services, the service is recorded as personal care not nursing care. Certain duties, however, may only be performed by qualified staff. For instance nursing duties are performed only by either registered or enrolled nurse. The HACC program monitors the delivery of services based on the combined total funding and output of the service types contracted. This allows agencies more discretion to respond to the fluctuating needs of clients.

The mix of home care services offered to clients may be influenced by the availability of certain categories and types of labour. Furthermore, agency contracts with government may be based on the expected scarcity faced by the agency within that region. Although the distribution of the nursing workforce as a ratio of nurses to area population is relatively even throughout Australia, there are variations within jurisdictions. This is particularly the case in remote areas of Queensland (AGDHA 2008). Also many allied health professionals are based within major cities, with low numbers working in regional and remote areas (AGDHA 2008). The mix of services provided in regional and remote areas may reflect this scarcity.

3 Theoretical background

In health care the role of prices is often subdued and in some cases entirely missing (Morris et al 2007). Such is the case in the home care sector where the government either fully or heavily subsidises HACC services. It is difficult to recover efficient cost or production

parameters from observed data with accuracy (Smith et al 2005). This is primarily due to the multiple organisations and complex objectives. Many of the issues being addressed by community care providers are complex, leading to difficulties in measuring the work of the sector. There are multiple commonwealth and state funding sources reflecting the multiple agencies involved in service provision. The range of professionals involved in the sector possesses different training, different orientations and different emphases in treatment (Duckett 2000). For example in 2008 there were approximately 714 active service providers on the Queensland HACC MDS agency register (Queensland Government 2008). The majority of Queensland HACC clients (56%) received two or more types of assistance. Of these 15% received 5 or more HACC services (Queensland Government 2008).

Given the complexities of the home care sector the development of a production function can be a challenge. Consider the production of home care in a simplified form. The inputs to home care production include types of labour such as the time of a nurse, allied health professional, personal carer and so on. In addition there is the use of equipment such as lifting devices, transport, drugs, dressings and disposables which are all types of capital. The production function analyses how these various inputs combine to produce output. Hours of total home care becomes the outcome measure.

The individual HACC agency can produce home care to clients in a variety of ways by combining different amounts of skilled, semi-skilled and unskilled labour and capital. To some extent it may be possible to substitute between types and levels of staff (e.g. nursing and personal care) to produce similar outcomes. For instance basic nursing and personal care can be used for many different types of care.

Although the complexity of the home care sector makes it difficult to construct an efficient combination of inputs to produce a constant output (isoquants), it is possible to construct a production frontier that shows the observed input combinations that produce a given output. Stratifying the analysis by urbanicity allows us to see how agencies choose a combination of labour types that meet client needs. The different combinations of service inputs for each region reflect the availability of various types and categories of labour used to produce a given amount of home care. For example case managers in remote areas may respond to shortages in allied health by recruiting a greater number of nurses to fulfil home care needs.

4 Method

4.1 Linear regression

Health economists commonly define need as the capacity for a client to benefit from health care (Morris et al 2007). In this study it is assumed that client needs are met and reflected in the receipt of services.

In order to estimate the urbanicity-productivity and service type-productivity, we consider a log-transformed Cobb-Douglas model.

$$\ln Y = \ln \beta_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \varepsilon \quad (1)$$

where: Y is the output, X_2 is the labor input and X_3 is the capital input. β_2 and β_3 is the partial elasticity of output with respect to labor and capital input, respectively.

Specifically, the production function is expressed as a linear regression. Linear regression is run for total home care service hours, after controlling for confounding variables.

$$\ln \text{TOTALCare}_i = \beta_0 + \beta_1 U_i + \beta_2 \ln V_i + \beta_3 \text{Urban}_i + \beta_4 \text{SD}_i + \varepsilon_i \quad (2)$$

Where $\ln \text{TOTALCare}_i$ represent the log of total home care service hours during a 12 month period in 2007/08¹.

¹ Certain services are excluded because they are measured either as a cost or quantity rather than hours of service. These include transport, home maintenance, home modifications and meals.

The primary aim of the HACC services is to allow individuals to remain in their home and delay institutionalisation. This may require health professional services (e.g. nursing, allied health) as well as domestic services. Personal and socio-economic characteristics tend to influence these requirements (refer to the literature review). Factors identified by previous research as significant in the prediction of services are included in the model as control variables. U represents the vector of client characteristics such as date of birth, gender, pension status, living arrangements, carer status, functional profile (domestic, self care, cognitive, behavioural) and language.

$\ln V$ is the vector of services provided by HACC funded agencies. The proportion of service hours to total home care hours² include: nursing care at the centre³; allied health care at the centre; respite care; home maintenance; counselling; assessment; case management; centre based day care; care coordination. All measures of service are transformed to the log.

Urban represents four categories of urbanicity: major city, inner region, outer region and remote. This measure is based on the ABS (Australian Bureau of Statistics) Accessibility Remoteness Index of Australia. The classification relates to the distance to large towns and cities, and the distance to other people. There is the assumption that: 1. people tend to obtain goods and services from the nearest urban centre; 2. large urban centres offer a wider range of goods and services compared to smaller urban centres; and 3. frequency of access to goods and services is relative to remoteness.

To control for homogeneity within a location, thirteen categories of Statistical Divisions, represented by SD are also included in the model (refer Table 1). The statistical divisions are delimited on the basis of socioeconomic criteria. A Capital City statistical division contains the anticipated development of the city for a period of at least 20 years. This fixed statistical division boundary delimits an area which is stable for general statistical purposes. Statistical divisions outside a capital city are defined as a relatively homogeneous region characterised by identifiable social and economic links between the inhabitants and between the economic units within the region, under the unifying influence of one or more major town or city (ABS 2001b). The Statistical Divisions reflects HACC funding arrangements, wage differentials and availability of other health services that may vary by division.

4.2 Linear regression stratified by selected services

Linear regressions are also run for each of the five service types (Nursing at home, allied health at home, social support, domestic assistance and personal care). This provides information about the relationship between services.

Previous research has shown an inverse relationship between nursing and allied health services within a community care agency (Stevens and Vecchio 2009). This, coupled with the scarcity of skilled labour in the health sector, warrants the investigation of nursing and allied health services.

While little flexibility exists among agencies in the offering of most HACC funded services, there is flexibility in the provision of social support, domestic care and personal care services (Queensland Government 2006 p3). That is, agencies have discretion to respond to fluctuating needs of clients by altering the quantity offered of these three services. These services are also included as dependent variables in the analysis of home care services. The model becomes:

$$\ln \text{ServiceHours}_i = \beta_0 + \beta_1 U_i + \beta_2 \ln V_i + \beta_3 \text{Urban}_i + \beta_4 \text{SD}_i + \varepsilon_i \quad (3)$$

² This eliminated multicollinearity.

³ Services are located outside the home, usually at the agency/community centre.

Where `lnServiceHours` represent the log of service hours at home relating to either nursing, allied health, social support, domestic assistance or personal care. Each dependent variable represents the hours of service during a 12 month period in 2007/08.

Nurse hours received by clients at home consist of registered/enrolled nursing, assessment nursing, wound management, stomal therapy and diabetes management.

The quantity of allied health hours at home includes occupational therapy, dietetics and nutrition, social work, podiatry, diversional therapy and physiotherapy.

Social support is assistance provided by a companion either within the home or while accessing community services. The primary purpose of this service is to meet the client's need for social contact and or accompaniment in order to participate in community life.

Domestic assistance includes house cleaning, washing and ironing, help with shopping, transport to and from banks and appointments etc, and general household support.

Personal care may include help with bathing, toilet use, eating, dressing and personal grooming.

A further regression is run that adds $V*Urban$ to the model. The interaction term between urbanicity and service type identify whether regional differences impact on specific home care services when a client receives a certain type of service.

4.3 Marginal effects

After fitting the models with a linear regression, the statistical package Stata10.1 allows the computation of the marginal effects (Baum 2006). The marginal effects in the probabilities are calculated when all the dependent variables are at their mean value. The option computes the elasticity of one type of service with respect to another. The analysis is run for nursing and allied health, stratified by urbanicity and user intensity (low, moderate and high). For instance the nurse model shows the elasticity of nurse hours with respect to say allied health hours, for a specific range of total home care hours (user intensity), holding constant other variables. User intensity in relation to home care service hours is classified as: low if clients receive between 1 and 25 hours; moderate if clients receive between 26 and 77 hours; and high if clients receive 78 or more hours.

5 The Sample

All service providers that receive HACC funding are required to collect data on a quarterly basis. Providers send their data directly to the National Data Repository for validation. The collection of the information is on the basis of informed consent.

The analysis is based on the Australian HACC Minimum Data Set of 2007/08. The data consists of de-identified client information acquired from approximately 714 active service providers that includes community, commercial, religious and charitable organisations and state and local government bodies. The agency participation rate is 94% (Disability Services Queensland 2009).

Since the functional status of children and adolescents were not captured in the data set only those clients aged 18 and over were included in the study. This resulted in 75494 cases available for analysis.

The study is confined to the State of Queensland to ensure consistency in government subsidies, staffing regulations, award wages and industrial relation laws that may vary by Australian State. Only those clients that received HACC services due to their own frailty, disability or condition were selected for the investigation. Only clients who receive services measured in hours are included in the analysis.

6 The Data

The conversion of all service variables to the log reduced skewness and kurtosis to a normal range.

The data set captured information regarding the functional profile of clients. On a scale of 1 (poorest) to 3 (best), the assessment team rated client's on their ability to perform five domestic tasks relating to housework, transport, shopping, medication and money. The aggregated score of each domestic activity became the total domestic functional profile score (DomFP). The aggregated score of self care activities, e.g. walking and bathing, became the total self care functional profile score (SelfFP).

The variable, country of birth, was transformed to a dichotomous variable that represented Main English-speaking countries and otherwise. The main English speaking countries comprised Australia, United Kingdom, New Zealand, the Republic of Ireland, Canada, the United States of America and South Africa.

Postal areas of clients were transformed into two categorical variables - remoteness and statistical division classifications⁴. These categories are based on the Australian Bureau of Statistics (ABS) classifications. The Australian Bureau of Statistics developed a concordance product that enabled the conversion of postal areas into the two variables (ABS 2007).

7 Empirical Results

7.1 Descriptive statistics

Table 1 presents the descriptive statistics of the HACC clients under investigation. Females comprise 65 percent of the sample. The majority of clients receive a pension and the mean age is 75 years. Almost 39 percent of clients receive assistance from a care-giver, while 45 percent live alone. The mean hours of service presented in Table 1 are based on the total selected sample.

INSERT TABLE ONE HERE

Table 2 presents the mean number of hours received per client per assistance type. The 2007-2008 financial year data indicates that domestic assistance is the most received type of service with 50851 instances of assistance. The total allied health care services (at home and in the centre) and total nursing services (at home and the centre) are also commonly used services within the HACC program.

INSERT TABLE TWO HERE

The highest mean annual hours of assistance to individual clients was for centre-based⁵ day care hours (167), followed by respite care (61.76) and social support (34.19). Over the financial year HACC clients also received substantial hours of domestic assistance (28.8) and personal care (23.63).

⁴ For full details of the geographic areas refer to: Statistical Geography Volume 1 Australian Standard Geographical Classification (ASGC) 2006 (cat no. 1216.0) for SDs; and Statistical Geography Volume 2 Census Geographic Areas Australia 2006 (cat no. 2905.0) for POAs.

⁵ Services offered at the agency or community centre.

7.2 Correlations

The correlations between the HACC services are presented in Table 3.

INSERT TABLE THREE HERE

The results of the analysis indicate a significant and positive correlation of 0.166 (correlation is significant at the 0.01 level, 2 tailed) between nursing and personal care service time received at home. For home care clients, nursing time increases (decreases) as personal care time increases (decreases), indicating a complementary relationship between the two services.

A significant and positive association also exists between nursing and allied health hours received at home (0.133, correlation is significant at the 0.01 level, 2 tailed).

7.3 Linear Regression: total home care and selected HACC services

The results from the correlation matrix demonstrate a positive relationship between the selected service times (nursing, allied health, domestic assistance, personal care and social support). These results, however, may be misleading. To remove other influences from the analysis such as age and functional profile, standard multiple regressions are performed for total hours of home care and for each of the 5 HACC services to adequately identify the relationships between services. The log transformation of the hours of service variables allows the reporting of the percentage change in the dependent variable for a given percentage change in hours of each HACC service.

INSERT TABLE FOUR HERE

Total Home Care Model

The coefficients reported in Table 4 reflect the descriptive statistics presented in Table 1. The sample of HACC clients are more likely to be female and live alone. Poorer domestic and self care functional profile is linked to greater hours of home care. This is also true for clients with memory and behavioral problems. Compared to those without a carer, those cared for by parents are associated with higher levels of service hours – possibly reflecting long term health conditions of the recipients of care. Among the statistical divisions, clients residing in the Central West division use a greater amount of total home care hours. Clients who reside further away from the city receive fewer home care hours.

Of the services offered by HACC, total home care hours are most sensitive to changes in in-centre care, respite and domestic assistance followed by personal carers and social support. This reflects the statistics reported in Table 2.

Nursing model

Overall the HACC services and the control variables of the nursing model explain 27 percent of the variance in nursing time. Referring to the nursing model (Table 4), females tend to receive less nursing hours than males. Clients that either do not receive any government pension, live alone or come from an English speaking background receive more hours of nursing compared to their counterparts. Those reporting poorer functional status (domestic and self care) also receive a greater amount of nursing services. Compared to those who do not have a carer, clients cared for by their parents tend to receive less hours of nursing.

Urbanicity is significantly associated with the amount of nursing hours received. After controlling for confounding variables, clients residing in remote areas receive more nursing hours than city clients. Specifically, the mean nurse hours of clients residing in remote areas of Queensland are 29 percent higher than city clients⁶. In contrast, the mean nurse hours of inner regional clients are 25 percent lower than city clients⁷.

Of all the services provided at home, personal care shows the greatest sensitivity to nursing hours. A one percent increase in the hours of personal carers, is associated with an increase in nursing hours by 0.39 percent. This implies that personal care and nursing are complementary services – a service is typically performed in conjunction with another kind of service.

A positive and significant association exists between the hours of home nursing and services such as home allied health, assessment, counselling and nursing at the centre. The allied health time coefficient 0.104 gives the constant percentage increase in nursing time as a result of a 1 percent increase in allied health time. If allied health time rises by 10 percent, all else held constant, it is predicted that nursing time will rise by 1 percent.

Allied Health Model

The results of the regression model for allied health show a Nagelkerke R^2 of 17 percent. Females, pensioners, those from an English speaking background tend to receive greater hours of allied health services compared to their counterparts (male, non-pensioners, non-English speaking background). As self care functional profile decreases there is an increase in allied health hours. Memory problems are also associated with greater allied health services.

City clients tend to receive more allied health hours than those residing in other areas of Queensland. Holding other influences constant, the mean allied health hours of those residing in inner and outer regions become 3⁸ and 6⁹ percent, respectively, lower than that of city clients.

Among other services, allied health at the centre, assessment and counseling are positively related to allied health hours received at home.

Domestic Assistance Model

A Nagelkerke R^2 of 18 percent is reported for the domestic assistance models. Females, pensioners, those who live alone and from a non English speaking background tend to receive greater hours of domestic assistance.

Clients without either memory or behavioural problems and those reporting better levels of self care function are associated with more hours of domestic assistance. The mean hours of domestic assistance received by clients in regional and remote areas are lower than that received by city clients.

There is also greater involvement by case managers, counsellors, care co-ordinators and personal carers when a client receives domestic assistance. An inverse relationship exists between hours of domestic assistance and hours of nursing services.

⁶ To obtain the relative change in mean hours of nursing provided to clients at home, we take the antilog of the estimated dummy coefficient and subtract it by one (Halvorsen and Palmquist, 1980). The antilog 0.251 = 1.284, and thus, $(1.285 - 1) = 0.285$.

⁷ The antilog -0.292 = 0.747, and thus $(0.747 - 1) = -0.253$.

⁸ The antilog -0.034 = 0.967, and thus, $(0.967 - 1) = 0.033$.

⁹ The antilog -0.058 = 0.944, and thus, $(0.944 - 1) = -0.056$.

Personal Care Model

The variables of the personal model explain 25 percent of the variance in personal care time.

Clients with poorer levels of self care functions tend to receive more hours of personal care. Increasing hours of home nursing and respite are some of the services associated with greater hours of personal care.

Social Support Model

The results of the regression model for social support show a Nagelkerke R^2 of 13 percent.

Individuals that either live alone or have no carer or are from a non-English speaking background tend to receive more hours of social support than their counterparts. Clients residing outside the city receive lower levels of social support compared to city clients. A positive and significant association exists between social support and services such as case management, care co-ordination, centre based care and personal carers.

7.4 Regression with interaction effects between urbanicity and hours of services

Implicit in the models presented in Table four is the assumption that the differential effect of location is constant across the hours of services and that the differential effect of the service hours is constant across location. For example in the nursing model it is assumed that the mean hours of nursing at home are higher in remote areas than in the city, regardless whether or not these clients also receive allied health services. However it is plausible that a nursing client residing in a remote area may receive less allied health hours than nursing clients residing in the city. And this may be driving the positive relationship between remote areas and nursing hours. This scenario is plausible given that the ratio of health professionals is not constant across the regions (Productivity Commission 2005).

To account for this, interaction terms between urbanicity and service type are added to the models (refer Table 5). These interactions show whether the regional differences (city, inner regional, outer regional and remote) on the dependent variable (e.g. nursing hours) is different if a client also receives another type of service (e.g. allied health). The inclusion of interaction terms into the models change the interpretation of the estimated coefficients for the selected services.

INSERT TABLE FIVE HERE

Nurse Model

For city clients increases in either allied health or personal care hours at home is associated with rising hours of nursing (refer $\ln\text{AlliedHealth}$ and $\ln\text{PersonalCare}$, Table 5). Increases in hours of domestic or social support services in the city are associated with minor decreases in hours of nursing.

The interaction terms - InnerPC, OuterPC - reveal that clients residing outside the city receive increased hours of personal care as hours of nursing rise. Inner regional clients show a significant and inverse relationship between allied health and nursing (InnerAH). Outer regional and remote clients tend to receive more nursing hours as social service hours rise (OuterSS, RemoteSS).

Allied health Model

Increasing hours of personal care and nursing services in city areas are associated with increasing allied health service hours (refer InPersonalCare and InNursing, Table 5).

Referring to clients residing outside the city, there is an inverse relationship between allied health and several of the selected services - personal care (InnerPC, OuterPC, RemotePC) and nursing (InnerNrs, OuterNrs, RemoteNrs).

Domestic Assistance

In the city, increases in allied health, social support and personal care hours are associated with rising domestic assistance hours (refer InAlliedHealth, InSocialSupport and InPersonalCare, Table 5), while higher nursing hours (InNursing) is associated with lower hours of domestic assistance.

Social support and personal care hours tend to rise with domestic assistance hours when these services are received by clients in outer regional (OuterSS, OuterPC) and remote (RemoteSS, RemotePC) areas of Queensland. However rising allied health care tends to lower the amount of domestic assistance hours received by those in inner (InnerAH) regional areas.

Personal Care Model

In the city there is a significant and positive relationship between personal care services and several HACC services - allied health, domestic assistance, social support and nursing hours.

The interaction terms of the personal care model show that as the hours of allied health care rise for clients outside the city, personal care hours tend to fall (InnerAH, OuterAH, RemoteAH). Also in remote areas, a significant and inverse relationship exists between hours of home nursing and personal care (RemoteNrs).

Social Support Model

Rising domestic assistance and personal care hours received by clients in the city are associated with rising social support hours. However rising nursing hours in the city is associated with a fall in social support services.

The interaction terms in the social support model reveal that among inner regional clients the rising allied health hours is associated with lower hours of social support. Nursing hours tend to rise with social support hours among clients in regional and remote areas. There is a positive and significant relationship between hours of social support and hours of domestic assistance in outer regional and remote areas.

7.5 Marginal effects: selected HACC services by urbanicity and service intensity

The marginal effects give an indication of the percentage change between one hour of a type of labour with respect to another type of labour stratified by urbanicity (city, inner region, outer region and remote) and service intensity (low is 1 to 25 total hours; moderate is 26 to 77 total hours; high is 78 and over total hours).

INSERT TABLE 6 HERE

The analysis output for the allied health and nursing models produce similar results. Among low and moderate users of HACC services, the elasticity coefficients show that a change in

allied health hours generally has a greater impact (is more responsive) on nursing hours in city areas compared to areas outside the city. These two groups of users (low and moderate) also display an inverse relationship between allied health and nursing hours. In contrast, high end users of services show a positive relationship between nursing and allied health hours. Within each user intensity range (low, moderate, high) hours of personal care mirrors the nursing hour patterns. This confirms the complementary nature of the two services identified in the previous analysis (refer Tables 3, 4 and 5).

8 Discussion

The study reported here investigated regional differences in the amount of service hours received by clients and associations between these services. The inclusion of the statistical division variables in the regression analysis controlled to some extent the regional variation in the availability of other health services (e.g. hospitals, nursing homes).

In 2005, the Productivity Commission reported that apart from nurses, the number of health professionals relative to population diminished from communities located further away from the major cities (Productivity Commission 2005 p 204). Specifically, in remote areas of Australia the physiotherapists to population ratio were less than a half of that in the cities (Productivity Commission 2005 p 204-5). Consistent with the report, we found that clients living in outer regional/remote areas were more likely to receive nursing services but less likely to receive allied health services, compared to residents of a major city (refer Table 4).

Acknowledging that the mix of services may differ by urbanicity, interaction terms that combined urbanicity with selected services were included in the model (refer Table 5). The analysis was stratified by nursing, allied health, personal care, domestic assistance and social support. The nursing model showed that in city and regional areas, personal care and nursing hours rose together. In contrast, although allied health hours increased with nursing hours in the city areas, we found in inner regional an inverse relationship between allied health and nursing hours.

Within the allied health model, the interaction terms revealed that as personal care and nursing hours increased for city clients, allied health hours also rose. However, for clients outside the city, increasing personal care and nursing hours was associated with falling hours of allied health. The lower proportion of allied health staff relative to nursing staff outside city areas may have led to nursing and personal care services being used to substitute for allied health services. Previous investigation by Stevens and Vecchio (2009) has shown an inverse relationship between allied health and nursing hours.

Finally marginal effects were calculated for the nurse and allied health models. Overall the coefficients for the city and regional clients with low and moderate use of services showed an inverse relationship between nursing and allied health. Consistent with findings of the previous analysis, personal care and nursing hours again exhibited a complementary relationship.

The literature on home care services show that informal care tends to be a substitute for lower skilled activities and a complement for higher skilled tasks (Spillman and Pezzin 2000). Given this, one might expect that high intensive and specialized services such as allied health would be complemented by other services. Low end users with lesser specialized needs may have greater opportunities to substitute with other services offered under the HACC program. Certainly within this study when the analysis was stratified by user intensity the results showed that among low and moderate end users, nursing and, to a lesser but still significant extent, personal care was inversely related to allied health. Among higher end users a complementary association existed.

8.1 Data Limitations

Due to data limitations the client's diagnostic category was not available as a control variable. The inclusion, however, of several indicators relating to functional status acted as proxies for client need.

The data set did not segregate services such as allied health and nursing into separate levels or categories. It is possible that the significance and direction of association between nursing and allied health will depend on the type of allied health service (e.g. physiotherapy, social work) and the level of nurse qualification (e.g. registered nurse, enrolled nurse) (Stevens and Vecchio 2009).

Information relating to specific agencies could not be incorporated into the model, including information relating to employee wages and the profit status (for-profit, not-for-profit and government) of the agencies.

Service mix is not easily conceived or measured. Not only are there multiple market forces impacting on the service mix for frail and disabled people living at home, there is heavy government intervention. This distorts the markets for labour and service delivery under HACC funding. The limitations are compounded by the lack of appropriate economic data relating to input prices/costs under the 'service mix' funding regime.

9 Conclusions

Significant relationships exist between the HACC services. The direction of these relationships partly depended on urbanicity and intensity of service. Compared to city areas, there was an inverse association between allied health and nursing hours in regional and remote areas. Certain hours of allied health services may be substituted for nursing services. Also personal carers may on occasions supplement nursing duties to meet the needs of clients. Future research needs to include a qualitative approach to confirm the presence of low level and moderate substitution of skilled labour between HACC services.

While in this study labour substitution within the home care sector remains inconclusive, investigations of nursing homes have found evidence of factor substitution and the consequence of lower quality outcomes (Weisbrod 1998; Cawley et al 2006; Grabowski and Hirth 2003; Zinn 1993). In contrast to the nursing home sector, when substitution arises in the home care sector it is expected that the quality of service would remain constant. Compared to nursing home clients, home care clients possess greater flexibility in their choice of services. Relatively less transaction costs arise from switching from one service provider to another. Also, since a primary carer is often involved in the decisions when the client is cognitively impaired, decisions about services tend to be made in the best interest of the client. Informal carers may also perform extra duties to meet agency shortfalls.

Stephen Duckett is a strong advocate of the need to extend and expand the categories of the health care workforce in order to meet the needs of a rapidly aging Australian population. Duckett (2000) argues that a critical issue to be faced in the redesign of primary and community care is the relative role of various professionals. Addressing issues of relative roles will be facilitated by the inevitable restructure of the primary and community care sector. This would provide opportunities to create a broader role for staff

Part of the process towards health reform involves the development of effective workforce programs that identify and acknowledge the existence of labour substitution. The findings of this study are part of the initial steps in examining the potential opportunities available to government in implementing skill mix reforms within the health sector. Particularly within the home care program these reforms are both attractive and inevitable to policy makers that face increasing budget constraints and resource limitations.

References

- Armfield, S. G. and A. Spencer (2006) *Socioeconomic differences in children's dental health* (Canberra: AIHW).
- Armstrong, B., Gillespie, J., Leeder S., G. Rubin and L. Russell (2007) "Challenges in health and health care for Australia", *Medical Journal of Australia*, 187(9), pp. 485-9.
- Australian Bureau of Statistics (2007) *Australian Bureau of Statistics Postal Area Concordances*, (Canberra: ABS).
- Australian Bureau of Statistics (2006) *Statistical Geography Volume 1 - Australian Standard Geographical Classification (ASGC)*, (Canberra: ABS).
<http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/BD1B52D132D130E7CA2573630012F67B?opendocument>
- Australian Bureau of Statistics (2006) *Statistical Geography: Volume 2 - Census Geographic Areas, Australia*, (Canberra: ABS).
<http://www.abs.gov.au/ausstats/abs@.nsf/DirClassManualsbyTopic/C0110354C7D4789ECA2570B5000F4D87?OpenDocument>
- Australian Government Department of Health and Ageing (2008) *Home and Community Care Program Minimum Data Set 2006-07 Annual Bulletin* (Canberra: Community Care Branch, Ageing and Aged Care Division).
- Australian Government Department of Health and Ageing (2008) *Report on the Audit of Health Workforce in Rural and Regional Australia*, April, 2008. Commonwealth of Australia, Canberra.
- Broe, G., Grayson, D., Waite, L., et al. (2002) "Determinants of service use among the elderly: the Sydney older persons study", *Australas J Ageing*, 21, pp. 61-6.
- Cameron A. and P. Trivedi (2009) *Microeconometrics Using Stata* (Texas: StataCorp).
- Cawley, J, D. Grabowski and R. Hirth (2006) "Factor substitution in nursing homes", *Journal of Health Economics*, 25, pp. 234-247.
- Council of Australian Governments (COAG) (2009) "A Healthier Future For All Australians – Final Report of the National Health and Hospitals Reform Commission – June 2009",
<http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/nhhrc-report>
- Disability Services Queensland (2009) *Queensland HACC Minimum Data Set (MDS) 2007-2008 Annual Bulletin*, Queensland Health.
<http://www.health.qld.gov.au/hacc/HACCmds/Final%20Qld%20MDS%20Annual%20Bulletin%202007-2008%20-%20%2020090928.pdf>
- Diwan, S. (1999) "Allocation of case management resources in long-term care: predicting high use of case management time", *Gerontologist*, 39, pp. 580-90.
- Duckett, S. (2000) *The Australian health care system*. Oxford University Press, Melbourne.
- Duckett, S. (2005a) "Health workforce design for the 21st century", *Australian Health Review*, 29 (2), pp. 201-10.
- Duckett, S. (2005b) "Interventions to facilitate health workforce restructure", *Australia and New Zealand Health Policy*, 2(14), pp. 1-6.
- Duckett, S. (2006) "Next Steps in Health Workforce Reform. Policy Forum: Australia's Health Workforce", *The Australian Economic Review*, 39(3), pp. 318-22
- Edelbrock, D., Waite, L., Broe, G. and H. Creasy (2003) "The relation between unpaid support and the use of formal health services: the Sydney older persons study", *Australas J Ageing*, pp. 22: 2-8.
- Granger, C., Cotter, A., Hamilton, B. and R. Fielder (1990) "Functional assessment scales: a study of persons with multiple sclerosis", *Arch Phys Med Rehabil*, 71, pp. 870-5.
- Grabowski, D. C. and R. A Hirth (2003) "Competitive spillovers across nonprofit and for-profit nursing homes", *Journal of Health Economics*, 22(1), pp. 1-22.

- Kipp, J., Killick, K. and W. Kipp (2002) "Predicting in-home time of community care professionals", *Int J Health Care Qual Assur Inc Leadersh Health Serv*, 15, pp. 11-6.
- Langa, K., Chernew, M., Kabeto, M. and S. Katz (2001) The explosion in paid home care in the 1990s: who received the additional services? *Medical Care*, 39(2), pp. 147-157 cited in Van Houtven C. and Norton E. (2004) "Informal care and health care use of older adults", *Journal of Health Economics*, 23, pp.1159-1180.
- Liu, K., Manton K., and C. Aragon (2000) "Changes in home care use by disabled elderly persons: 1982-1994", *Journal of Gerontology B: Psychological Sciences Social Sciences* 55 (4), S245-S253 cited in Van Houtven C. and Norton E. (2004) "Informal care and health care use of older adults", *Journal of Health Economics*, 23, pp.1159-1180.
- Marek, K. D. (1996) "Nursing diagnoses and home care nursing utilization", *Public Health Nurs*, 13, pp. 195-200.
- Morris, S., Devlin, N. and D. Parkin (2007) *Economic Analysis in Health Care* (West Sussex: Wiley and Sons)
- Productivity Commission (2005) *Australia's Health Workforce* (Canberra: Productivity Commission).
- Queensland Government (2006) *Service Agreement Guideline, Service Type and Unit of Service Definitions* (Brisbane: Queensland Government, Home and Community Care Unit).
- Smith, P., Ginnelly, L. and M. Sculpher (2005) *Health policy and economics. Opportunities and challenges* (Berkshire: Open University Press).
- Snell, M. (1985) Community care for elderly: costs and dependency. *Soc Sci Med*, 20, pp. 1313-8.
- Spillman, B., and L. Pezzin (2000) Potential and active family caregivers: changing networks and the "sandwich generation". *Milbank Quarterly* 78 (3), 339-347 cited in Van Houtven C. and Norton E. (2004) "Informal care and health care use of older adults", *Journal of Health Economics*, 23 pp.1159-1180.
- Stevens, S. (2002) "Nursing Workforce Retention: Challenging a Bullying Culture", *Health Affairs*, 21(5), pp. 189-93.
- Stevens, S. and N. Vecchio (2009) "Substitution across professions within the home care sector: An investigation of nursing and allied health services", *Australian Health Review*, 33(1), pp. 19-26.
- Van Houtven, C. and E. Norton (2004) "Informal care and health care use of older adults", *Journal of Health Economics*, 23 pp.1159-1180.
- Vecchio, N. (2008) "The Use of Dental Services among Older Australians", *Australian Economic Review*, 41(3), pp. 272-282.
- Weisbrod, B. A. (1998) "Institutional form and organizational behaviour" in W. W. Powell and E. S. Clemens (eds), *Private Action and the Public Good* (New Haven, CT: Yale University Press)
- Zinn, J. S. (1993) "The influences of nursing wage differentials on nursing home staffing and resident care decisions", *The Gerontologist*, 33(6), pp. 721-729.

TABLE 1
DESCRIPTIVE STATISTICS, N = 72111

Dependent Variables		Mn/% (S.D)
Nursing hours at home	Continuous variable from 0 to 1290	4.30 (16.144)
Allied health hours at home	Continuous variable from 0 to 234	1.72 (5.988)
Domestic assistance hours at home	Continuous variable from 0 to 924	14.20 (22.496)
Personal care hours at home	Continuous variable from 0 to 2039	3.89 (26.594)
Social support hours at home	Continuous variable from 0 to 3096	8.38 (48.884)
Independent Variables		
Birth date	Continuous variable	1933.12(14.319)
Sex	1 male; 2 female	65.36
No government pension	1 no pension; 0 other	6.41
Lives alone	1 lives alone; 0 other	44.75
English language	1 ESB; 0 other	94.86
Domestic Functional profile (DomFP)	Continuous variable from 5 (worst) to 15 (best)	11.68 (2.327)
Self Care Functional Profile (SelfFP)	Continuous variable from 2 (worst) to 6 (best)	5.40 (0.915)
Memory (CogFP)	1 no problems, 2 memory problems	28.29
Behaviour (BehFP)	1 no problems, 2 behaviour problems	18.62
Urbanicity	Major city	Categorical: 'major city' is referent 55.20
	Inner regional	26.32
	Outer regional	15.47
	Remote	3.00
Statistical Division	Brisbane	Categorical: 'Brisbane' is referent 38.73
	Gold Coast	14.74
	Sunshine Coast	7.79
	West Moreton	1.51
	Wide Bay-Burnett	8.40
	Darling Downs	7.17
	South West	1.02
	Fitzroy	4.24
	Central West	0.36
	Mackay	4.47
	Northern	4.27
	Far North	6.69
	North West	0.60
Relationship to Carer	No carer	Categorical: 'no carer' is referent 60.71
	Spouse/partner	18.13
	Parent	2.80
	Son/daughter	13.43
	Other	4.94
Nursing hours at centre	Continuous variable from 0 to 113	0.09 (1.467)
Allied health hours at centre	Continuous variable from 0 to 150	0.71 (3.980)
Assessment hours	Continuous variable from 0 to 78	0.63 (1.885)
Case management hours	Continuous variable from 0 to 125	0.40 (2.728)
Counselling hours	Continuous variable from 0 to 157	0.58 (2.854)
Centre based day care hours	Continuous variable from 0 to 3388	25.59(102.687)
Home maintenance hours	Continuous variable from 0 to 441	1.39 (5.460)
Respite care hours	Continuous variable from 0 to 2959	3.72 (28.873)
Care coordination hours	Continuous variable from 0 to 217	0.51 (3.192)

Source: Queensland HACC MDS, 2007/08

TABLE 2
MEAN NUMBER OF HOURS RECEIVED PER CLIENT PER ASSISTANCE TYPE

HACC Services	Observations	Mean	Std. Dev.
Nursing hours at home	40699	11.8486	23.66067
Allied health hours at home	31881	6.834165	10.42542
Domestic assistance hours at home	50851	28.79599	25.58581
Personal care hours at home	18174	23.63277	57.02631
Social support hours at home	26143	34.19317	90.63609
Nursing hours at centre	2327	6.1633	9.792998
Allied health hours at centre	15617	5.57796	10.27819
Assessment hours	26649	2.778303	3.32632
Case management hours	7285	5.856143	9.132342
Counselling hours	15856	6.349584	19.78267
Centre based day care hours	17086	169.9839	212.9968
Home maintenance hours	31513	6.402881	8.833035
Respite care hours	6688	61.76092	100.9368
Care coordination hours	12234	5.589586	20.39857

Source: Queensland HACC MDS, 2007/08

TABLE 3
CORRELATION MATRIX, HACC SERVICE HOURS

	Total Care	Nursing at home	Allied health at home	Domestic assistance at home	Personal care at home	Social support at home
Total Care	1.0000					
Nursing hours at home	0.1606*	1.0000				
Allied health hours at home	0.0995*	0.1133*	1.0000			
Domestic assistance hours at home	0.1725*	-0.0047	0.0079*	1.0000		
Personal care hours at home	0.3143*	0.1660*	0.0932*	0.0791*	1.0000	
Social support hours at home	0.5300*	0.0111*	0.0100*	0.0533*	0.0334*	1.0000
Nursing hours at centre	0.0649*	0.0334*	0.0252*	0.0034	0.0099*	0.0088*
Allied health hours at centre	0.0977*	0.0124*	0.1344*	-0.0010	0.0385*	0.0060
Assessment hours	0.0507*	0.1220*	0.0930*	0.0157*	0.0768*	0.0059
Case management hours	0.1006*	0.0460*	0.0452*	0.0817*	0.1012*	0.0631*
Counselling hours	0.0840*	0.0509*	0.0848*	0.0750*	0.0240*	0.0266*
Centre based day care hours	0.8392*	-0.0116*	0.0009	-0.0399*	0.0621*	0.2009*
Home maintenance hours	0.0596*	-0.0102*	0.0102*	0.0708*	-0.0057	0.0213*
Respite care hours	0.2942*	0.0355*	0.0493*	-0.0102*	0.1034*	0.0185*
Care coordination hours	0.0711*	0.0195*	0.0172*	0.0333*	0.0075*	0.0545*

* Correlation is significant < 0.05 level (2-tailed)

Source: Queensland HACC MDS, 2007/08.

TABLE 4
MODELS OF SELECTED HACC SERVICE HOURS AND TOTAL HOME CARE HOURS
(N=72111)

Variable	Nursing at home	Allied health at home	Domestic Assistance	Personal Care	Social Support	Total Home Care
birth_date	-0.001*	0.002***	-0.007***	-0.004***	0.003***	0.003***
Female	-0.099***	0.021***	0.318***	0.048***	0.100***	0.081***
NoPension	0.242***	-0.030*	-0.517***	-0.030*	-0.037*	-0.062***
LivesAlone	0.068***	-0.015*	0.732***	-0.049***	0.241***	0.177***
English	0.252***	0.139***	-0.115***	0.038*	-0.353***	-0.012
DomFP	-0.031***	0.009***	-0.026***	0.001	0.006*	-0.027***
SelfFP	-0.040***	-0.070***	0.191***	-0.159***	0.058***	-0.024***
CogFP	-0.002	0.030***	-0.142***	0.001	0.042***	-0.053***
BehFP	0.017	0.016	-0.317***	0.053***	0.019	-0.049***
SpousePartner ^a	0.105***	0.118***	0.350***	-0.022*	-0.219***	0.071***
Parent ^a	-0.179***	-0.066**	0.025	0.019	-0.036	0.422***
SonDaughter ^a	0.121***	0.084***	-0.043*	0.050***	-0.152***	0.067***
OtherCarer ^a	0.125***	0.088***	0.026	0.038*	-0.070**	0.155***
InnerRegional^b	-0.292***	-0.034**	-0.712***	-0.017	-0.235***	-0.209***
OuterRegional^b	0.044	-0.058**	-0.687***	-0.026	-0.140***	-0.185***
Remote^b	0.251***	0.030	-0.731***	-0.042	0.067	-0.282***
Gold Coast ^c	-0.160***	-0.000	0.226***	-0.008	0.040**	0.018
Sunshine Coast ^c	0.028	-0.130***	-0.426***	0.050***	0.520***	-0.188***
West Moreton ^c	0.266***	0.059*	0.851***	0.020	0.290***	0.284***
WBay-Burnett ^c	0.116***	-0.124***	0.601***	0.060***	0.023	0.166***
Darling Downs ^c	0.285***	-0.157***	0.888***	-0.054**	0.208***	0.118***
South West ^c	0.316***	-0.441***	1.018***	-0.126**	0.012	0.267***
Fitzroy ^c	0.399***	-0.275***	0.977***	0.002	0.179***	0.081***
Central West ^c	0.058	-0.569***	0.620***	0.053	0.716***	0.450***
Mackay ^c	0.136***	-0.164***	0.852***	-0.011	0.437***	0.151***
Northern ^c	-0.270***	-0.141***	0.926***	-0.041	0.473***	0.263***
Far North ^c	-0.429***	-0.202***	0.618***	-0.004	0.004	0.357***
North West ^c	-0.607***	-0.403***	0.390***	0.057	0.247***	0.071
InNursing		0.068***	-0.136***	0.293***	-0.001	7.334***
InAlliedHealth	0.104***		0.003	0.066***	-0.015*	6.824***
InDomesticAss	-0.054***	0.001		0.054***	0.039***	8.835***
InPersonalCare	0.385***	0.057***	0.179***		0.115***	8.772***
InSocialSupport	-0.001	-0.006*	0.062***	0.055***		8.441***
InAllHlthcentre	-0.063***	0.338***	-0.101***	0.047***	-0.004	6.434***
InAssessment	0.341***	0.117***	-0.000	0.128***	-0.012	5.187***
InCaseMgt	-0.006	0.038***	0.207***	0.114***	0.321***	6.232***
InCounselling	0.152***	0.099***	0.200***	-0.032***	0.061***	6.236***
InCentreCare	-0.059***	-0.019***	-0.106***	0.033***	0.125***	10.997***
InHomeMaint	-0.025***	0.037***	0.060***	0.003	0.041***	7.045***
InNursingCentre	0.373***	0.035*	0.047	-0.004	-0.019	7.057***
InRespite	-0.007	0.014***	-0.018*	0.138***	0.082***	9.640***
InCareCo	-0.058***	0.034***	0.137***	-0.022**	0.384***	5.955***
_cons	2.190***	-4.479***	14.274***	8.017***	-5.552***	-7.986***
r2_a	0.263	0.138	0.175	0.247	0.134	0.549

a Referent is no carer. b Referent is major city. c Referent is Brisbane. * p<0.05; ** p<0.01; *** p<0.001. Source: Qld HACC MDS, 2007/8.

TABLE 5
MODELS OF SELECTED HACC SERVICE HOURS, INCLUDES INTERACTION
TERMS (N=72111)

Variable	Nursing at home	Allied Health at home	Domestic Assistance	Personal Care	Social Support
birth_date	-0.001*	0.002***	-0.007***	-0.004***	0.003***
Female	-0.097***	0.022***	0.318***	0.049***	0.102***
NoPension	0.242***	-0.031**	-0.515***	-0.030*	-0.035
LivesAlone	0.070***	-0.015*	0.734***	-0.048***	0.242***
English	0.245***	0.137***	-0.123***	0.045**	-0.367***
DomFP	-0.031***	0.009***	-0.026***	0.000	0.005*
SelfFP	-0.040***	-0.069***	0.190***	-0.158***	0.057***
CogFP	-0.003	0.030***	-0.142***	0.001	0.042***
BehFP	0.018	0.015	-0.315***	0.052***	0.015
SpousePartner ^a	0.104***	0.117***	0.349***	-0.022*	-0.216***
Parent ^a	-0.177***	-0.065**	0.029	0.019	-0.038
SonDaughter ^a	0.119***	0.084***	-0.044*	0.050***	-0.154***
OtherCare ^a	0.124***	0.089***	0.027	0.040**	-0.072***
InnerRegional ^b	-0.300***	-0.036**	-0.713***	-0.015	-0.256***
OuterRegional ^b	0.030	-0.055**	-0.691***	-0.023	-0.190***
Remote ^b	0.191***	0.047	-0.780***	-0.017	-0.032
Gold Coast ^c	-0.161***	0.005	0.221***	-0.009	0.038**
Sunshine Coast ^c	0.033*	-0.125***	-0.417***	0.051***	0.517***
West Moreton ^c	0.276***	0.069*	0.854***	0.024	0.319***
WBay-Burnett ^c	0.116***	-0.117***	0.597***	0.059***	0.040
Darling Downs ^c	0.296***	-0.153***	0.884***	-0.060**	0.235***
South West ^c	0.354***	-0.428***	1.057***	-0.129**	-0.036
Fitzroy ^c	0.392***	-0.268***	0.956***	-0.006	0.195***
Central West ^c	-0.013	-0.539***	0.496***	0.016	0.618***
Mackay ^c	0.148***	-0.158***	0.859***	-0.012	0.455***
Northern ^c	-0.264***	-0.149***	0.907***	-0.033	0.515***
Far North ^c	-0.405***	-0.206***	0.630***	-0.016	0.065
North West ^c	-0.623***	-0.452***	0.339***	-0.069	0.464***
InAllHlthcentre	-0.061***	0.339***	-0.097***	0.051***	-0.002
InAssessment	0.343***	0.114***	0.004	0.129***	-0.008
InCaseMgt	0.001	0.037***	0.215***	0.114***	0.325***
InCounselling	0.153***	0.096***	0.200***	-0.033***	0.069***
InCentreCare	-0.060***	-0.018***	-0.107***	0.032***	0.123***
InHomeMaint	-0.027***	0.036***	0.056***	0.003	0.040***
InNursingCentre	0.371***	0.029*	0.044	-0.002	-0.020
InRespite	-0.007	0.014***	-0.017*	0.138***	0.081***
InCareCo	-0.052***	0.034***	0.143***	-0.017*	0.385***
InNursing		0.082***	-0.149***	0.292***	-0.036***
InAlliedHealth	0.117***		0.019*	0.087***	-0.001
InDomesticAss	-0.056***	0.001		0.056***	0.027***
InPersonalCare	0.351***	0.077***	0.162***		0.125***
InSocialSupport	-0.016***	-0.006*	0.033***	0.059***	
InnerAH	-0.049***		-0.051**	-0.068***	-0.054***
OuterAH	-0.006		-0.028	-0.061***	0.006
RemoteAH	0.001		-0.050	-0.103**	-0.087
InnerPC	0.085***	-0.052***	0.011		-0.015
OuterPC	0.095***	-0.052***	0.084***		-0.063***

RemotePC	-0.025	-0.068**	0.099*		0.110***
InnerDA	-0.007	-0.003		-0.006	-0.015*
OuterDA	0.009	0.002		-0.004	0.063***
RemoteDA	0.020	0.002		0.005	0.103***
InnerSS	-0.000	0.002	0.013	-0.001	
OuterSS	0.065***	0.005	0.124***	-0.035***	
RemoteSS	0.184***	0.000	0.227***	0.050***	
InnerNrs		-0.025***	0.041**	0.013*	0.033**
OuterNrs		-0.026**	-0.005	0.013	0.103***
RemoteNrs		-0.083***	-0.031	-0.130***	0.275***
_cons	2.217***	-4.371***	14.361***	8.035***	-5.703***
<i>r2_a</i>	<i>0.266</i>	<i>0.140</i>	<i>0.177</i>	<i>0.249</i>	<i>0.139</i>

a Referent is no carer. b Referent is major city. c Referent is Brisbane.

*p<0.05; ** p<0.01; *** p<0.001.

Source: Queensland HACC MDS, 2007/08.

TABLE 6
MODELS OF SELECTED HACC SERVICES BY URBANICITY: MARGINAL EFFECTS

User Intensity ^a	Model	City	Inner Regional	Outer Region	Remote
Nurse					
Low	Allied health	-0.104***	-0.058***	-0.035***	-0.032
	Personal care	0.010***	0.035***	0.025***	0.002
Moderate	Allied health	-0.0134***	-0.067***	-0.056***	-0.0144
	Personal care	-0.101***	-0.056***	-0.011	-0.012
High	Allied health	0.064***	0.041***	0.026	0.017
	Personal care	0.067***	0.101***	0.110***	0.031
Allied Health					
Low	Nursing	-0.141***	-0.079***	-0.043***	-0.027
	Personal care	-0.012***	-0.021***	-0.004	0.002
Moderate	Nursing	-0.232***	-0.160***	-0.098***	-0.054
	Personal care	-0.105***	-0.079***	-0.038***	-0.023
High	Nursing	0.055***	0.076***	0.034	0.057
	Personal care	0.026***	0.028	-0.020	-0.082

Source: Queensland HACC MDS, 2007/08.

*p<0.05; ** p<0.01; *** p<0.001.

Control variables excluded from the table.

All coefficients represent ey/ex, that is, elasticity of the dependent variable with respect to selected services.

a. Low is 1-25 hours; moderate is 26-77 hours; high is 78 and over hours.