TOWARDS THE DEVELOPMENT OF A RESOURCE ALLOCATION MODEL FOR PRIMARY, CONTINUING AND COMMUNITY CARE IN THE HEALTH SERVICES

Volume2

Technical Report

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Report prepared by a research team led by Professor Anthony Staines, DCU

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Note

This report is in two volumes. Volume 1 is written for a more general audience, and is an extended executive summary of the more detailed Technical Report (Volume 2.) While some references are provided in Volume 1, Volume 2 contains the full set of references and a more detailed technical discussion.

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Summary

Statement of principle

This report proposes a resource allocation model for the Irish health services based on the principle that each Irish resident should be provided with access to health services funded from general taxation and in proportion to their need for those services. At the moment, such a system cannot be deployed as some necessary financial information is not available. The information could be made available, and should be done as quickly as possible. If this information were made available, the model proposed here, while very crude, would serve as a good starting point for resource allocation and should be initiated as soon as possible. Any reasonable system of resource allocation would be an improvement on the system that is currently in place.

Resource allocation

The issue of resource allocation raises a number of fundamental questions, all of which need to be answered. One basic question is: '**How much of the States resources should be spent on health services?**' A crucial additional question is: 'Given the total national spend, **how should these resources be allocated between different services?**'

This study does not address either question. Rather, the question posed by the study was: 'Given the national spend on the health services, and existing allocation between services, **how should the budget for each service be divided between primary, continuing and community care (PCCC) areas in order to support access to services in rough proportion to the need for these services in each area?**' The current system does not allocate resources in a way that addresses this question.

The model developed in this study proposes to allocate **money** – not staff, facilities or equipment – to specified areas (LHO's for the purposes of this study) in which the managerial responsibility for ensuring that services are provided to the resident population of that area actually resides. This does not imply that services would have to be physically located within a particular LHO catchment area; neither does it imply that services would have to be provided by agencies either directly or indirectly managed by the relevant LHO managers. Currently, while many services are provided to LHO populations, they are either delivered outside the LHO, or they are provided by the voluntary sector or other providers. If the proposed model were implemented, this system would continue unchanged.

Resource allocation models

This study conducted a review of resource allocation models currently in use by health services in a selection of developed countries. The study identified three major types of resource allocation models i.e. those based on individual health utilisation and demographic data (e.g. the Swedish model); those based primarily on small-area data (e.g. the English and Scottish models), and those based on direct assessment of health needs (e.g. the Welsh model). From this review, it was concluded that the best option for the Irish health services would be a model based on the principles of the Welsh model.

There is no single correct way to allocate resources, and there is no perfect model. What is required is a model that is comprehensible to non-specialists; is acceptable to practitioners, politicians and the general public; is flexible and is robust in the sense that small changes in the model and in the data will lead to small changes in resource allocation. The model proposed in this report has the capacity to meet these requirements.

Resource allocation for PCCC in the HSE

At present, it is difficult to ascertain exactly how resources are allocated between care groups at LHO level. Budgets do not reflect service provision to the population at LHO level and there is no truly systematic approach to resource allocation.

This study proposes a new model, which would operate at LHO level; a model in which resource allocation is driven by LHO populations and is weighted by age and gender-specific estimated need. Need was estimated using as proxy age and gender-specific estimates of national GP and PCCC utilisation. Several possible sets of weights were derived, but this made little difference to the overall distribution of resources. These allocations were then further refined using estimates of the relationship between LHO-level data on deprivation and healthcare utilisation.

It is not currently possible to estimate the additional costs of providing services to dispersed rural populations due to the lack of LHO-level cost data. As a result, the effect of living in a rural area was not considered when designing the model, but this should be built into the design at a future date. The model lends itself easily to further extension.

The severe limitations of existing health information systems mean that any Irish model developed at present will necessarily be very crude. This report makes a number of specific recommendations aimed at bringing Irish health information systems into line with the necessary international standards. According as this is done, it will be possible to refine and improve resource allocation.

Sources of data

All of the financial data used in the study was extracted from the HSE's financial reporting system, using the outcome data (that is, actual expenditure at year end, as opposed to budgeted expenditure) for 2006 and 2007. This is the system used to prepare reports on a common basis from the eleven separate financial systems operated by the former Health Boards. Work is underway to improve the recording and reporting of HSE expenditure in these systems, and there are significant improvements each year, but they are not yet completely consistent in the classification of expenditure.

Implementation

In the current economic environment, where budgets are shrinking, the implementation of a resource allocation model will be difficult. This report suggests adopting a phased approach to implementing the resource allocation strategy i.e. one where the development of the financial system is agreed as a priority action. Only when this has been done will it be possible to develop actual budgets at LHO level for the provision of services to individual LHO populations. These budgets can then be compared with the proposed allocation derived from the model proposed in this study, and a strategy for gradual implementation can be devised.

This report suggests that an early decision on implementation is necessary and that this course of action might fit well with other work on integrated service plans within the PCCC service and elsewhere within the HSE. This study emphasises that an overly rapid implementation of any resource allocation system would be likely to cause severe damage to the delivery of healthcare to the Irish population.

Other recommendations

This report illustrates with great clarity the inadequacy of current Irish health information systems for the management of the HSE. Addressing this must be a priority. The report recommends that a single unit within the HSE should have direct operational responsibility for running all the major health information systems, including the Hospitals Inpatients Enquiry System (HIPE), the National Psychiatric Inpatient Reporting system (NPIRS), the Primary Care Reimbursement Service (PCRS), and the disability databases. This operational unit should also be given a remit to develop and refine primary care information systems in partnership with GPs.

Summary by chapter

1. The principles of resource allocation (RA)

- Active resource allocation (RA) is driven by the need to achieve efficiency and equity in healthcare provision.
- Risk-adjusted capitation is the commonest method used internationally.
- Risk adjustment should reflect healthcare needs.
- Identification of needs should be based on available epidemiological and scientific data rather than apparent healthcare expenditure or utilisation information.
- Equitable allocation is imperative if the model is to achieve acceptance.

2. A review of RA models and best practice in the Republic of Ireland and internationally

- RA models from eight different countries are reviewed.
- The majority of RA models are based on measures of indirect need such as Standardised Mortality Ratios.
- Measures of direct need, based on epidemiological data, permit a more equitable allocation of resources.
- The Stockholm county model is considered the 'gold standard'.
- The Welsh model is highlighted as a template that could be used to develop an Irish RA model.

3. Sources of data for RA models in PCCC

- Irish data systems are quite limited, and collect data on a small subset of health service activity.
- Some survey data, collected for various reasons by different agencies, is available, but is of limited use for the purposes of model development.

4. PCCC net expenditure by local health office (LHO) and care group

- PCCC expenditure data is available and provides useful information on broad levels of health expenditure, but it cannot be linked effectively to population subgroups.
- PCCC expenditure on different care groups varies greatly between LHO areas, for no easily discernable reason.
- Identified patient flows do not explain the majority of the variation in expenditure observed between LHOs.

5. Building a health RA formula for Ireland – principles

- There are many different types of RA model in operation around the world.
- It is useful to divide models into 'direct' and 'indirect', based respectively on direct assessment of health needs, usually based on morbidity, and on indirect measures derived from utilisation and other sources.
- A direct model is preferable for Ireland, given the data issues in typical small area- based indirect models.
- A structure for such a model is suggested.

6. An RA model for PCCC – components and structures

- PCCC budgetary data are not available at LHO level.
- No suitable direct measures of need can be identified from existing Irish data.
- Estimated PCCC and GP utilisation, based on the literature and on the limited Irish survey

data, are proposed as proxies for need.

- The impact of LHO-level deprivation on health service need can be estimated, albeit very crudely, and is likely to be significant.

7. Developing and assessing an allocation model for PCCC services in Ireland

- It is feasible to develop an RA model in accordance with the principles proposed in the earlier chapters.
- The construction of this model is described, based on 2007 PCCC outcome data.
- A model based on LHO populations, weighted by the estimated PCCC utilisation by age and gender, with an adjustment of LHO level deprivation, is recommended.
- This model greatly reduces inter-LHO variation in per-capita spending.
- This model does not accommodate the extra cost of delivering care to rural areas, but a viable model would accommodate this extra cost.
- The relative impact of different choices of weights on per capita LHO spend is quite modest.
- A carefully staged implementation process is recommended.

Abbreviations

ACRA	Advisory Committee on Resource Allocation
ALOS	Average Length of Stay
ASMR	Age-specific Mortality Rates
CARAN	Combining Age-related and Additional Needs
CRS	Central Records System
CSO	Central Statistics Office
DCU	Dublin City University
DFLE	Disability-free Life Expectancy
DHB	District Health Board
DOHC	Department of Health and Children
DRG	Diagnosis-related Group
EA	Enumeration Areas
ED	Electoral Divisions
EDOCC	Education and Occupation
ESRI	Economic and Social Research Institute
GAM	Generalized Additive Model
GIS	Geographical Information System
GLM	General Labour Market
GMS	General Medical Services
HBSC	Health Behaviour in School-age Children
HCHS	Hospital and Community Health Services
HIPE	Hospital In-patient Enquiry
HRB	Health Research Board
HSE	Health Service Executive
HSSBNI	Health and Social Services Boards, Northern Ireland
HURA	Health Utilisation Research Alliance
ICD	International Classification of Diseases
LHO	Local Health Office
MFF	Market Forces Factor
NCRI	National Cancer Registry of Ireland
NHO	National Hospitals Office
NHS	National Health Service
NPIRS	National Psychiatric In-patient Reporting System
OLS	Ordinary Least Squares
PAS	Patient Administration System
PCA	Principal Components Analysis
PCCC	Primary Community and Continuing Care
PCRS	Primary Care Reimbursement Service
PCT	Primary Care Trust
PoC	Programme of Care
PYLL	Potential Years of Life Lost
QNHS	Quarterly National Household Survey
RA(M)	Resource Allocation (Model)
RAWP	Resource Allocation Working Party
RDF	Resource Distribution Formula
RHA	Regional Health Administration
RMI	Relative Mortality Index
SAPS	Small Area Population Statistics
SAHRU	Small Area Health Research Unit
SEHD	Scottish Executive Health Department
SHARE	Scottish Health Authorities Revenue Equalisation
SIR	Standardised Incidence Ratio
SLÁN	Survey of Lifestyle, Attitudes and Nutrition
SMR	Standardised Mortality Ratio
SSWD	Standardised Spatial Wage Differentials
UA	Unitary Authority
UCD	University College Dublin
WHS	Welsh Health Surveys

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Recommendations

RECOMMENDATION 1 **The HSE should prioritise the collection of LHO-level budgetary data that reflect expenditure on a population basis.**

Current status:
An exercise quantifying patient flows across LHOs for PCCC services was undertaken in 2007 and is currently being updated and reassessed.

RECOMMENDATION 2 **The HSE should support the adoption of a single health identifier for use on all health records, and should require its use in all HSE-funded activities.**

Current status:
The HSE is working on the development of a national client index, which will be an essential building block in the process of uniquely identifying patients.

RECOMMENDATION 3 **The HSE should develop a single consistent set of nested hierarchical boundaries for all services. These are built from Electoral Divisions at the moment, and will be built from the new census output areas in the future.**

Current status:
The HSE will continue to link with the CSO and other relevant bodies in order to improve the consistency of boundaries for the purpose of data collection.

RECOMMENDATION 4 **The HSE should adopt a central geocoding system based on the Geodirectory, with a web interface to permit geocoding by administrative staff of all changes of address, and with a link between the unique health identifier and the geocode at any given time.**

Current status:
Part of this functionality is already available in the Health Atlas, but has not as yet been used at service level for geocoding.

Recommendation 5 **The HSE should rationalise and improve current systems for recording health service activity, and it should carry out more detailed health service utilisation surveys on a regular basis.**

Current status:
A joint HSE/Department of Health and Children (DoHC) Performance Information Group was established in 2008 with the aim of simplifying, consolidating and sharing high-value performance data between the HSE and the DoHC while actively developing and improving data collection in all areas, with particular focus on service activity and outcome.

RECOMMENDATION 6 **Healthstat should be reviewed according as it develops, in order to ascertain whether the information it collects can be used to improve resource allocation in the Irish health services.**

Current status:
Under active development.

RECOMMENDATION 7 **A national survey on health service utilisation and major illness in adults and children is required and could be established by either expanding the SLÁN survey or by establishing a separate national survey with an adequate sample size, which would help researchers to make inferences at LHO level.**

Current status:
Not being actively developed.

RECOMMENDATION 8 **The HSE should consider ways of integrating existing and newly collected data in order to provide more reliable, robust and updated measures of population health need.**

Current status:
Not being actively developed

RECOMMENDATION 9 **The HSE should collect Irish data on the relationship between deprivation and both GP and PCCC service utilisation.**

Current status:
This data is not currently being collected, and requires coordinated efforts between the HSE, the Central Statistics Office (CSO) and others.

RECOMMENDATION 10 **The HSE should consider the deployment of the model proposed in this study, in tandem with other work on its financial systems.**

Current status:
To be considered.

RECOMMENDATION 11 **The HSE should establish a small group of HSE staff, civil servants, CSO staff, academics and others, charged with responsibility for developing, improving and maintaining the resource allocation model.**

Current status:
A national expert group on resource allocation has recently been established. The HSE currently has a team reviewing all related work in this area.

1. The principles of resource allocation

This chapter describes why a systematic method of allocating resources is necessary in healthcare delivery. The principles for resource allocation are as follows:-

- Active resource allocation is driven by the need to achieve efficiency and equity in healthcare provision.
- Risk-adjusted capitation is the most common method used internationally.
- Risk adjustment should reflect healthcare needs.
- Identification of needs should be based on available epidemiological and scientific data rather than apparent healthcare expenditure or utilisation information.
- Equitable resource allocation is imperative if the model is to be widely accepted.

1.1 Introduction

Resource allocation is a procedure for distributing resources between competing claims to meet certain pre-specified goals. Resource allocation is an essential function for any government providing public services; in particular, it has become a major focus of health service planning work in many countries.

Active resource allocation is driven by the need to achieve efficiency and equity in healthcare provision, regardless of the mechanisms by which these healthcare services are provided. The main mechanism used in European health systems, and in some US health systems, is a risk-adjusted capitation scheme.

Rice and Smith (1999) define capitation as the amount of health service funds to be assigned to a person with certain characteristics for the service in question, for the time period in question, subject to any overall budget constraints. In effect, a capitation system puts a price on the head of every citizen. Individuals' healthcare needs vary considerably, depending on personal characteristics such as age, gender, morbidity and social circumstances. Risk adjustment is then used as a method to determine the expected healthcare costs of one member of the population relative to all other members, given that member's personal characteristics. The idea behind risk adjustment is that it should reflect the individual's relative healthcare expenditure needs (Rice and Smith, 1999).

While capitation is based on simple demographic data, with risk adjustment it can be refined to incorporate several other different categories of individuals. Age and gender are considered to be important determinants of expenditure variation, along with many other potential risk adjusters. However, when other possible variables used to adjust risk are to be incorporated into the mix, most capitation schemes become constrained by the availability of data (Rice and Smith, 1999).

Ensuring the control of expenditure is the underlying principle of most resource allocation systems. Capitation methods are preferred to other methods such as fee-for-service for setting budgets on the basis of two fundamental elements: efficiency and equity. Essentially, capitation seeks to address how (given that healthcare expenditure is to be constrained) the limited resources available should be distributed between healthcare plans according to society's equity and efficiency objectives. The purpose of risk-adjusted capitation is to ensure that healthcare plans receive the same level of funding for people with 'equal need' for healthcare, regardless of extraneous circumstances such as their area of residence and level of income.

The capitation sum for a given individual can be considered as that individual's relative expenditure needs and the characteristics to be taken into account when calculating their needs as 'needs factors'.

The general principles that should be considered when choosing needs factors are that they represent relevant influences on the propensity to utilise the particular healthcare service under consideration. It also raises the important question as to who should decide what constitutes 'need' for a particular healthcare service. This is usually based on the actual spending behaviour of the healthcare sector. Unfortunately, this tends to preserve historical patterns of expenditure, regardless of the needs of the present day health service.

There is also the aspect of 'unmet need' within capitation methods. This notion describes certain individuals or groups in every society, for example ethnic minorities, those living in rural areas, or patients with particular conditions, who do not receive the services to which they are entitled, when compared with the general pattern of utilisation amongst the population as a whole.

Selecting the factors to be included when calculating healthcare capitation is both highly complex process and highly controversial. The reasons for this are:

- Relevant data are often lacking.
- Research evidence on appropriate needs factors is sparse, dated or ambiguous.
- There is great difficulty in modelling co-variance between needs factors.
- Disentangling legitimate healthcare needs factors from other policy and supply influences on utilisation is very difficult.
- It is often difficult to identify the healthcare costs associated with a proven needs factor.
- The recipients of public sector budgets often feel they have a clear idea about which needs factors will favour their area, and so will seek to influence the choice of these factors through the political process.

Essentially, there are two approaches to identifying needs factors: normative and empirical. With the normative approach, needs factors are selected on the basis of epidemiological and other scientific evidence. With the empirical approach, needs factors are selected on the basis of a proven association with healthcare spending. The empirical approach is the most widespread method currently in use.

Once needs factors have been identified, weights must be attached to these factors, to reflect their relative influence on expenditure (Rice and Smith, 1999). Risk adjustment uses two approaches to setting capitation: a matrix approach based on individual level data and an index approach based on aggregate data. With the matrix approach, one, or more, determinants of need (e.g. age, gender, ethnic origin, or disability status) is used to create a grid of capitation sums in which each entry represents the expected annual healthcare costs of an individual with the associated characteristics. One example of a matrix approach is the Stockholm approach, which uses age, gender, housing tenure, employment status, marital status, and previous healthcare utilisation as measures of need. For empirical estimation purposes, the matrix approach usually requires a substantial database of individual-level data in which all the relevant needs factors are recorded (Diderichson *et al.,* 1997).

An alternative to the matrix approach is the index approach. With the latter, aggregate measures of the characteristics of a population are pooled in order to create an index that seeks to indicate the aggregate spending needs of the population under scrutiny. Using the index approach creates the potential for an enormous increase in data that can be used as the basis for capitations. In cases where plans are based on geographical units, Census data can be used as the basis for setting expenditure targets. However, the use of aggregate data in this manner to set capitation targets presents another set of problems in the form of so-called 'ecological fallacy'. This occurs when the relationship between a supposed needs factor and healthcare expenditure at the aggregate level does not hold true at the individual level (where capitation methods usually operate). Most analysts seem to be aware of this problem, and seek to minimise the effects by using disaggregated data wherever possible. However, they are often constrained by data limitations (Rice and Smith, 1999).

1.2 Equity in resource allocation

Many definitions for equity exist in the literature and it is accorded primacy among the objectives of policy-makers, health administrators and analysts. Samantha Smith (2009) has recently published a significant report on equity in the Irish health system. The first part of this report is an extended critique of the ways in which the word 'equity' has been used in the development of Irish healthcare policy. Smith identifies four different uses of equity in discussions about healthcare policy:

- Ensure equal access to healthcare for all in the population.
- Distribute healthcare according to need
- Ensure equal distribution of health
- Distribute healthcare on the basis of willingness to pay.

Smith then describes some of the conceptual and linguistic confusions arising from the use of different ideas of equity in Irish healthcare policy development. She infers that many of the problems in the Irish system are sustained at least in part by the conceptual confusion between the libertarian idea of equity (i.e. roughly equal care for equal money), and the more socially responsible vision of equal care for equal need.

Oliver and Mossialos (2004) give examples of three types of equity:

- Equal access to healthcare for those in equal need of healthcare
- Equal utilisation of healthcare for those in equal need of healthcare
- Equal (or rather, equitable) health outcomes (as measured by, for example, Quality Adjusted Life Expectancy)

The authors, in agreement with seven Ministers of Health (Chile, Germany, Greece, New Zealand, Slovenia, Sweden and the UK) attending the International Forum on Common Access to Healthcare Services (2005) decided that "equal access to healthcare for those in equal need" was the most appropriate principle of equity for healthcare policy-makers to pursue because:

1. It is specific to healthcare and does not require that we discriminate between people who are already ill purely on the basis of factors that are exogenous to their health.
2. It respects acceptable reasons for differentials in healthcare utilisation by those in equal need.

Rice and Smith (2001) argue that no matter what definition of equity is applied, geography is important for three reasons. First, many systems of healthcare are organised on a geographical basis; therefore issues of territorial equity become central to the distribution of healthcare resources. Second, whatever system of healthcare is in place, healthcare facilities such as hospitals and clinics are concentrated in specific locations, implying that geographical issues may be of central importance when determining access to healthcare and health outcomes. Third, there is much evidence to suggest that geographical inequalities in the form of "area effects" may exist beyond social class and income inequalities. Geography then becomes a key factor in the organisation of healthcare finance systems; this is especially so where public sectors schemes are concerned in that it often becomes a central policy objective. It is also plays a crucial role where adjustments to healthcare allocations covering factors such as the additional costs of providing care in rural areas come into play.

Bond and Conniffe (2002) provide a number of definitions of 'equity' in relation to health services. When it comes to measurement, it is usually equality of expenditure (or a closely related measure) for equal need that is understood. Bond and Conniffe give an example of two individuals, who have the same health needs, but are from different groups defined by region, or by income, age, or any other socio-economic characteristic. Both individuals are being treated equitably when there is equal expenditure on their healthcare. It could be validly argued that unequal expenditure for equal need does not necessarily imply inequity. Some people may *choose* to receive less treatment than is actually on offer, and while they are perhaps unwise to do so, they cannot be forced to use more health services. In such circumstances, this person cannot be considered as being treated inequitably.

Bond and Conniffe (2002) conclude that while 'access' to equal healthcare rather than equality of care may be a preferable definition, the problem is that existing data, particularly at aggregate level, usually cannot distinguish between a choice *not* to utilise health services, and a lack of need for them. Again, it is true that equality of the quantity and quality of health services, delivered to people of equal need is what is important. Equal expenditures do not guarantee this, because, for example, efficiency can vary by region.

Achieving equity demands an emphasis on the allocation of resources according to health need. While "equal access for equal need" is the preferred definition of equity, there are no generally accepted definitions of 'need' and 'access'. Utilisation is often used as a proxy for access, but some authors disagree with this and consider it inappropriate (Oliver and Mossialos, 2004).

Another more careful definition of access to healthcare is the ability to secure a specified set of healthcare services at a specified level of quality – subject to a specified maximum level of personal inconvenience and cost while in possession of a specified amount of information. This definition can direct policy-makers towards the relevant factors for consideration, such as relevant range and quality of healthcare services, inconvenience, disutility, time costs, financial costs involved in securing those services, and the information required to take advantage of those services. This general definition can also be used as a standard against which "current" access can be judged, and can therefore help policy-makers to observe how they can improve and whether they are improving equity of access for the population for whom they are responsible. Up to now, research on equity of access has used utilisation as a proxy for access; this is because utilisation is easier to observe. However, the principle of equal utilisation for equal need does not take into account variations in the use of healthcare, and therefore consensus is required when defining the reasons for these acceptable variations (Oliver and Mossialos, 2004).

Along with 'access', disagreement also exists as to what constitutes 'need' for healthcare services. Bradshaw (1972) has defined need in the following ways:

- Normative need – in which an expert, professional administrator or scientist defines need by laying down their desired standard and comparing it with the standard that actually exists.
- Felt need – in which need is equated with want, and is assessed by simply asking a person or population if they feel they need a service.
- Expressed need – where felt need leads to an action.
- Comparative need – where the characteristics of a population who receive a service are ascertained, and where people with similar characteristics who do not receive the service are considered to be in need.

Health resource allocation formulae sometimes use morbidity and mortality indicators or socio-economic characteristics as proxies for need (depending on data availability). In such situations, need is estimated on the basis of the extent to which these characteristics contribute towards historical patterns in the utilisation of healthcare services, and reflects Bradshaw's (1972) idea of 'comparative need'. Oliver and Mossialos (2004) recommend that a lot more work must be undertaken in order to develop an accepted working definition of need, but two factors stand out as important:

- The state of the individual's pre-treatment health (with greater ill health equating to greater need, which is the definition currently favoured by clinicians).
- The individual's capacity to benefit from healthcare (with the amount of healthcare resources required to exhaust an individual's capacity to benefit from healthcare determining the size of their need, which is the definition favoured by health economists such as Mooney and Houston (2004)).

If consensus can be reached on a definition of healthcare need, healthcare policy-makers will be better informed to formulate policy that is not only more consistent with providing 'equal access for equal need' (horizontal equity), but is also more consistent with providing appropriately disproportionate access for those with different levels of need i.e. vertical equity.

Another critical point raised in Oliver and Mossialos (2004) work is the role of both supply and demand factors in driving utilisation. On the supply side, the ability to overcome inefficient patterns of both oversupply and undersupply due to historic resource allocation may be very limited (Oliver and Mossialos, 2004; Oliveira and Bevan, 2003). On the demand side, the ability of more deprived people to access services, even where these are made available to them, may be severely limited. This is an issue of great relevance in Ireland where the evidence suggests that primary care fees suppress a great deal of healthcare demand from people who are just over the medical card limit (O'Reilly *et al.*, 2007).

1.3 The foundations for resource allocation in Ireland

Public expenditure on health in Ireland is mainly funded by the Exchequer through general taxation. There is also an ear-marked health tax i.e. the health contribution, which is collected by the Revenue Commissioners. It is not equivalent to a social insurance payment, as it is not paid into a separate fund; it does not guarantee an entitlement to benefit, and it is perceived by the tax payer as no different to general taxation.

Currently, in the absence of published estimates, it is reckoned by key stakeholders that about one-fifth of all healthcare spending in Ireland comes from private sources. This private expenditure mostly consists of household expenditure on GP visits, hospital visits, pharmaceuticals, and health insurance contributions towards private hospital care. Dentists' fees and opticians' fees are also included.

Entitlement to the Irish healthcare system depends on eligibility, and is determined on the basis of personal income. Eligibility falls into two main categories: Category I and Category II, and the category to which a person belongs determines what services they must pay for and what services are free of charge.

The Irish healthcare system has a unique structure; a combination of a universal public health system and a fee-based private system. These two systems are intertwined at all levels of operation. Very unusually, by international standards, the same personnel provide both public and private treatment. The health service is a predominantly tax-funded system. The approach to funding, which has been in place since the 1970s, initially required that the overall funding level for the health service be determined by negotiations between the Department of Finance and the Department of Health and Children, and, subsequently, by the provision of annual budgets to the regional Health Boards. Since the 1970s funding has also been allocated to the Voluntary Hospitals and other service delivery agencies in the voluntary sector. The funding framework that is in operation in Ireland could be best described as a prospective funding system based on anticipated future expenditure using fixed budgets (Rice and Smith, 2002).

The current shape of the Irish health system is largely determined by history, which reflects the outcome of a lengthy process of responding to historical perceptions of healthcare needs. While the adoption of diagnosis-related groups (DRGs) and case mix-based funding has had a significant impact on health funding for acute general hospitals (introduced in order to contain costs, provide a transparent process for reimbursement, and give equality of payment to different providers), the underlying perverse distribution of resources persists. Funding in general has not been directed to meet the health needs of the population; neither has it been used to maximise health benefits, given the available resources.

Given these inherent historic problems with the health service, a wide-ranging reform of the health system was set in train (Department of Health and Children, 2003). The range of reforms introduced included the establishment of the HSE, in order to manage the health service as a single entity. The HSE was established on 1 January 2005 following the introduction of the 2004 Health Act. With the establishment of the HSE, the Regional Health Boards/Regional Health Authorities were abolished in favour of four administrative regions. These administrative regions have been designated to run HSE activities in there are and were also established to put in place procedures aimed at ensuring that health service users benefit from a comprehensive and integrated response from the delivery system.
Core reforms introduced by the HSE include the establishment of the National Hospitals Office (NHO); the development of Directorates for Population Health and Primary, Community and Continuing Care

(PCCC) as well as a National Shared Service Centre designed to enable all publicly-funded health agencies to partake in shared service arrangements. Resource allocation is seen as a central function of the HSE. For example, the Brennan Report noted that:

> "The key function of the new Executive will be to provide the country's health service with quality management, analysis and evaluation of existing resource allocation mechanisms built around evidence-based needs assessment." (Department of Finance, 2003)

Inequities in healthcare resource allocation in Ireland have been identified in previous research (O'Loughlin and Kelly, 2004). This study conducted a policy Delphi study[1] to assess the current method of resource allocation in Ireland, and to suggest ways to improve it. The implementation of a needs- based model was identified as the main way to improve equity in the Irish health system. Limitations in the provision of Irish national data on healthcare were highlighted as one of the biggest potential barriers to developing such a model (O'Loughlin and Kelly, 2004).

Recent research on equity in healthcare takes an '*equal access to treatment approach'*. Layte and Nolan (2004) analysed '*Equity in the Actual Utilisation of Health Care'* in a recent study of equity in the Irish healthcare system. They found that in-patient hospital services, GP services, out-patient hospital services and prescriptions were used substantially more by those in the lower income brackets, whereas dental and optical services were used more by those in higher income brackets. After standardising the data for health status, they found that the large differences in health service usage between income groups could largely be accounted for in terms of 'needs' factors. However, in the case of GP services usage, the lower income groups made greater use of these services than would have been predicted, having analysed the measured health need data. The findings support those reported in an earlier study of horizontal equity in selected European countries carried, out by van Doorslaer *et al.* (2000), who found that for GP visits and consultant appointments, Ireland was 'pro-poor', and positively discriminated in favour of lower income groups by exempting them from co-payments for these services.

Equity must also be considered in the provision of private services within the public sector. Since the early 1990s, 20% of all beds in public hospitals have been designated as semi-private/private beds. Analyses of Hospital Inpatient Enquiry (HIPE) data in the period 1999-2001[2] have shown that while just 20% of beds in public hospitals are designated as private, 31% of elective in-patient discharges in 2001 were private. The percentage change in the number of private patients treated on a planned basis in public hospitals during the period 1999 to 2001 was exactly three times the rate of growth estimated for public patients. In other words, private elective discharges increased by 10.8% compared with an increase of just 3.6% for public elective in-patient discharges. Public hospitals receive a *per diem* charge for the treatment of private patients, and it has been estimated that this income covers just about half the cost of all services provided to private patients (Comptroller and Auditor General, 2009).

This increase in the number of private patients treated in public hospitals has obvious implications for resource allocation and also for access. Equity is being compromised because private insurance coverage facilitates preferential access to public hospital facilities – either in a public or a private bed. Given that this policy was not being strictly adhered to, the Health Strategy 2001, (Department of Health and Children, 2001) stated that the Government was determined to ensure that admissions were managed so that the designated ratio between public and private patients would be maintained, and so that access by public patients would be protected.

Equity and ability to pay are also affected by the reliance on user charges for some services (GP consultations, prescriptions, co-payment charges for out-patient and in-patient visits, A&E visits). Healthcare funding and reimbursement in Ireland are complicated by arrangements that are designed to contain costs, and manage demand, through a series of user charges or co-payments.

[1] A Delphi study is a method of collecting data in which individuals share their expertise and knowledge to generate consensus on a particular topic.

[2] Since 1999, data on the public/private status of discharges have been collected by the Hospital Inpatient Enquiry (HIPE)

1.3.1 Irish health strategies

Health: The Wider Dimensions (A Consultative Statement on Health Policy), which was published by the Department of Health and Children in 1986, was the first explicit policy document relating to health system development in Ireland. Publication of such policy documents continued throughout the next two decades. *Shaping a Healthier Future: A Strategy for Effective Healthcare in the 1990s* was published in 1994. It was followed in 2001 by *Quality and Fairness: A Health System for you* (Department of Health and Children, 2001). The fundamental principles of this 2001 Health Strategy were:

- equity
- people centredness
- quality and accountability

and these were proposed as routes towards the four national goals of:

- improved health for all
- fair access
- appropriate care in the appropriate setting
- high performance

Quality and Fairness: A Health System for you continued to develop the commitment of equity, quality and accountability that was highlighted in the earlier documents. An additional focus of this strategy was that it placed the patient at the centre of future reform. *Quality and Fairness* also states that access to healthcare should be fair. The system should respond to people's needs rather than have their access to the system determined by geographical location or their ability to pay. A perceived lack of fairness and equal treatment are central to many of complaints about the existing system. Improving equity of access will improve healthcare by ensuring that people know which services they are entitled to, and how to access those services. It also ensures that they know that there are no barriers (financial or otherwise) to receiving the services they need (Department of Health and Children, 2001).

Any resource allocation system that is proposed must work towards the achievement of these goals. While all healthcare goals are important, 'Fair Access' is the one that most directly guides the construction of resource allocation. Indeed, *Quality and Fairness* set out four principles that will guide the implementation of the strategy; in addition, a formal resource allocation procedure of the type that is proposed in this study would help the HSE to reach the principles of set out in *Quality and Fairness,* that is:

- Equity and fairness; because a resource allocation model will be built to achieve a more equitable allocation of resources.
- A people-centred service; because a resource allocation approach will seek to match resources to needs.
- Quality of care; because resources will adapt to current and future needs.
- Clear accountability; due to a transparent and open framework for the allocation of resources, thereby permitting a fully democratic critique of the decisions taken.

The primary objective of this study is to develop a basis for a workable scheme in the Republic of Ireland, taking into account the current state of the Irish health service and the complex mixture of public and private mechanisms used to deliver healthcare to Irish residents.

2. A review of resource allocation models and best practice in the Republic of Ireland and internationally

This chapter reviews resource allocation models from other countries, and draws on their experience to guide the development of a proposed model for the Republic of Ireland.

- RA models from eight different countries are reviewed.
- The majority of RA models are based on measures of indirect need such as Standardised Mortality Ratios.
- Measures of direct need, based on epidemiological data, permit a more equitable allocation of resources.
- The Stockholm county model is considered the 'gold standard'.
- The Welsh model is highlighted as a template that could be used to develop an Irish RA model.

2.1 Examples of resource allocation

There are many different models of health service resource allocation. Developing an Irish model requires a careful review of other models from which certain principles can be extracted and applied in Ireland. This study reviewed resource allocation models from England, Wales, Scotland, Northern Ireland, Portugal, New Zealand, New South Wales and Sweden.

All capitation models begin with the size, and usually the age distribution of the population in the areas to which resources are being allocated. These measures provide the basis for all further calculations. Different countries use two different methods of allocating resources to people i.e. either individual-level data, (as is the case in Sweden and New Zealand), or small area-level data, (as is the case in England).

2.1.1 England

A founding principle of the UK National Health Service, which was established in 1948, was that healthcare should be free of charge at the point of delivery and that those with equal need should be entitled to equal access, irrespective of their personal circumstances. The concept of equity is fundamental to the operation of the NHS. Accordingly, there has been widespread concern that the allocation of the health authorities' budgets should be equitable, given the wide variations in healthcare needs found in the population.

The UK has a long and complex history of using capitation formula for acute health services resource allocation. The rationale for using such a formula is that without it, future budgets are likely to reflect the historical supply of healthcare as well as population needs, and this in turn could create perverse incentives to inflate expenditure levels in order to secure larger budgets the following year. A capitation formula should promote efficiency, in that it would seek to fund some standard level of healthcare, taking into account the area's demographic and social characteristics. The budget created by a formula should, therefore, be independent of the actual policies adopted in the area (Rice and Smith, 1999).

As early as the 1970s, a Resource Allocation Working Party (RAWP) was established to distribute health resources from the central government to regional areas. The RAWP developed a formula that

was in use from the late 1970s to 1990, and interpreted the underlying objective of resource allocation to be 'equal opportunity of access to healthcare for people at equal risk'. The RAWP also recognised that 'need' for healthcare could not be measured directly, and argued that the most appropriate proxy was population morbidity. The working party chose standardised mortality rates (SMRs) for males and females as the proxy.

The RAWP recommended distributing financial resources on the basis of population, weighted according to the need for healthcare and the unavoidable cost of providing healthcare services. RAWP therefore established the principle of a weighted capitation formula – an approach that has been used ever since. While the idea of a weighted capitation formula was widely accepted, it did not come without criticism. In particular, there was no empirical justification for the assumption that SMRs are linearly related to healthcare needs (ACRA, 1999). However, the RAWP methodology represented a major advance in the allocation of NHS funds, and resulted in a substantial redistribution of funds from the south to the north of the country.

Given the criticisms associated with the RAWP formula, the Government set up a review of the RAWP that they hoped would help to improve the accuracy with which the formula measured relative need. It was believed that fine-tuning of the formula was required. While they acknowledged that the goal of equal opportunity of access to healthcare had almost been achieved at a regional level, they identified several persistent problems of resource allocation within the NHS that that it was felt needed to be addressed. Among these problems were a lack of data, uneven provision of services among health districts, difficulties with funding medical education, fragmentation of health services, and underutilisation of services by the socially deprived. The majority of this work was based on ordinary least squares (OLS) regression analyses of the determinants of hospital utilisation in small areas. They maintained that the measurement of relative morbidity should move away from informed judgement to a more empirical approach to the identification and weighting of need indicators, with the aim of making the formula more 'sensitive to need'. It was suggested that the SMRs for all causes of mortality amongst those under 75 should become the basis of the mortality measure, instead of all-age mortality measures. However, this empirical approach was criticised on methodological grounds, most importantly in relation to the limited dataset analysed, the absence of any costing data and the use of OLS regression methods (Diderichson and Whitehead, 1997; Sheldon and Carr-Hill, 1992). It should not be forgotten that this review represented a first attempt at developing an allocation formula based on empirical evidence, and the principle of basing the formula on observed utilisation levels.

As a result of the review, in 1993, the NHS commissioned health economists at York University to improve the sensitivity of the current model for allocating resources to the Regional Health Authorities. The 'York model' used small area (census) data to identify the determinants of use of hospital services and also used two-stage least squares regression in order to allow for supply-induced utilisation of health services. The aim of the empirical work was to seek to explain small area variations in NHS in-patient utilisation. The units of analysis used in the study were 4,985 small areas with average populations of about 10,000 people covering the whole of England (Rice and Smith, 1999). For each small area, data were assembled relating to socio-economic conditions, the supply of health services and the utilisation made of in-patient services.

Small areas' utilisations were modelled as a function of supply and needs, using two-stage least squares regression. Using an explicit modelling procedure, potential indicators of healthcare needs were deleted from a comprehensive 'unrestrictive' model until no further variable could be excluded without altering the nature of the model in a statistically significant fashion. Tests were carried out to assess whether the model was statistically well-specified, and to ensure that the two-stage least squares method was justified over ordinary least squares (Rice and Smith, 1999). During its implementation between 1997 and 2003, the principles used in the York study were extended so that almost all NHS Hospital and Community Staff (HCHS) were allocated using the York indices.

The York approach (Carr-Hill *et al.*, 1994) has not, however, gone without criticism:

a) The analysis is still based on (in-patient) utilisation. Any use, and therefore need, which is not revealed through in-patient use is ignored;

b) The implicit assumption in their work is that the existing national allocation of resources between care groups (as revealed in in-patient utilisation) is appropriate;

c) The analysis (except for SMR data) was limited to the social variables available in the 1991 Census. These data may go out of date rapidly, and may also suffer from incomplete enumeration;

d) The census data relates to small area geographies, and the circumstances of an individual may not be typical of the area in which they live. This leads to 'problems of attribution' and gives rise to the 'ecological fallacy', whereby associations observed at an area level are wrongly inferred to exist at an individual level;

e) The analysis yields models, which amount to the national average response to needs, there is a question mark over whether the models may be sustained at lower levels of aggregation – for example predicting practice needs (ACRA, 1999).

ACRA continually reviews the weighted capitation formula. In 1998, a wide-ranging review of the model known as the AREA report (Allocation of Resources to English Areas) (Sutton *et al.*, 2002) was conducted by a team in Glasgow; the review resulted in new need adjustments being introduced. For the first time, the formula incorporated unmet need, as well as the met need predicted in the utilisation approach. This allowed for the inclusion of determinants that were more representative of health inequalities such as morbidity data from the Health Survey for England.

More recently, in December 2008, a review of the main elements of the formula was published; this looked at the how the population base is constructed, the 'need' formula and the market forces factors that account for unavoidable differences in the costs of treatment across primary care trusts. ACRA also considered how the formula takes account of specific issues faced by rural areas. In terms of establishing a population base, the review recommended that this should be based on GP-registered populations, but should also include those who are not GP-registered, where data is available; these groups include sub-national projections, prisoners, and armed forces-related populations. Other groups that should be included are asylum seekers and migrant workers. Temporary residents, on the other hand, should be excluded.

ACRA commissioned a separate review of the two need elements of the weighted capitation formula – 'Combining Age-related and Additional Needs ' (CARAN) (Morris *et al.*, 2007). This resulted in a new acute formula where age and need are calculated in a one-stage model that has a separate need adjustment for each of 18 age bands. A further recommendation was that there would be separate formulas for acute care settings and maternity care settings and, for the first time, these would use admitted patient and out-patient data. It also included a recommendation for prescribing that will now use a more comprehensive data set to develop the RA formula. No changes were made to either the mental health services need formulas or the primary medical services need formulas, and no further adjustment was made for rurality.

While the new model is an improvement on previous models, it still does not address the issue of reducing health inequalities as it continues to be based on healthcare utilisation data. ACRA therefore recommended a separate formula for health inequalities that used disability-free life expectancy (DFLE) – the number of years from birth that a person is expected to live, which are free from limiting long-term illness. It is applied by comparing every primary care trust's DFLE to a benchmark figure of 70 years.

The final element of the formula is the component that represents the unavoidable costs created by the varying costs of delivering health services due to the location of those services. A market forces factor (MFF) is included in the weighted capitation formula in order to allow for these unavoidable geographical variations in costs. The majority of the hospital and community health services (HCHS) spending is on staff, and ACRA has recommended that the staff MFF is assessed using the General Labour Market (GLM) approach. The basis of this approach is that the private sector sets the standard for labour costs in a given area. Although wages are determined nationally by the NHS, if wages in a given area are below the national average, this leads to higher indirect costs in the form of a poor quality workforce, recruitment and retention difficulties, increased reliance on agency staff and lower productivity. Statistical modelling of private sector wages adjusts for the influence on earnings of age,

gender, industry, occupation and geographical work area. These are called Standardised Spatial Wage Differentials (SSWDs).

A separate index is created for adjustments for age, additional need and MFF. Each index is a relative index, comparing the PCT score on the adjustment to a mean value of 1. The weighted population for each PCT is as follows:

Weighted population = Population * Age index * Additional need index * MFF Index

2.1.2 Scotland

In Scotland, the cost of providing healthcare services is funded out of national general taxation and arranged locally by 14 geographically defined health boards that are accountable to the Secretary of State for Scotland; each health board has responsibility for an average population of 370,000 people. A distinctive feature of Scotland is the contrast between the predominantly urban Greater Glasgow Health Board catchment area (population 900,000), which exhibits problems associated with large urban areas, and the remote Highlands and island health board catchment areas, which have completely different problems i.e. problems accessibility and a dispersed population.

In Scotland, resource allocation was, until 1977, based on historical allocations. From 1977 onwards, a new resource allocation process, SHARE (Scottish Health Authorities Revenue Equalisation), was established as it was felt that the existing resource allocation process did not accurately reflect the actual health needs of the Scottish population. The main objective of the 'SHARE' capitation system was to ensure that health funding would be distributed on the basis of the geographical pattern of health need. The key to the SHARE approach is that population size is the most important determinant of the amount of resources required by a particular Health Board. Each Health Board population (based on the 1991 Census) was adjusted for three elements:

1. Age and gender of the population
2. Standardised Mortality Ratios for deaths under the age of 65 years
3. A measure of sparsely. (Sparsely is calculated by measuring the distance between the average patient's home and where their GP's surgery is located.) Health Boards with an above national average sparsely factor receive proportionately higher funding.

Deprivation is also a serious issue in some parts of Scotland, especially Glasgow. The city has less than 18% of Scotland's population, but includes more than half of Scotland's most deprived postal code areas in Scotland. The SHARE formula did not explicitly include social deprivation or social class weighting because of doubts about the consistency of such factors across rural and urban areas. This omission of deprivation in turn led to persistent financial difficulties for the Greater Glasgow Health Board.

The SHARE base formula had remained the same since its introduction in 1977 and no large-scale review had been undertaken since that time. In 1997, Sir John Arbuthnott was asked to lead a process to develop a new allocation formula. The Arbuthnott Groups' remit was as follows:

> "To advise the Secretary of State on methods of allocating the resources available to the National Health Service in Scotland, including both primary and secondary care which are as objective and needs-based as available data and techniques permit, with the aim of promoting equitable access to healthcare" (Health and Community Care Committee, 1999).

The Arbuthnott Commission included general medical scheme (GMS) expenditure as well as GP prescribing practices in their deliberations; this was because the previous SHARE model had concentrated on HCHS only. Four basic principles were adhered to when developing the new formula (Health and Community Care Committee, 1999):

- Equity Develop a formula to fairly allocate resources to Health Boards according to their needs.
- Transparency Methodology should be explicable to non-experts.
- Objectivity Formula should be evidence-based.
- Practicality Use good quality and routinely available data.

The base will remain the population size of a Health Board, but weighted for age and gender, life circumstances and remoteness. The formula may be presented as follows:

$$\mathbf{Wpop_i = Pop_i * A_i * B_i * C_i}$$

Where $Wpop_i$ represents the population share for Health Board i, A_i is an index of the cost of meeting the needs of Health Board i relative to Scotland, because of the age/gender structure of the population, B_i is an index of the cost of meeting the needs of Health Board i relative to Scotland, because of the morbidity and life circumstances of the population, and C_i represents an index of the unavoidable additional costs of Health Board i relative to Scotland, due to the degree of remoteness.

The new formula was built on postal code sector-level data (the availability of Census data by postal code sector was facilitated by the Scottish use of postal-coded patient data.) Indicators of healthcare need, such as social class, poverty, lone households and others, were validated using healthcare utilisation data. The Arbuthnott Groups report *National Review of Resource Allocation for the NHS in Scotland* (2000) recognised that the population is not static and that migration was very likely. In order to cater for the latter eventuality, the population base used in the calculations must allow for year-on-year adjustments to be made. As the Census data is outdated within a short period of time, the Arbuthnott Commission Report concluded that mid-year population estimates are significantly more reliable than population projections. They recommended against using direct data on population health, primarily on the grounds that it would be too expensive to collect this data. They also examined the 'proximity to death' model (where differences in mortality between Health Boards are used to measure differences in health needs) but rejected this model as an option on the basis that the methods required to measure this were still undeveloped.

Premature mortality and a wide range of socio-economic and demographic ('indirect') measures of health needs, as well as limiting long-term illness, have been rigorously examined using regression analysis to establish their influence on the utilisation of health services (Scottish Executive Health Department, 1999; 2000). However, use of a large number of proxy need indicators has led to instability between care programmes and adjacent years in the significant influences identified. To avoid instability, a restricted number of the more important need indicators have been identified and combined into the composite 'Arbuthnott' index. This index helps to make the construction of a formula more transparent, more comprehensible, and less time-consuming. Additionally, three of the indicators chosen can be updated between Censuses (these indicators are: under 65 SMR; the unemployment rate; the proportion of elderly on income support). The other indicators in the index were updated when the 2001 Census results became available in 2003. These latter indicators are: unemployed or permanently sick head of household; low socio-economic group; overcrowding; large households; lone parent families; all-elderly households.

The Arbuthnott Group recommended more transparent and accurate costing of hospital episodes, using fixed treatment and variable length-of-stay costs. Medical, theatre and laboratory costs were treated as fixed per episode, while other costs were taken as related to length of stay.

Several rural mainland health boards in Scotland are estimated to require up to 10% additional resources per capita, to cover the additional costs of providing hospital services; they are estimated to require up to 23% additional resources to cover GMS costs (Scottish Executive Health Department, 1999). For both hospital and general medical services, population densities and the proportion of the population living in settlements of various sizes were shown to be (statistically) related to health boards' hospital expenditures (total and disaggregated by sector) and GMS costs (Scottish Executive Health Department, 1999). In the final report of the Arbuthnott Group (Scottish Executive Health Department, 2000), road kilometres per thousand population was the sole preferred remoteness indicator for estimating the extra costs of (total) hospital services. The GMS formula in this report was

developed using data for over 1,000 practices (rather than health boards), and controlled for age/gender characteristics of practice patients, health board policy, list inflation and deprivation.

This review of the resource allocation formula for the NHS in Scotland looked carefully at the data used, the methods of analysis and the results, and it adopted a resource allocation formula which, when compared with the previous SHARE formula:

- is based on much better evidence;
- reflects more accurately the influence of morbidity and life circumstances on healthcare needs;
- takes into account more fully the influence of remoteness on the costs of delivering healthcare;
- will achieve a more equitable distribution of resources.

2.1.3 Wales

Gordon *et al*. (2001) were asked to develop a resource allocation model for the Welsh National Health System. The Welsh NHS had previously used a system similar to the earlier English system, where the main determinants of resource allocation were population and premature mortality (SMR <75). The goal of the Welsh NHS was to develop a resource allocation formula based on a novel set of principles (Gordon *et al*., 2001):

1 The NHS mainly provides services for people who are alive, not dead. In particular, most of the services it provides are for the 'sick' rather than for the 'healthy'.

2 The NHS provides a considerable number of services for people with health conditions that only very rarely result in death e.g. tooth decay, back pain, food poisoning, arthritis, etc.

3 The geographical distribution of health need and death are not the same.

4 A high proportion of people living in Wales require NHS services in any given year, but only a relatively small number will die under the age of 75 years (i.e. approximately 15,000 people per year).

The review team maintained that it made little sense to distribute resources using indirect measures of need such as death rates, and that using direct measures would be far more sensible. For example: "it makes sense to allocate money for maternity services on the basis of the number of babies born or the number of pregnant women in an area rather than on the basis of the number of people who have died" (Gordon *et al*., 2001).

The review team also identified a needs-based budgeting approach as the best option for allocating resources that are aimed at improving overall health and reducing inequalities in health for the Welsh population. The needs-based budgeting approach adopted here has two stages. First, the overall budget is apportioned between the various categories of service provision. Second, once the different areas of activity have received their overall budget, this can be distributed among the different health areas based on the strength of 'objectively' measured levels of need and inequality in each area.

The review team's basic resource allocation formula was:

Area resource allocation = amount of health needs
*** costs of meeting the health needs**

Three different options were proposed as a means of providing estimates on cost and health needs as the basis for calculating resource allocation in Wales:

1. Maintain the status quo (which was rejected as being entirely unsatisfactory).
2. Adopt a model similar to the English and Scottish models, i.e. statistically analyse the patterns of existing age/gender standardised utilisation of health services to identify the best

explanatory variables (e.g. SMRs). This option was rejected because of data issues – generating and validating a significant amount of small area data, and developing complex models for it - and due to conceptual issues and the inappropriateness of using indirect proxies for healthcare need.

3. Develop an alternative direct approach, based primarily on epidemiological data such as the Cancer Registry, the hospital episodes system, infectious disease notification, and so on.

   While the suitability of the data would need to be validated, the major advantage of this approach was that is was a far more accurate and fair method for resource allocation than either of the other two options.

The strategy driving this alternative direct approach was to develop a series of health condition indicators that would be used to estimate population need for specific bundled services in each health authority area. Some of these indicators were derived from routinely collected data, such as the Hospital Episode Statistics, the birth notification system, and prescribing data; some were derived from special surveys, such as child dental health surveys, and a postal survey of health (The Welsh Health Survey).

The Welsh Health Surveys (WHS) conducted in both 1995 and 1998 obtained detailed information on the health of approximately 1,000 adults in each Unitary Authority (UA) area. These two surveys provided a unique resource for morbidity data which is available in Wales but is not available in other UK countries. The Office for National Statistics and the WHS research team conducted some analysis on the data, and established that the 1998 WHS data were accurate and reliable at Local Health Group/Unitary Authority level after suitable weighting factors had been applied. The research team suggested that some of the morbidity information collected in the WHS could be used as part of a resource allocation formula. However, the inclusion of this data caused some controversy. While the data could be used to compare relative rates of ill health, systematic biases could limit the use of such data as measures of health need. Other measures of health need, where available, may provide more reliable and precise; these include vital statistics for the number of births and low birth weight babies born in each UA area, or Cancer Registry data on incidence/types of cancer. However, the WHS does provide a range of self-reported information that is not available elsewhere.

The WHS also included information on health services. Separate analyses were conducted for nine different groups of services: acute adult medical and surgical hospital in-patient services; all child health services maternity services; psychiatric services; accident and emergency services; acute adult medical and surgical hospital out-patient services; general practice services; community nursing services and chiropody services. Average national costs of treatment, derived from hospital data, were used to estimate costs. Efficient services were supported while inefficient ones were penalised. Certain supra-regional services were excluded, and analysis of these services makes it simple to include additional factors such as extra costs of rural care, need for translators and so on.

Based on worked examples by the review team, the 'direct'/needs-based resource allocation formula has the effect of allocating a greater proportion of NHS resources to the more deprived Local Health Groups areas of Wales than would be the case if an 'indirect'/mortality-based allocation formula were used. This principle also holds true for notional prescribing and GMS allocations where, in general, the more deprived districts receive a higher allocation and the wealthier districts receive a lower allocation than they would if a purely per capita basis principle were applied (i.e. if allocations were based on size of population only).

The review team did point out, however, that even if a needs-based NHS resource allocation model were to be implemented, in itself it would not reduce inequalities in health. In order to reduce such inequalities, specific resources would need to be allocated for the purpose, and health equity policies would also need to be implemented.

2.1.4 Northern Ireland

The Health and Social Services (HSS) Boards in Northern Ireland are responsible for commissioning health and social services for their own populations.

The Department of Health, Social Services and Public Safety provides an annual block of grant funds to each HSS Board based on a resource allocation capitation formula. This formula allocates resources in the health system according to the population size, gender/age and additional needs of the population. The formula also considers the extra cost of providing services to rural populations. Data at small area level, defined by electoral ward boundaries, has been used for the calculation of population and needs estimates (Capitation Formula Review Group, 2004; 2008).

One of the early recommendations of the Capitation Formula Review Group was the introduction of a Programme of Care (PoC) approach to address the specific needs of individual client groups (Capitation Formula Review Group, 2004). Nine PoCs were identified. These are listed below:

- Acute services
- Maternity and child health
- Family and child care
- Elderly care
- Mental care
- Learning disability
- Physical and sensory disability
- Health promotion and disease prevention
- Primary health and adult community

Each PoC formula for the relevant population group is weighted by age/gender and need. By 2000, needs weightings were constructed for the first five PoCs. For the remaining PoCs, needs weightings were generally based on Standardised Mortality Ratio (SMR) (Capitation Formula Review Group, 2004).

Sensitivity analyses of the resource allocation formula used in Northern Ireland have demonstrated the robustness of the formula at the overall level. Some technical difficulties were noted, however, with a strong relationship between the size of the uncertainty interval and the population size.

2.1.5 Sweden

Swedish healthcare provision is publicly funded, with most of the necessary finance raised from local income taxes. The main responsibility for funding and organising the Swedish healthcare system lies with county councils and regional self-governing bodies. Sweden's 26 counties are free to organise the provision of services in whatever way they wish as long as the overall management of the services is judged to be in line with national principles and guidelines.

During the early 1990s, many county councils introduced at least some aspects of market-style reforms such as purchaser-provider splits and performance-related payment systems. The reforms implemented in Stockholm County even went as far as a managed-market system that introduced competition between providers (Diderichsen and Whitehead, 1997).

Diderichsen and Whitehead (1997) describe the implementation of the internal market in the Stockholm County Council catchment area, which has a population of 1.7 million and a fixed healthcare budget of about £1.6 billion. About 90% of the budget is distributed to nine geographically defined health authorities with populations of between 50,000 and 300,000. Prior to the introduction of this system, allocations to health authorities were based on historical activity. Now, however, the mathematical formula that has been developed is the principal basis used for calculating the allocations to be distributed.

The development of the Stockholm formula was greatly helped by the availability of comprehensive linked records (census and other socio-economic databases) of all individuals living in Sweden based on a unique personal identification number. Moreover, a new payment system was introduced in 1994, whereby actual costs of healthcare expenditure incurred by each member of the population are

readily available. This led to the construction of a dataset linking records on healthcare utilisation by all citizens to data on age, gender, socio-economic grouping, education, cohabitation and marital status, country of birth, and housing conditions. One database covered a 30% random sample of the counties' populations, and contained information on their socio-economic characteristics and healthcare utilisation.

Multivariate Poisson regressions were used to identify the demographic and socio-economic variables that had the greatest association with utilisation. These led to capitations based on (a) age in 10 bands; (b) four socio-economic characteristics based on employment; (c) four classes of cohabitation and marital status and (d) five classes of housing, according to tenure and size. The incorporation of gender into the model was found to be unnecessary. In principle, the inclusion of the above factors would result in a 10x4x4x5 contingency table, requiring the estimation of 800 capitations. In practice, in 1994, not all characteristics were found to be significant for all age groups, and a technique known as 'matrix compression' was applied in order to reduce the number of separate capitations to reasonable proportions (Rice and Smith, 1999).

A corresponding matrix was also developed, with the number of inhabitants in each of the nine health authorities assigned a weighting based on their social and demographic characteristics. The data for these weighted individuals were then summarised for each health authority, and a budget was calculated as a proportion of the total sum for the county council catchment area as a whole (Diderichsen and Whitehead, 1997). The per capita weightings implied by these capitations range from 119% in central Stockholm to 86% in the south-east health authority. The allocations based on this analysis have been phased in gradually. The County Council allocated additional funds to those health authorities that were hit hardest by the new distribution system.

Since 1992, this model has been applied gradually when calculating health authority budgets in the Stockholm County Council catchment area, and it has resulted in more funds being allocated for the care of people living in disadvantaged socio-economic circumstances. The hospital model was considerably refined by developing a separate matrix for the most seriously ill 5% of the population (who account for 50% of healthcare expenditure). Inclusion in this model is on the basis of 'costly diagnosis groups', determined by hospital admission diagnosis over a specified period. The groups used are based on International Classification of Disease (ICD) chapters, and include: cancer, ischaemic heart disease, cerebrovascular disease, arthritis, arthrosis, hip fracture, schizophrenia, and other psychoses. Inclusion of these factors in the matrix (along with the socio-economic and demographic variables) leads to an improvement in the predictive power of the capitations. This updated model will form the basis of a national resource allocation scheme that will allocate funds between the 26 Swedish counties (Rice and Smith, 1999).

2.1.6 Portugal

The Portuguese healthcare system was put in place in the late 1970s and is characterised by a public/private mix of healthcare finance and provision. The insurance and provision functions were merged, and healthcare is organised and operated by the Serviço Nacional de Saúde (National Health Service, NHS). While health professionals are public sector employees and are paid a salary, physicians working for the NHS are also allowed to have private practices. Since the mid-1990s, reforms have been introduced gradually and the system has been moving towards a public-contract model, with the private sector being given an increasing role. NHS service providers are organised into three networks: primary healthcare centres, hospitals and long-term care units. The NHS was decentralised in 1993 and organised into five health regions, administrated and managed by autonomous Regional Health Administration (RHAs), which are responsible for monitoring the health status of the population, and are also responsible for supervising the providers to the three networks and for allocating financial resources to providers in the health region that is managed by them

In addition to the NHS, Portugal has several health insurance sub-systems that are financed through social contributions. These provide cover for about a quarter of the population (mainly civil servants and employees of private financial institutions), and healthcare is provided either directly by the insurer or through contracts with private and/or public healthcare providers. People covered by private health insurance usually also have access to NHS services. About a quarter of the population benefit from double or triple coverage via the sub-systems. This pattern of double/triple coverage is due to

the continuation of occupationally-based sub-systems of health coverage from the pre-1993 social insurance system.

The Portuguese system is based on the principle of universal coverage, and was conceived with equity as a main policy objective. Nevertheless, there remain some shortcomings as regards both equity of access and equity of financing.

The geographical distribution of health services is uneven. Medical facilities are concentrated in three main urban areas (near Lisbon, Porto and Coimbra), leaving the central part of the country under-served. With doctors and nurses concentrated on the coastal areas, human resources are in short supply elsewhere. Inadequate service levels are particularly notable in rural as well as low-income urban areas. Oliveira and Bevan (2003) show important geographical inequities by comparing actual resource levels with estimated needs, as reflected by a capitation formula based on factors including population, gender, age, and mortality.

Oliviera and Bevan (2003) set out to measure the need for hospital care in Portugal by adapting the methods used in other countries, especially England. The capitation formula developed in England can be used in Portugal as a tool to measure geographic inequities, by comparing targets (that indicate an equitable distribution) with the current distribution of hospital resources. Transferring the capitation methodology used in other countries to Portugal raised a number of questions:

- What modifications are required in order to apply capitation methods to the Portuguese system of healthcare?
- What modifications are required as a result of the lack of data?
- Are the methodological issues presented by implementing the system in Portugal common to other countries?
- Are questions being raised about the adequacy of capitation methods used in other countries?

The objective of Oliviera and Bevan was to calculate equitable shares of resources as targets and hence achieve "equal access for those in equal need". The authors considered the definition of populations, adjustments for age and gender, for additional need (morbidity), and for building estimates of inequity. They used a community-based population (census data) for the purpose of their research, as no alternative was available; they also used estimates of past populations as population projections were not available at district level. This resulted in at least a two-year time-lag between the population estimates and the year of allocation.

In relation to demography, their choice of method was to measure the cost of providing care by evaluating DRG cases per age/gender at DRG prices. They used a 1998 database that covered all public hospitals within the system and included all DRG cases. The Portuguese cost per age/gender curve was compared with the English curve, and its elements were estimated in terms of price and volume. They found that when the potential for redistribution across age groups in Portugal is compared with England, costs for older groups are higher. The relationship between male/female per capita spending follows a similar trend in both countries. Comparison of utilisation by gender shows that females have higher utilisation in the 15-54 years age group, and males have higher utilisation in the 0-14 years age group and in the over 54 years age group. Average Length of Stay (ALOS) is higher in Portugal than in England across all age groups, with the exception of females aged over 75 years. Comparison of national expenditure shares by age group shows that Portuguese public hospitals are spending a comparatively higher amount of resources on the elderly.

Due to the lack of available data, when it came to measuring additional need (morbidity), the normative approach rather than the empirical approach was used. Oliviera and Bevan compared various different indices of mortality: three types of SMRs, all age, under 75 years, under 65 years, age-specific mortality rates (ASMRs), potential years of life lost (PYLL) and relative mortality index (RMI). ASMRs, PYLL, and RMI were shown to provide a more robust indication of relative risk than SMRs and, for this reason, the use of ASMRs rather than SMRs was justified for determining morbidity targets in Portugal. Oliviera and Bevan claim that ASMRs have a more sound epidemiological meaning in the context of this study as they measure deviations on mortality rates per age group against

national mortality rates per age group, and, unlike SMRs, they give equal weighting for deaths in different age groups. However, they also suggest that further work needs to be done on proxies for morbidity (determinants of variations in mortality in Portugal) in order to either validate or challenge their use of ASMRs.

Oliviera and Bevan adopted a multiplicative model based on an index approach that handles information on population characteristics at district level in order to estimate inequity. The approach is based on average values for areas that are commonly used and appropriate when relative needs are to be estimated. However, it is subject to a number of challenges. According to the authors, it lacks a theoretical basis and, therefore, a clear rationale to indicate adequate levels of redistribution; it is also prone to errors due to biased sampling.

2.1.7 New South Wales

The Australian health services use a wide variety of resource allocation systems at federal and state level. Currently, New South Wales is the only state using such explicit resource allocation methods. The New South Wales approach has been developed and refined over the past 20 years. The Resource Distribution Formula (RDF) is 'used as a planning tool to guide the allocation of funding to the 17 Area Health Services and to monitor progress towards the achievement of fairness in health funding'. It seeks to indicate the achievement of geographical equity in health funding across New South Wales (Gibbs *et al.*, 2002).

The RDF reflects a strong commitment to the idea that population-based funding should be directed to communities in accordance with their health needs. A number of principles are set out for guiding the development of the RDF, including the need to incorporate the assessed needs of the population, variations in the costs of delivering care, and the use made of private healthcare. In addition, the RDF is expected to reflect the need for areas to improve the health status of priority population groups, notably Aboriginal people and homeless people. Enormous differences exist in socio-economic groups and settlement patterns between the different areas.

The methods used are as follows. A global annual budget is determined and distributed between nine healthcare programmes.[3] For each programme, certain expenditure unrelated to population size is first deducted and the remaining expenditure is then distributed between areas by using an appropriate capitation methodology. The resultant allocations are summed to obtain an area's total allocation. An adjustment is made for cross-boundary flows (New South Wales Department of Health, 1999).

The broad elements of each capitation formula are:

1. The population (usually weighted by age and gender);
2. An Aboriginality factor;
3. A homeless factor;
4. An adjustment for private hospital care;
5. A rurality factor.

An assumption about the area's ability to raise revenue from private patient fees is also built into the formula. This is usually based on historical revenue patterns.

An adjustment is made for population health, for primary and community services, and for out-patient and emergency services. An adjustment is also made for those of Aboriginal origin, and for the homeless and a weight of 2.5 is applied to members of these populations. Thus, the effective population size used in the RDF is increased as a result of making these two adjustments (to the extent that an area's population includes Aboriginal and homeless people).

A central aspect of the needs elements of the RDF is a generic needs factor that has been developed at the University of Newcastle. It is defined as:

[3] Population health, Oral health, Primary & community, Outpatients, Emergency services, Acute inpatient, Mental health, Rehabilitation & extended care, Teaching and research

GNI = 97.5 + 0.4*SMR – 0.4*EDOCC – 0.9*RUR

where SMR is the Standardised Mortality Ratio for ages under 70 years, EDOCC is an index of educational and occupational status, and RUR is a rurality index based on four categories of settlement (remote, rural, major urban and metropolitan). The generic needs index is based on a statistical analysis of variations in hospital utilisation in 154 local government areas. The generic needs index is used for most of the programme components. However, separate needs indices have been developed for oral health. This weights the population according to age, rurality and ethnicity on the basis of data taken from the National Oral Health Survey (Rice and Smith, 1999).

The adjustment for private utilisation occurs in the hospital component of care, and is required because the resource allocation methods used provide a measure of total expected hospital utilisation (both public and private). Private healthcare by area residents is therefore costed (using standard DRG rates from hospital records). Where such care is considered to be a substitute for public sector care, the associated expenditure is deducted from the area allocation.

Rice and Smith (1999) describe how an adjustment is also made for the supposedly higher costs of services in rural and remote areas, based on the observation that throughout Australia age-standardised rates of hospital admissions are 23-40% higher in remote areas than in state capital cities. The Dispersion Costs Factor is based on an empirical analysis of the additional costs of care found in rural areas after taking account of any variations due to age, gender and generic needs. In addition, a negotiated sum is paid to remote areas in order to compensate for the higher costs of running ambulance and other patient transfer services.

The RDF now covers most types of health expenditure; only a few services as well as additional payments for teaching hospitals and national specialist services are excluded. The objective is to leave the RDF as a purely population-based model. Resources are allocated to programmes based primarily on population estimates and a need index.

For most services, this is derived from a predictive model for hospital utilisation at small area level, including premature mortality, an education-based measure of social class, and a measure of rural status. The specific area level cost factors taken into account include: the extent to which private sector services meet the local population's needs; the additional costs of delivering services to dispersed rural or remote populations; the cost of interpreter services for non-English speakers; the impact of the role that principal referral hospitals play in terms of managing more severely ill patients; teaching and research; and the effect of certain state-wide services. The RDF also adjusts for the flows of patients between AHSs.

2.1.8 New Zealand

New Zealand allocates resources between the 21 District Health Boards (DHB) using a 'Population-Based Funding Formula' (PBFF), which determines the share of total funding to be allocated to each, based primarily on their population. The goal is to distribute funding between the DHBs fairly and according to the relative needs of their populations, and taking into account the cost of providing health and disability support services to meet those needs. In theory, this gives each DHB the same level of opportunity, in terms of resources, to respond to the needs of its population (Ministry of Health, 2004).

Three elements contribute to the formula for sharing out health and disability funding:

1. Its share of the projected New Zealand population, weighted according to the national average cost of the health and disability support services used by different demographic groups.
2. An additional policy-based weighting for unmet need that recognises the different challenges DHBs face in reducing disparities between population groups.
3. A rural adjustment and an adjustment for overseas visitors, each of which redistributes a set amount of funding between DHBs in order to recognise unavoidable differences in the cost of providing certain health and disability support services.

This is an example of an individual level resource allocation system. It has been in operation for the last three years, and it is intended to review it in 2006. Like the Wales model, a feature of the New Zealand model is that budget allocations reflect historical costs for services by age, gender, ethnicity and deprivation; however, these are national costs, not local costs. This alone is a significant driver of needs-based redistribution of resources.

3. Sources of data for resource allocation models in PCCC

This chapter provides an overview of existing Irish data sources, and considers some of the implications of these for possible RA models. This overview draws particular attention to two issues – the paucity of reliable small area data, and the limited data available for primary care.

- Irish data systems are quite limited, and collect data on a small subset of health service activity.
- Some survey data, collected for various reasons by different agencies, is available, but is of limited use for the purposes of this study.

3.1 Vital statistics

Irish vital statistics are of good quality. Birth and death records are complete, timely, and provide coverage down to county, city and county borough level (Central Statistics Office, 2006). Ireland also has a National Perinatal Reporting System, managed by the ESRI, which collects a great deal of detail about births in Ireland. This information is available at county level (Bonham, 2005).

3.2 Private health care data

A significant and increasing amount of Irish acute health services are provided in the private sector, outside the State-funded sector (Department of Health and Children, 1999). Two issues arise from this situation. The first relates to identifying the quantity of these services; this may prove difficult as both the insurance companies and the service providers are reluctant to share information with each other. The second issue relates to identifying who receives the services, as the development of an RA model requires age and gender utilisation information by county. Information about private sector costings is even more sensitive than information about public care. The amount of information available is limited and is mostly derived from the annual reports of service providers. However, information on good quality costings for private care is not very important for the purposes of this study as the bulk of private care in Ireland at the moment is either provided in a general practice setting or in an acute hospital care setting.

3.3 Measures of deprivation

Most deprivation indices are derived from a series of indicator variables, which are reduced to a smaller number of dimensions using a factor analysis approach. One index frequently used is that developed by the Small Area Health Research Unit (SARHU) in Trinity College Dublin (http://www.sahru.tcd.ie/services/deprivation.php). An alternate measure is the one developed by Haase and Pratschke (2008), which is based on 1991, 1996 and 2002 Census data. The latter was more readily available at LHO level and is outlined in Table 1. Haase and Pratschke have developed three dimensions of affluence/disadvantage: demographic profile, social class composition, and labour market situation. These are linked to observable indicators from successive population censuses, using confirmatory factor analysis.

Table 1: Haase and Pratschke's dimensions of affluence/disadvantage

Dimension 1	Dimension 2	Dimension 3
Demographic profile % population	**Social class composition % population**	**Labour market situation % population**
Population increase over previous 5 years	Primary school only	Households headed by semi-skilled/unskilled manual workers and farmers with <30 acres
Aged <15 and >64 years	Third-level education	Single-parent household with children <15 years
Primary school only	Households headed by managers, technical employees and farmers with >30 acres	Male unemployment rate
Third-level education	Households headed by semi-skilled/unskilled manual workers and farmers with <30 acres	Female unemployment rate
Single parent household with children <15 years	Mean number of persons per room	

Each dimension is calculated using the same method for each census, and these are then combined to form an absolute index score as well as a relative index score. The absolute index scores had a mean of zero and a standard deviation of ten in 1991, with varying means and standard deviations in subsequent periods, which reflect the underlying trends. The relative index score is almost identical to the absolute score in 1991, with the only difference being that the overall average for each census wave is subtracted from the scores (which consequently have a mean of zero) in order to remove national trends from the index scores and to highlight differences in their relative values. In addition, the standard deviation is set to ten for each wave, so that the relative index scores provide a standardised measurement of relative affluence or deprivation in a given area at a specific point in time. Inclusion of the indicators in the resource allocation model uses the 1996 Census as the baseline for the absolute index and 2006 Census for the relative baseline.

3.4 Healthcare utilisation data

The Insight study provides health utilisation data from a nationally representative sample of 3,517 people using Irish hospital and community services (Boilson *et al.*, 2007). The study was an independent survey of consumer satisfaction with the health and social care services commissioned by the HSE. Interview methodology was applied to obtain information on socio-economic circumstances, measures of self-related health and well-being, and history of utilisation of the health services in the 12 months preceding the survey.

3.5 Primary care data

There is good quality data available for activity within the GMS system. While all individual patient contacts are not fully recorded because the GMS works on a capitation system, prescriptions and many special items are recorded in detail. Detailed costs are readily available from the GMS Board records. There are no national data on private general practice activity.

Some information on service utilisation is available in a number of surveys e.g. in SLÁN, a national health survey that was conducted in 1998 (Friel *et al.*, 1999), 2002 (Kelleher *et al.*, 2003a), and again in 2007 (Morgan *et al.*, 2008); in the Lifeways cohort study – a three-generation birth cohort study involving parents, grandparents and siblings of babies born in two centres in Ireland (Fallon *et al.*, 2007); in 2001 in the Quarterly National Household Survey (conducted by the CSO), which covered

health in a special module; and in the HARP (Healthy Ageing Research Programme Steering Group, 2005), an all-Ireland survey of health and social services utilisation by older people.

3.6 Other survey and registry data

There are a number of health surveys in Ireland, not covered in previous sections, which provide Irish data:

- In developing an RA model, the most important is the SLÁN survey (Friel *et al.*, 1999, Kelleher *et al.*, 2003a, 2003b; Morgan *et al.*, 2008). This national postal survey covers a geographically representative sample of the adult population.
- The Health Behaviour in School Children survey (Kelleher *et al.,* 1999 and 2003; Kelly *et al.*, 2009) provides information on health status, but not health service utilisation, for children (Nic Gabhainn S, NUI Galway, personal communication).
- The Lifeways Cross-generation Cohort study has GP utilisation data for children at ages 3 years and 5 years (Fallon *et al.*, 2007).
- The HARP (Healthy Ageing Research Programme 2005) study concentrates on elderly patients and provides valuable health information on this age group at an all-island level.
- The Irish Cancer Registry provides very high quality cancer incidence data and also collects detailed information about the first year of therapy and long-term survival (National Cancer Registry Ireland, 2005). Costs can be estimated from these data by assuming standard national costs for services.
- The Quarterly National Household Survey, run by the CSO, which included a module on health status and health service utilisation in 2001 and 2007 (Central Statistics Office, 2008).
- Ireland was a participant in the European Community Household Panel survey. This contains limited, but useful data on health status (EPUNET, 2004).

3.7 PCCC resource distribution review

The PCCC Resource Distribution Review developed by Valerie Walshe (2007) was aimed at identifying the distribution of PCCC financial resources by regional area, LHO and care group. It also studied the impact of persons crossing LHO boundaries for PCCC services (patient flows) on budgets and allocations.

National and regional PCCC services were identified in the analysis, and the financial cost of providing these services was distributed to the relevant LHO receiving the service. This allowed for the calculation of the net availability of resources by LHO. Financial data for the end of March 2006 was provided by each LHO from various financial systems. Information was obtained by LHO and care group, including statutory and voluntary providers.

This analysis is considered useful as a benchmark of the current distribution of PCCC financial services. However, it does not take into account the issue of population need. It is proposed as a "starting point" for further work on this area.

The key findings were as follows:-

- With a total PCCC budget of €1,459m in 2006, the Dublin/Mid-Leinster region consumed the greatest allocation of financial resources; it was followed by the Western region, which had a budget of €1,207m.
- The care group with the single biggest allocation of funding is the disability care group (mainly provided by voluntary services), followed by the primary care group. Both care groups consume half the overall national budget (€4,893m).
- In terms of patient flows, the Dublin/Mid-Leinster and Dublin/North-East regional areas are net providers of PCCC services for the three other HSE areas. The Western and Southern regional areas are providers for each other, and are overall net receivers of PCCC services.

- Within each of the HSE areas, the provision of PCCC services for people from outside a LHO area significantly alters the allocation of budgets.
- On a per capita basis, the average PCCC allocation varies across areas, with the Southern area showing the lowest values (€1,075 and -6.9% per capita variance).
- Variation also happens with LHO per capita allocations when patient flows have been addressed. Values range from 32% below the national average (Meath) to 45% above the national average (Sligo/Leitrim).
- In terms of per capita allocations by care group, the study highlights that allocations for the mental health care group show the greatest variance across regional areas.

4. PCCC net expenditure by local health office (LHO) and care group

An initial review of PCCC expenditure for this study used 2006 data, and is presented here. Data from 2007, which subsequently became available, was used to develop the resource allocation model. A summary of PCCC net expenditure summaries by Local Health Office and care group is presented in Tables 2 and 3. Data on three care groups are presented: older persons; disability; children and families. Difficulties were encountered in analysing the data relating to the remaining care groups, of which Primary Care and Reimbursement Service (PCRS) and Primary Care are particularly relevant, given their weight on the total PCCC net expenditure.

- PCCC expenditure data is available, and gives useful information on broad levels of health expenditure, but it cannot be effectively linked to population subgroups.
- PCCC expenditure on different care groups varies greatly between LHO areas, for no obvious reason.
- Identified patient flows do not explain the majority of the variation.

A number of major data limitations were found in the PCCC net expenditure data provided by the HSE and these have implications for the development of a resource allocation model.

4.1 Data limitations

Observed PCCC expenditure by care group largely depends on the age distribution of a given LHO area. For some care groups, it also depends on gender and deprivation rates. Age standardisation facilitates comparisons across geographical areas by controlling for differences in the age structure of local populations. An age-standardised rate is a weighted average of the age-specific (crude) rates where the weights are the proportions of persons in the corresponding age groups of a standard population. The potential confounding effect of age is reduced when comparing age-adjusted rates computed using the same standard population.

PCCC expenditure data is not detailed by age or gender, which is a major limitation. Ideally, PCCC net expenditure should be computed for each LHO area assuming that the population has the age-specific rates of a given area e.g. the European standard population, or the whole Irish population. The figures presented in this chapter are based on the assumption that PCCC net expenditure per capita by LHO follows the HIPE age profile expenditure distribution. Strong similarities were found between the distributions of hospital expenditure by age group at national and county level. This assumption allows for age standardisation of PCCC net expenditure by age group, and also allows for comparisons by age group across geographical areas. The same data limitations in PCCC net expenditure apply to other socio-economic variables that affect the distribution of expenditure and comparisons across geographical areas, such as gender and deprivation.

The rates were calculated by computing the PCCC net expenditure by care group, assuming HIPE age profile expenditure ratios applied to the age group of analysis. Crude rates for each of the age groups by PCCC care group were calculated using population data from the 2006 Census of Population.

The age-adjusted rate was calculated by using the European standard population[1]. Proportions based on the standard population are used as the weights. Finally, the age-adjusted rate was calculated by multiplying each crude rate by the appropriate weight and summing the products.

[1] Other sources of standard populations are the World standard population and the US standard population. In the opinion of the authors the use of the European standard population is the most appropriate for the Irish population.

Similar assumptions were made for gender-adjusted PCCC net expenditure per capita. PCCC net expenditure by gender was assumed to follow the HIPE gender profile expenditure ratios. Gender-adjusted rates were computed assuming a standard population with a 50:50 distribution of the population by gender.

The data presented in Tables 6-9 and Table 10 show LHO-level expenditure for older peoples' services and disability services respectively. This represents both services provided for the population within the LHO area and services provided for other clients. However, while there is a very substantial provision of services across LHO boundaries, this is not reflected in the accounts provided. These services must be taken into account in order to calculate actual LHO-level expenditure on individual LHO area populations. The LHO-level expenditure figures presented are potentially quite misleading because cross-border patient flow is very substantial. For example, the North Cork LHO area does not actually spend €2.95 per capita per year on disability services; many of these services are provided across the border in Kerry.

4.2 Data assumptions

4.2.1 Older people

It is assumed, for the purposes of this study, that service need in older people, by age group and gender, is reflected in HIPE data on hospital utilisation by this group. An alternative assumption is that service need is more closely related to PCCC utilisation. However, these data but were not available when initial work on the model was being done. Subsequently, data from the Insight survey carried out in early 2007 (Boilson *et al.*, 2007) was accessed. There is a greater danger of 'supplier-induced demand' in using PCCC utilisation data than HIPE data on hospital utilisation, but both were examined in this study.[2]

4.2.2 Disability

Disability need is presumed to be reflected in responses to the relevant census question. This study also sought access to the HRB disability database but as there is very substantial variation in coverage of the database between different areas, which has not yet been successfully addressed, this data was not very helpful for the purposes of this study.

4.2.3 Children and families

In relation to older persons, it is assumed that service need in children and families, by age group and gender, is reflected in HIPE data on hospital utilisation in these two groups. Data from Insight 2007 cannot be used as a reference point for PCCC utilisation for children and families because this survey focused exclusively on adults.

4.3 Findings

4.3.1 Older persons

Table 4 shows the total PCCC net expenditure per capita according to the national distribution of expenditure per capita from the hospital sector, by LHO. Table 5 shows the actual population distribution by age from the 2006 Census of Population. The table shows that population decreases with age. The largest number of older persons (aged over 65 years) was found in the South region and in Dublin/Mid-Leinster.

Age-specific PCCC net expenditure rates per capita by age group are used to construct Table 6, which shows the European directly age-standardised 2006 PCCC net expenditure rates per capita by LHO. The largest rate per capita is found in the West (€1,848.56) and the lowest is found in Dublin/North-East (€1,423.60), which also presents the lowest total number of older persons in the country, as shown in Table 5.

[2] The distribution by age and gender by care group from Insight 07 is used as reference for PCCC net expenditure in the future and comparisons will be made between the PCCC net expenditure presented here and the resulting exercise from Insight 07

In terms of LHO areas, PCCC net expenditure per capita peaks in Dublin/South-East, Sligo/Leitrim/West Cavan, West Cork, Donegal and Kerry. One of the main reasons for this, particularly in the case of Dublin South-East, is the effect of patient flows. Research is currently being undertaken to address this issue and to correct for the effect of patient flows in PCCC net expenditure. The same analysis is carried out for gender. Table 7 shows the total PCCC net expenditure per capita according to the national distribution of expenditure per capita by gender from the hospital sector, by LHO. Table 8 presents the 2006 Census of Population distribution by gender, and Table 9 shows the directly gender-standardised PCCC net expenditure rates per capita by LHO.

The number of females in the older persons care group is significantly higher than the number of males in this group. However, assuming that the HIPE age profile expenditure ratios apply to PCCC expenditure, Table 7 shows that the net expenditure is lower for females than for males in all LHO areas. Gender-adjusted rates for PCCC net expenditure per capita in Table 9 show that the West is the region with the highest per capita expenditure; Dublin/Mid-Leinster has the next highest per capita expenditure. Again, further analysis of these tables and adjustments by patient flows may have a significant effect on the figures presented here.

4.3.2 Disability

Table 10 shows PCCC net expenditure per capita across the total population and the population with disabilities, according to the latest Census of Population (2006). The distribution of the population with disabilities is expected to be similar across all geographical areas. PCCC net expenditure per capita by LHO is assumed to follow the age and gender distribution of the hospital sector expenditure for the total population.

Table 11 presents the age distribution of persons with disabilities as reported in the 2006 Census. This table shows that the distribution of individuals who declared some level of disability in the 2006 Census of Population is largely dependent on age[4]. The distribution of persons with disabilities is not currently available by gender in the 2006 Irish Census of Population. Gender-standardised PCCC net expenditure per capita is not produced for this care group.

Table 12 presents the PCCC net expenditure per capita by age group. It should be noted that PCCC net expenditure for disability is not available for Donegal, and that data for age groups obtained from the 2006 Irish Census of Population are more aggregated than in the other care groups. The same analysis is presented for gender in Table 13. The 2006 PCCC net expenditure by LHO is presented assuming the same gender distribution for the PCCC group as for the hospital sector.

Table 14 shows the European directly age-standardised PCCC net expenditure per capita for the disability care group, by LHO. Per capita PCCC net expenditure is much larger in the South, than in any of the other regions, due to the very high expenditure reported for West Cork (€11,354.52), which reflects the allocation of responsibility for co-ordinating disability services for much of the region to the West Cork LHO. Overall, the results shown in this table for age-standardized net expenditure per capita differ from those computed without age adjustments. The use of HIPE age profile expenditure ratios for the disability care group may not be appropriate in this case, and the effect of patient flows may be much larger than anticipated.

4.3.3 Children and families

Table 15 presents the total PCCC net expenditure per capita according to the national distribution of expenditure per capita from the hospital sector, by LHO.

Table 16 shows the actual population distribution by age from the 2006 Census of Population for individuals aged under 15 years. Age-specific PCCC net expenditure rates per capita by age group are used to construct Table 17, which shows the European directly age-standardised PCCC net expenditure rates per capita by LHO for children and families. Dublin/North-East has the largest PCCC expenditure per capita in Ireland, adjusted by age. Dublin/South-City and Dublin/North-Central have

[4] The broad definition of disability in the 2006 Census of Population does not provide information on the nature of the disability.

the largest per capita PCCC expenditure, along with Sligo/Leitrim/West Cavan. Again, the effect of patient flows from other LHO areas may be the cause of this differential.

Table 18 shows the total PCCC net expenditure per capita according to the national hospital distribution of expenditure per capita by gender by LHO. Total expenditure per capita is found to be higher for males than for females. Table 19 presents the 2006 Census of Population distribution by gender for individuals aged under 15 years. Table 20 shows the directly gender-standardised PCCC net expenditure rates per capita by LHO for the children and families care group. When standardised by gender, the results continue to show the same pattern of expenditure in Dublin LHO areas i.e. Dublin North Central, Dublin South City and Sligo/Leitrim/West Cavan.

4.4 Patient flows

This study conducted a further analysis of PCCC 2007 outcome expenditure data, having made adjustments for patient flows, using data collected by Dr Valerie Walshe (HSE). The results of this analysis are not shown. Although this adjustment changes the distribution of resources at LHO level, it has relatively little impact on the degree of variation between LHOs.

4.5 Tables relating to 2006 LHO-level expenditures

Table 2: PCCC 2006 analysis of HSE net expenditure: summary by care group

Care group	Sum of year to date actual
Admin	€51,670,259
Children	€498,382,632
Disability	€831,905,295
Mental health	€800,137,036
Multiple care group	€520,490,244
Older persons	€875,028,907
Palliative	€39,643,836
PCRS	€1,436,996,801
Population health	€56,083,566
Primary care	€1,041,735,205
Social inclusion	€110,501,108
Total	€6,262,574,889

Table 3: PCCC 2006 analysis of HSE net expenditure: summary by HSE area

LHO area	Sum of year to date actual
Contracts	€1,055,125
National direct	€781,323
National care groups	€1,950,586
PCCC - West	€1,313,977,610
PCCC – South	€1,177,693,018
PCCC Dublin/Mid-Leinster	€1,282,416,616
PCCC Dublin/North East	€1,035,231,839
PCRS DML	€368,113,846
PCRS DNE	€279,471,989
PCRS Group 01 – Gene	€12,327,074
PCRS South	€401,247,009
PCRS West	€388,163,957
PME	€144,896
Total	€6,262,574,889

Table 4: 2006 PCCC net expenditure by LHO according to distribution by age from the hospital sector national expenditure – older persons

LHO Area	Year to date actual – older persons	PCCC net expenditure by age group				
		65-69	70-74	75-79	80-84	Over 85
Clare	€22,561,787	€3,255,162	€4,034,999	€4,889,770	€5,195,366	€5,186,490
Donegal	€49,298,385	€7,112,656	€8,816,630	€10,684,338	€11,352,078	€11,332,683
Galway	€29,026,965	€4,187,943	€5,191,245	€6,290,954	€6,684,121	€6,672,701
Limerick	€36,855,435	€5,317,416	€6,591,306	€7,987,603	€8,486,805	€8,472,306
Mayo	€34,754,879	€5,014,353	€6,215,638	€7,532,354	€8,003,104	€7,989,431
North Tipperary/East Limerick	€13,377,550	€1,930,082	€2,392,470	€2,899,289	€3,080,486	€3,075,223
Roscommon	€16,037,924	€2,313,914	€2,868,257	€3,475,866	€3,693,098	€3,686,789
Sligo/Leitrim/West Cavan	€47,020,224	€6,783,968	€8,409,199	€10,190,597	€10,827,479	€10,808,981
Total West	€248,933,149	€35,915,494	€44,519,744	€53,950,770	€57,322,537	€57,224,604
Carlow/Kilkenny	€25,815,666	€3,724,624	€4,616,930	€5,594,976	€5,944,646	€5,934,490
Kerry	€49,058,050	€7,077,981	€8,773,648	€10,632,251	€11,296,735	€11,277,435
North Cork	€14,611,661	€2,108,136	€2,613,181	€3,166,755	€3,364,668	€3,358,920
North Lee – Cork	€11,400,464	€1,644,832	€2,038,884	€2,470,799	€2,625,217	€2,620,732
South Lee – Cork	€29,966,680	€4,323,523	€5,359,306	€6,494,617	€6,900,512	€6,888,723
South Tipperary	€22,863,610	€3,298,708	€4,088,978	€4,955,183	€5,264,868	€5,255,873
Waterford	€23,280,068	€3,358,794	€4,163,458	€5,045,441	€5,360,767	€5,351,608
West Cork	€26,768,521	€3,862,100	€4,787,340	€5,801,487	€6,164,063	€6,153,532
Wexford	€24,901,566	€3,592,740	€4,453,450	€5,396,865	€5,734,154	€5,724,357
Total South	€228,666,286	€32,991,438	€40,895,174	€49,558,375	€52,655,629	€52,565,670
Dublin South	€8,706,692	€1,256,181	€1,557,124	€1,886,984	€2,004,914	€2,001,489
Dublin South City	€21,523,884	€3,105,416	€3,849,378	€4,664,827	€4,956,365	€4,947,898
Dublin South East	€76,554,989	€11,045,175	€13,691,260	€16,591,606	€17,628,533	€17,598,415

LHO Area	Year to date actual – older persons	PCCC net expenditure by age group				
		65-69	70-74	75-79	80-84	Over 85
Dublin South West	€11,046,561	€1,593,772	€1,975,591	€2,394,098	€2,543,723	€2,539,377
Dublin West	€2,453,261	€353,951	€438,747	€531,690	€564,919	€563,954
Kildare/West Wicklow	€26,061,969	€3,760,160	€4,660,979	€5,648,357	€6,001,363	€5,991,110
Laois/Offaly	€28,715,937	€4,143,068	€5,135,620	€6,223,546	€6,612,500	€6,601,203
Longford/Westmeath	€27,156,974	€3,918,145	€4,856,812	€5,885,675	€6,253,513	€6,242,829
Wicklow	€11,539,119	€1,664,837	€2,063,681	€2,500,850	€2,657,145	€2,652,606
Total Dublin/Mid-Leinster	€213,759,386	€30,840,705	€38,229,192	€46,327,633	€49,222,975	€49,138,880
Cavan/Monaghan	€32,223,603	€4,649,146	€5,762,939	€6,983,755	€7,420,220	€7,407,543
Dublin North	€9,449,411	€1,363,339	€1,689,953	€2,047,952	€2,175,943	€2,172,225
Dublin North Central	€14,903,270	€2,150,209	€2,665,333	€3,229,955	€3,431,818	€3,425,955
Dublin North West	€32,976,310	€4,757,745	€5,897,555	€7,146,888	€7,593,548	€7,580,575
Louth	€25,778,190	€3,719,217	€4,610,227	€5,586,854	€5,936,016	€5,925,875
Meath	€19,937,374	€2,876,518	€3,565,643	€4,320,986	€4,591,035	€4,583,192
Total Dublin/North East	€135,268,158	€19,516,174	€24,191,651	€29,316,390	€31,148,579	€31,095,364
TOTAL	€826,626,979	€119,263,811	€147,835,761	€179,153,169	€190,349,721	€190,024,518

Table 5: Population distribution by gender for individuals over 65 years – 2006 Irish Census of Population, CSO – older persons

LHO area	Aged 65-69	Aged 70-74	Aged 75-79	Aged 80-84	Aged 85+	Total
Clare	3,984	3,170	2,525	1,772	1,470	12,921
Donegal	5,602	4,502	3,554	2,626	2,127	18,411
Galway	7,622	6,381	4,965	3,587	2,953	25,508
Limerick	5,424	4,490	3,426	2,456	1,677	17,473
Mayo	5,067	4,398	3,565	2,672	2,160	17,862
North Tipperary/East Limerick	3,266	2,961	2,252	1,646	1,092	11,217
Roscommon	2,359	2,180	1,847	1,283	1,046	8,715
Sligo/Leitrim/West Cavan	3,596	3,066	2,591	1,913	1,473	12,639
Total West	36,920	31,148	24,725	17,955	13,998	124,746
Carlow/Kilkenny	4,048	3,459	2,699	1,904	1,377	13,487
Kerry	5,824	4,846	3,914	2,736	2,028	19,348
North Cork	2,931	2,669	2,167	1,528	1,156	10,451
North Lee - Cork	5,429	4,295	3,124	2,153	1,635	16,636
South Lee - Cork	6,095	5,130	3,845	2,589	1,822	19,481
South Tipperary	3,350	2,794	2,292	1,692	1,168	11,296
Waterford	4,489	3,770	2,728	2,018	1,327	14,332
West Cork	2,329	2,107	1,671	1,182	901	8,190
Wexford	5,040	4,035	2,880	1,960	1,409	15,324
Total South	39,535	33,105	25,320	17,762	12,823	128,545
Dublin South	5,480	4,749	3,797	2,458	1,896	18,380
Dublin South City	3,656	3,146	2,653	1,873	1,428	12,756
Dublin South East	4,012	3,245	2,710	1,925	1,716	13,608
Dublin South West	4,863	4,164	2,995	1,829	1,097	14,948
Dublin West	3,295	2,424	1,869	1,304	826	9,718
Kildare/West Wicklow	4,871	3,505	2,584	1,894	1,495	14,349
Laois/Offaly	4,426	3,829	3,071	2,093	1,426	14,845
Longford/Westmeath	3,747	3,273	2,509	1,927	1,362	12,818
Wicklow	3,594	2,792	2,012	1,440	1,109	10,947
Total Dublin Mid-Leinster	37,944	31,127	24,200	16,743	12,355	122,369
Cavan/Monaghan	3,965	3,706	2,969	2,199	1,697	14,536
Dublin North	7,885	5,697	3,874	2,368	1,485	21,309
Dublin North Central	4,473	4,139	3,406	2,232	1,664	15,914
Dublin North West	4,853	4,068	3,306	2,166	1,485	15,878
Louth	3,653	2,847	2,234	1,668	1,203	11,605
Meath	4,168	3,315	2,432	1,791	1,318	13,024
Total Dublin North East	28,997	23,772	18,221	12,424	8,852	92,266
TOTAL	143,396	119,152	92,466	64,884	48,028	467,926

Table 6: European age-standardised PCCC net expenditure per capita by LHO – older persons

LHO area	Year to date actual – older persons	Year to date actual per capita	European age-standardised PCCC net expenditure per capita
Clare	€22,561,787	€1,746	€1,584
Donegal	€49,298,385	€2,678	€2,420
Galway	€29,026,965	€1,138	€1,027
Limerick	€36,855,435	€2,109	€1,954
Mayo	€34,754,879	€1,946	€1,738
North Tipperary/East Limerick	€13,377,550	€1,193	€1,095
Roscommon	€16,037,924	€1,840	€1,640
Sligo/Leitrim/West Cavan	€47,020,224	€3,720	€3,331
Total West	€248,933,149	€1,996	€1,849
Carlow/Kilkenny	€25,815,666	€1,914	€1,751
Kerry	€49,058,050	€2,536	€2,311
North Cork	€14,611,661	€1,398	€1,259
North Lee – Cork	€11,400,464	€685	€640
South Lee – Cork	€29,966,680	€1,538	€1,436
South Tipperary	€22,863,610	€2,024	€1,842
Waterford	€23,280,068	€1,624	€1,518
West Cork	€26,768,521	€3,268	€2,949
Wexford	€24,901,566	€1,625	€1,536
Total South	€228,666,286	€1,779	€1,686
Dublin South	€8,706,692	€474	€433
Dublin South City	€21,523,884	€1,687	€1,518
Dublin South East	€76,554,989	€5,626	€5,030
Dublin South West	€11,046,561	€739	€731
Dublin West	€2,453,261	€252	€242
Kildare/West Wicklow	€26,061,969	€1,816	€1,693
Laois/Offaly	€28,715,937	€1,934	€1,783
Longford/Westmeath	€27,156,974	€2,119	€1,923
Wicklow	€11,539,119	€1,054	€981
Total Dublin/Mid-Leinster	€213,759,386	€1,747	€1,738
Cavan/Monaghan	€32,223,603	€2,217	€1,982
Dublin North	€9,449,411	€443	€456
Dublin North Central	€14,903,270	€936	€850
Dublin North West	€32,976,310	€2,077	€1,928
Louth	€25,778,190	€2,221	€2,038
Meath	€19,937,374	€1,531	€1,417
Total Dublin/North East	€135,268,158	€1,466	€1,424
TOTAL	€826,626,979	€1,767	€1,674

Table 7: 2006 PCCC net expenditure by LHO according to the distribution by gender from the hospital sector national expenditure – older persons

LHO area	Year to date actual – older persons	PCCC net expenditure by gender	
		Males	Females
Clare	€22,561,787	€13,028,546	€9,533,241
Donegal	€49,298,385	€28,467,882	€20,830,503
Galway	€29,026,965	€16,761,932	€12,265,032
Limerick	€36,855,435	€21,282,567	€15,572,868
Mayo	€34,754,879	€20,069,578	€14,685,301
North Tipperary/East Limerick	€13,377,550	€7,725,010	€5,652,540
Roscommon	€16,037,924	€9,261,272	€6,776,653
Sligo/Leitrim/West Cavan	€47,020,224	€27,152,333	€19,867,891
Total West	€248,933,149	€143,749,119	€105,184,030
Carlow/Kilkenny	€25,815,666	€14,907,533	€10,908,133
Kerry	€49,058,050	€28,329,098	€20,728,953
North Cork	€14,611,661	€8,437,661	€6,174,001
North Lee – Cork	€11,400,464	€6,583,320	€4,817,144
South Lee – Cork	€29,966,680	€17,304,581	€12,662,099
South Tipperary	€22,863,610	€13,202,837	€9,660,773
Waterford	€23,280,068	€13,443,325	€9,836,743
West Cork	€26,768,521	€15,457,770	€11,310,751
Wexford	€24,901,566	€14,379,677	€10,521,889
Total South	€228,666,286	€132,045,802	€96,620,484
Dublin South	€8,706,692	€5,027,773	€3,678,919
Dublin South City	€21,523,884	€12,429,198	€9,094,686
Dublin South East	€76,554,989	€44,207,500	€32,347,489
Dublin South West	€11,046,561	€6,378,955	€4,667,606
Dublin West	€2,453,261	€1,416,662	€1,036,599
Kildare/West Wicklow	€26,061,969	€15,049,764	€11,012,205
Laois/Offaly	€28,715,937	€16,582,326	€12,133,611
Longford/Westmeath	€27,156,974	€15,682,086	€11,474,888
Wicklow	€11,539,119	€6,663,388	€4,875,731
Total Dublin/Mid-Leinster	€213,759,386	€123,437,652	€90,321,734
Cavan/Monaghan	€32,223,603	€18,607,866	€13,615,738
Dublin North	€9,449,411	€5,456,664	€3,992,747
Dublin North Central	€14,903,270	€8,606,053	€6,297,217
Dublin North West	€32,976,310	€19,042,524	€13,933,786
Louth	€25,778,190	€14,885,892	€10,892,297
Meath	€19,937,374	€11,513,051	€8,424,323
Total Dublin/North East	€135,268,158	€78,112,050	€57,156,108
TOTAL	€826,626,979	€477,344,623	€349,282,356

Table 8: Population distribution by gender for individuals over 65 years – 2006 Irish Census of Population, CSO – older persons

LHO area	Males	Females	Total
Clare	5,894	7,027	12,921
Donegal	8,551	9,860	18,411
Galway	11,771	13,737	25,508
Limerick	7,736	9,737	17,473
Mayo	8,133	9,729	17,862
North Tipperary/East Limerick	5,123	6,094	11,217
Roscommon	4,042	4,673	8,715
Sligo/Leitrim/West Cavan	5,763	6,876	12,639
Total West	57,013	67,733	124,746
Carlow/Kilkenny	6,141	7,346	13,487
Kerry	8,814	10,534	19,348
North Cork	4,633	5,818	10,451
North Lee – Cork	7,321	9,315	16,636
South Lee – Cork	8,236	11,245	19,481
South Tipperary	5,202	6,094	11,296
Waterford	6,416	7,916	14,332
West Cork	3,831	4,359	8,190
Wexford	7,045	8,279	15,324
Total South	57,639	70,906	128,545
Dublin South	7,522	10,858	18,380
Dublin South City	5,170	7,586	12,756
Dublin South East	5,394	8,214	13,608
Dublin South West	6,401	8,547	14,948
Dublin West	4,081	5,637	9,718
Kildare/West Wicklow	6,460	7,889	14,349
Laois/Offaly	6,877	7,968	14,845
Longford/Westmeath	5,729	7,089	12,818
Wicklow	4,778	6,169	10,947
Total Dublin Mid-Leinster	52,412	69,957	122,369
Cavan/Monaghan	6,652	7,884	14,536
Dublin North	9,491	11,818	21,309
Dublin North Central	6,441	9,473	15,914
Dublin North West	6,566	9,312	15,878
Louth	4,991	6,614	11,605
Meath	5,890	7,134	13,024
Total Dublin North East	40,031	52,235	92,266
TOTAL	207,095	260,831	467,926

Table 9: Gender-adjusted PCCC net expenditure per capita by LHO – older persons

LHO area	Year to date actual – older persons	Year to date actual per capita	Gender-adjusted PCCC net expenditure per capita
Clare	€22,561,787	€1,746	€1,784
Donegal	€49,298,385	€2,678	€2,721
Galway	€29,026,965	€1,138	€1,158
Limerick	€36,855,435	€2,109	€2,175
Mayo	€34,754,879	€1,946	€1,989
North Tipperary/East Limerick	€13,377,550	€1,193	€1,218
Roscommon	€16,037,924	€1,840	€1,871
Sligo/Leitrim/West Cavan	€47,020,224	€3,720	€3,800
Total West	€248,933,149	€1,996	€2,089
Carlow/Kilkenny	€25,815,666	€1,914	€1,956
Kerry	€49,058,050	€2,536	€2,591
North Cork	€14,611,661	€1,398	€1,441
North Lee – Cork	€11,400,464	€685	€708
South Lee – Cork	€29,966,680	€1,538	€1,614
South Tipperary	€22,863,610	€2,024	€2,062
Waterford	€23,280,068	€1,624	€1,669
West Cork	€26,768,521	€3,268	€3,315
Wexford	€24,901,566	€1,625	€1,656
Total South	€228,666,286	€1,779	€1,882
Dublin South	€8,706,692	€474	€504
Dublin South City	€21,523,884	€1,687	€1,801
Dublin South East	€76,554,989	€5,626	€6,067
Dublin South West	€11,046,561	€739	€771
Dublin West	€2,453,261	€252	€266
Kildare/West Wicklow	€26,061,969	€1,816	€1,863
Laois/Offaly	€28,715,937	€1,934	€1,967
Longford/Westmeath	€27,156,974	€2,119	€2,178
Wicklow	€11,539,119	€1,054	€1,092
Total Dublin/Mid-Leinster	€213,759,386	€1,747	€2,001
Cavan/Monaghan	€32,223,603	€2,217	€2,262
Dublin North	€9,449,411	€443	€456
Dublin North Central	€14,903,270	€936	€1,000
Dublin North West	€32,976,310	€2,077	€2,198
Louth	€25,778,190	€2,221	€2,315
Meath	€19,937,374	€1,531	€1,568
Total Dublin/North East	€135,268,158	€1,466	€1,612
TOTAL	€826,626,979	€1,767	€1,677

Table 10: PCCC net expenditure per capita of total population and population with disabilities - a 2006 Irish Census of Population - Disability

LHO area	Year to date actual - Disability	PCCC expenditure per capita - total population	PCCC expenditure per capita - population with disabilities
Clare	€10,180,884	€92	€513
Galway	€6,653,225	€29	€167
Limerick	€20,890,857	€138	€675
Mayo	€12,956,601	€105	€535
North Tipperary/East Limerick	€10,350,312	€105	€572
Roscommon	€2,433,725	€41	€212
Sligo/Leitrim/West Cavan	€82,068,570	€901	€4,453
Total West	€145,534,174	€1,411	€7,126
Carlow/Kilkenny	€24,257,124	€201	€1,076
Kerry	€289,238	€2	€11
North Cork	€77,826	€1	€5
North Lee – Cork	€1,024,351	€6	€31
South Lee – Cork	€628,020	€4	€19
South Tipperary	€9,728,782	€110	€528
Waterford	€31,973,306	€266	€1,426
West Cork	€155,855,757	€2,910	€15,642
Wexford	€13,009,294	€99	€513
Total South	€236,843,698	€3,599	€19,252
Dublin South	€23,558,895	€186	€958
Dublin South City	€5,366,697	€40	€210
Dublin South East	€31,637,223	€286	€1,627
Dublin South West	€6,985,978	€47	€232
Dublin West	€2,879,951	€21	€112
Kildare/West Wicklow	€10,593,435	€52	€326
Laois/Offaly	€40,692,760	€295	€1,681
Longford/Westmeath	€33,727,565	€297	€1,571
Wicklow	€27,844,940	€255	€1,352
Total Dublin Mid-Leinster	€183,287,444	€1,480	€8,068
Cavan/Monaghan	€22,177,445	€187	€1,083
Dublin North	€51,075,157	€230	€1,274
Dublin North Central	€24,135,658	€191	€913
Dublin North West	€12,190,112	€66	€359
Louth	€10,881,863	€98	€522
Meath	€24,658,592	€151	€1,021
Total Dublin North East	€145,118,827	€922	€5,173
TOTAL	€710,784,143	€7,412	€39,619

Table 11: Population with disabilities - Distribution by age – 2006 Irish Census of Population, CSO – Disability

LHO Area	Population with disabilities by age group					
	0-14	15-24	25-44	45-64	Over 65	Total
Clare	1,866	1,330	3,568	5,654	7,428	19,846
Donegal	2,564	2,070	5,178	8,716	11,434	29,962
Galway	3,108	2,946	7,968	10,898	14,846	39,766
Limerick	2,504	2,232	5,998	9,690	10,542	30,966
Mayo	1,660	1,280	3,742	7,050	10,496	24,228
North Tipperary/East Limerick	1,628	1,454	3,466	5,088	6,464	18,100
Roscommon	752	534	1,648	3,320	5,238	11,492
Sligo/Leitrim/West Cavan	1,402	1,210	3,206	5,360	7,254	18,432
Total West	15,484	13,056	34,774	55,776	73,702	192,792
Carlow/Kilkenny	2,106	1,658	4,242	6,746	7,794	22,546
Kerry	2,110	1,724	4,482	7,740	10,316	26,372
North Cork	1,176	864	2,634	4,108	5,908	14,690
North Lee – Cork	2,910	2,316	7,104	10,438	9,778	32,546
South Lee – Cork	2,632	2,596	6,854	9,188	11,054	32,324
South Tipperary	1,578	1,284	3,148	5,422	6,994	18,426
Waterford	1,706	1,498	4,230	6,724	8,260	22,418
West Cork	738	550	1,594	2,736	4,346	9,964
Wexford	2,448	1,650	4,936	7,616	8,712	25,362
Total South	17,404	14,140	39,224	60,718	73,162	204,648
Dublin South	1,860	1,944	4,210	6,614	9,970	24,598
Dublin South City	1,338	2,442	6,234	7,316	8,176	25,506
Dublin South East	1,270	1,728	3,702	4,952	7,794	19,446
Dublin South West	2,528	2,286	6,328	9,922	9,108	30,172
Dublin West	2,424	2,080	6,082	8,172	6,936	25,694
Kildare/West Wicklow	3,646	2,910	7,472	9,518	8,984	32,530

LHO Area	Population with disabilities by age group					
	0-14	15-24	25-44	45-64	Over 65	Total
Laois/Offaly	2,276	1,696	4,678	7,020	8,534	24,204
Longford/Westmeath	1,866	1,536	4,026	6,250	7,794	21,472
Wicklow	2,128	1,758	4,132	6,112	6,464	20,594
Total Dublin/Mid-Leinster	19,336	18,380	46,864	65,876	73,760	224,216
Cavan/Monaghan	1,650	1,348	3,442	5,558	8,480	20,478
Dublin North	3,800	3,104	8,730	11,884	12,560	40,078
Dublin North Central	1,652	2,032	5,638	7,294	9,818	26,434
Dublin North West	2,716	2,556	8,302	9,550	10,820	33,944
Louth	1,726	1,472	4,380	6,346	6,904	20,828
Meath	2,744	2,006	5,298	6,796	7,308	24,152
Total Dublin/North East	14,288	12,518	35,790	47,428	55,890	165,914
TOTAL	66,512	58,094	156,652	229,798	276,514	787,570

Table 12: 2006 PCCC net expenditure by LHO according to the distribution by age from the hospital sector national expenditure – disability

LHO area	Year to date actual – disability	PCCC net expenditure by age group				
		0-14	15-24	25-44	45-64	Over 65
Clare	€10,180,884	€516,370	€332,283	€941,899	€1,897,700	€6,492,632
Galway	€6,653,225	€337,448	€217,147	€615,533	€1,240,150	€4,242,946
Limerick	€20,890,857	€1,059,575	€681,834	€1,932,748	€3,894,021	€13,322,679
Mayo	€12,956,601	€657,153	€422,877	€1,198,699	€2,415,089	€8,262,784
North Tipperary/East Limerick	€10,350,312	€524,963	€337,813	€957,574	€1,929,281	€6,600,681
Roscommon	€2,433,725	€123,437	€79,432	€225,160	€453,642	€1,552,054
Sligo/Leitrim/West Cavan	€82,068,570	€4,162,480	€2,678,548	€7,592,694	€15,297,446	€52,337,403
Total West	€145,534,174	€7,381,425	€4,749,933	€13,464,308	€27,127,329	€92,811,178
Carlow/Kilkenny	€24,257,124	€1,230,310	€791,702	€2,244,183	€4,521,488	€15,469,441
Kerry	€289,238	€14,670	€9,440	€26,759	€53,913	€184,455
North Cork	€77,826	€3,947	€2,540	€7,200	€14,507	€49,632
North Lee – Cork	€1,024,351	€51,955	€33,433	€94,769	€190,937	€653,257
South Lee – Cork	€628,020	€31,853	€20,497	€58,102	€117,062	€400,506
South Tipperary	€9,728,782	€493,439	€317,527	€900,073	€1,813,429	€6,204,314
Waterford	€31,973,306	€1,621,671	€1,043,542	€2,958,057	€5,959,771	€20,390,264
West Cork	€155,855,757	€7,904,931	€5,086,808	€14,419,224	€29,051,255	€99,393,538
Wexford	€13,009,294	€659,825	€424,596	€1,203,574	€2,424,911	€8,296,387
Total South	€236,843,698	€12,012,602	€7,730,087	€21,911,943	€44,147,274	€151,041,794
Dublin South	€23,558,895	€1,194,896	€768,913	€2,179,586	€4,391,339	€15,024,161
Dublin South City	€5,366,697	€272,196	€175,158	€496,508	€1,000,343	€3,422,492
Dublin South East	€31,637,223	€1,604,625	€1,032,573	€2,926,964	€5,897,126	€20,175,934
Dublin South West	€6,985,978	€354,326	€228,008	€646,318	€1,302,175	€4,455,152
Dublin West	€2,879,951	€146,070	€93,996	€266,443	€536,818	€1,836,625
Kildare/West Wicklow	€10,593,435	€537,294	€345,748	€980,067	€1,974,599	€6,755,727
Laois/Offaly	€40,692,760	€2,063,918	€1,328,127	€3,764,750	€7,585,063	€25,950,902

LHO area	Year to date actual – disability	PCCC net expenditure by age group				
		0-14	15-24	25-44	45-64	Over 65
Longford/Westmeath	€33,727,565	€1,710,646	€1,100,798	€3,120,355	€6,286,762	€21,509,003
Wicklow	€27,844,940	€1,412,282	€908,801	€2,576,116	€5,190,251	€17,757,490
Total Dublin/Mid-Leinster	€183,287,444	€9,296,254	€5,982,122	€16,957,107	€34,164,476	€116,887,485
Cavan/Monaghan	€22,177,445	€1,124,830	€723,826	€2,051,779	€4,133,839	€14,143,172
Dublin North	€51,075,157	€2,590,508	€1,666,987	€4,725,293	€9,520,325	€32,572,044
Dublin North Central	€24,135,658	€1,224,149	€787,738	€2,232,946	€4,498,847	€15,391,978
Dublin North West	€12,190,112	€618,277	€397,860	€1,127,786	€2,272,217	€7,773,972
Louth	€10,881,863	€551,923	€355,161	€1,006,752	€2,028,361	€6,939,666
Meath	€24,658,592	€1,250,672	€804,805	€2,281,326	€4,596,321	€15,725,468
Total Dublin/North East	€145,118,827	€7,360,359	€4,736,377	€13,425,881	€27,049,909	€92,546,300
TOTAL	€710,784,143	€36,050,640	€23,198,519	€65,759,239	€132,488,988	€453,286,758

Table 13: 2006 PCCC net expenditure by LHO according to the distribution by gender from the hospital sector national expenditure – disability

LHO area	Year to date actual – disability	PCCC net expenditure by gender	
		Males	Females
Clare	€10,180,884.00	€5,000,688	€5,180,197
Galway	€6,653,225	€3,267,958	€3,385,268
Limerick	€20,890,857	€10,261,255	€10,629,603
Mayo	€12,956,601	€6,364,075	€6,592,526
North Tipperary/East Limerick	€10,350,312	€5,083,908	€5,266,404
Roscommon	€2,433,725	€1,195,407	€1,238,318
Sligo/Leitrim/West Cavan	€82,068,570	€40,310,768	€41,757,802
Total West	€145,534,174	€71,484,058	€74,050,117
Carlow/Kilkenny	€24,257,124	€11,914,711	€12,342,413
Kerry	€289,238	€142,069	€147,169
North Cork	€77,826	€38,227	€39,599
North Lee - Cork	€1,024,351	€503,145	€521,206
South Lee - Cork	€628,020	€308,474	€319,547
South Tipperary	€9,728,782	€4,778,622	€4,950,160
Waterford	€31,973,306	€15,704,776	€16,268,530
West Cork	€155,855,757	€76,553,854	€79,301,903
Wexford	€13,009,294	€6,389,957	€6,619,337
Total South	€236,843,698	€116,333,835	€120,509,864
Dublin South	€23,558,895	€11,571,752	€11,987,143
Dublin South City	€5,366,697	€2,636,036	€2,730,661
Dublin South East	€31,637,223	€15,539,698	€16,097,525
Dublin South West	€6,985,978	€3,431,400	€3,554,577
Dublin West	€2,879,951	€1,414,586	€1,465,365
Kildare/West Wicklow	€10,593,435	€5,203,326	€5,390,109
Laois/Offaly	€40,692,760	€19,987,633	€20,705,128
Longford/Westmeath	€33,727,565	€16,566,440	€17,161,125
Wicklow	€27,844,940	€13,676,989	€14,167,951
Total Dublin/Mid-Leinster	€183,287,444	€90,027,859	€93,259,584
Cavan/Monaghan	€22,177,445	€10,893,206	€11,284,239
Dublin North	€51,075,157	€25,087,300	€25,987,857
Dublin North Central	€24,135,658	€11,855,049	€12,280,609
Dublin North West	€12,190,112	€5,987,588	€6,202,524
Louth	€10,881,863	€5,344,997	€5,536,866
Meath	€24,658,592	€12,111,906	€12,546,686
Total Dublin/North East	€145,118,827	€71,280,046	€73,838,781
TOTAL	€710,784,143	€349,125,797	€361,658,346

Table 14: European directly age-standardised PCCC net expenditure per capita by LHO - disability

LHO area	Year to date actual - disability	Year to date actual per capita	European age-standardised PCCC net expenditure per capita
Clare	€10,180,884	€513	€350
Galway	€6,653,225	€167	€116
Limerick	€20,890,857	€675	€466
Mayo	€12,956,601	€535	€395
North Tipperary/East Limerick	€10,350,312	€572	€388
Roscommon	€2,433,725	€212	€162
Sligo/Leitrim/West Cavan	€82,068,570	€4,453	€3,133
Total West	€145,534,174	€894	€716
Carlow/Kilkenny	€24,257,124	€1,076	€729
Kerry	€289,238	€11	€8
North Cork	€77,826	€5	€4
North Lee - Cork	€1,024,351	€31	€22
South Lee - Cork	€628,020	€19	€13
South Tipperary	€9,728,782	€528	€365
Waterford	€31,973,306	€1,426	€996
West Cork	€155,855,757	€15,642	€11,354
Wexford	€13,009,294	€513	€348
Total South	€236,843,698	€1,157	€1,872
Dublin South	€23,558,895	€958	€673
Dublin South City	€5,366,697	€210	€157
Dublin South East	€31,637,223	€1,627	€1,165
Dublin South West	€6,985,978	€232	€160
Dublin West	€2,879,951	€112	€77
Kildare/West Wicklow	€10,593,435	€326	€220
Laois/Offaly	€40,692,760	€1,681	€1,139
Longford/Westmeath	€33,727,565	€1,571	€1,074
Wicklow	€27,844,940	€1,352	€907
Total Dublin/Mid-Leinster	€183,287,444	€817	€678
Cavan/Monaghan	€22,177,445	€1,083	€761
Dublin North	€51,075,157	€1,274	€862
Dublin North Central	€24,135,658	€913	€655
Dublin North West	€12,190,112	€359	€248
Louth	€10,881,863	€522	€359
Meath	€24,658,592	€1,021	€683
Total Dublin/North East	€145,118,827	€875	€607
TOTAL	€710,784,143	€938	€968

Table 15: 2006 PCCC net expenditure by LHO according to the distribution by age from the hospital sector national expenditure – children and families

LHO area	Year to date actual – children	PCCC net expenditure by age group		
		0-4	5-9	10-14
Clare	€8,069,061	€4,681,473	€1,744,710	€1,642,878
Galway	€21,953,954	€12,737,150	€4,746,933	€4,469,872
Limerick	€16,021,683	€9,295,391	€3,464,244	€3,262,049
Mayo	€7,963,208	€4,620,060	€1,721,823	€1,621,326
North Tipperary/East Limerick	€11,676,573	€6,774,464	€2,524,735	€2,377,375
Roscommon	€4,801,293	€2,785,593	€1,038,146	€977,553
Sligo/Leitrim/West Cavan	€30,457,454	€17,670,674	€6,585,578	€6,201,202
Total West	€100,943,227	€58,564,804	€21,826,168	€20,552,255
Carlow/Kilkenny	€9,265,369	€5,375,542	€2,003,379	€1,886,449
Kerry	€6,923,572	€4,016,888	€1,497,030	€1,409,654
North Cork	€6,810,345	€3,951,196	€1,472,548	€1,386,601
North Lee – Cork	€27,233,795	€15,800,385	€5,888,551	€5,544,858
South Lee – Cork	€8,386,898	€4,865,874	€1,813,434	€1,707,590
South Tipperary	€8,214,605	€4,765,914	€1,776,180	€1,672,511
Waterford	€12,343,177	€7,161,211	€2,668,869	€2,513,097
West Cork	€4,285,888	€2,486,568	€926,704	€872,616
Wexford	€8,304,906	€4,818,305	€1,795,705	€1,690,897
Total South	€91,768,557	€53,241,884	€19,842,401	€18,684,273
Dublin South	€18,555,140	€10,765,241	€4,012,034	€3,777,866
Dublin South City	€28,676,815	€16,637,590	€6,200,564	€5,838,660
Dublin South East	€5,331,800	€3,093,381	€1,152,854	€1,085,566
Dublin South West	€12,777,393	€7,413,132	€2,762,756	€2,601,504
Dublin West	€16,944,323	€9,830,684	€3,663,739	€3,449,900
Kildare/West Wicklow	€9,820,697	€5,697,729	€2,123,453	€1,999,515
Laois/Offaly	€11,886,972	€6,896,532	€2,570,227	€2,420,213
Longford/Westmeath	€16,075,156	€9,326,414	€3,475,806	€3,272,936
Wicklow	€12,962,424	€7,520,483	€2,802,764	€2,639,177
Total Dublin/Mid-Leinster	€133,030,720	€77,181,187	€28,764,197	€27,085,336
Cavan/Monaghan	€6,104,113	€3,541,458	€1,319,845	€1,242,810
Dublin North	€42,891,781	€24,884,767	€9,274,156	€8,732,857
Dublin North Central	€30,884,208	€17,918,266	€6,677,852	€6,288,090
Dublin North West	€30,240,360	€17,544,721	€6,538,638	€6,157,001
Louth	€9,339,154	€5,418,350	€2,019,333	€1,901,471
Meath	€7,688,867	€4,460,894	€1,662,504	€1,565,470
Total Dublin/North East	€127,148,483	€73,768,456	€27,492,327	€25,887,700
TOTAL	€452,890,987	€262,756,331	€97,925,093	€92,209,564

Table 16: Population distribution by age for individuals under 15 years – 2006 Irish Census of Population, CSO – children and families

LHO area	Aged 0-4	Aged 5-9	Aged 10-14	Total
Clare	8,206	8,118	7,649	23,973
Donegal	11,168	11,293	10,965	33,426
Galway	16,237	15,135	14,674	46,046
Limerick	10,104	9,924	9,507	29,535
Mayo	8,280	8,449	8,680	25,409
North Tipperary/East Limerick	6,894	7,002	6,614	20,510
Roscommon	3,944	3,992	4,041	11,977
Sligo/Leitrim/West Cavan	5,947	6,043	6,063	18,053
Total West	70,780	69,956	68,193	208,929
Carlow/Kilkenny	8,817	8,370	8,334	25,521
Kerry	8,835	9,298	9,115	27,248
North Cork	5,698	5,446	5,229	16,373
North Lee - Cork	12,504	11,645	10,727	34,876
South Lee - Cork	11,886	11,496	11,230	34,612
South Tipperary	6,131	6,216	6,302	18,649
Waterford	8,811	8,434	7,953	25,198
West Cork	3,530	3,854	3,782	11,166
Wexford	10,025	9,858	9,355	29,238
Total South	76,237	74,617	72,027	222,881
Dublin South	7,067	7,679	8,168	22,914
Dublin South City	6,636	5,905	5,866	18,407
Dublin South East	5,929	5,622	5,363	16,914
Dublin South West	10,234	9,722	9,154	29,110
Dublin West	11,068	9,495	8,440	29,003
Kildare/West Wicklow	17,421	15,821	13,654	46,896
Laois/Offaly	10,947	10,521	9,653	31,121
Longford/Westmeath	8,611	8,367	8,136	25,114
Wicklow	8,185	7,645	7,420	23,250
Total Dublin Mid-Leinster	86,098	80,777	75,854	242,729
Cavan/Monaghan	8,559	8,806	8,523	25,888
Dublin North	16,558	15,207	14,258	46,023
Dublin North Central	6,416	6,283	6,287	18,986
Dublin North West	14,546	11,538	10,211	36,295
Louth	8,830	8,341	7,397	24,568
Meath	14,228	12,800	11,122	38,150
Total Dublin North East	69,137	62,975	57,798	189,910
TOTAL	302,252	288,325	273,872	864,449

Table 17: European age-standardised PCCC net expenditure per capita by LHO – children and families

LHO	Year to date actual – children and families	Year to date actual per capita	European age-standardised PCCC net expenditure per capita
Clare	€8,069,061	€337	€344
Galway	€21,953,954	€477	€482
Limerick	€16,021,683	€542	€555
Mayo	€7,963,208	€313	€327
North Tipperary/East Limerick	€11,676,573	€569	€586
Roscommon	€4,801,293	€401	€417
Sligo/Leitrim/West Cavan	€30,457,454	€1,687	€1,753
Total West	€100,943,227	€618	€638
Carlow/Kilkenny	€9,265,369	€363	€370
Kerry	€6,923,572	€254	€266
North Cork	€6,810,345	€416	€423
North Lee – Cork	€27,233,795	€781	€785
South Lee – Cork	€8,386,898	€242	€247
South Tipperary	€8,214,605	€440	€458
Waterford	€12,343,177	€490	€497
West Cork	€4,285,888	€384	€406
Wexford	€8,304,906	€284	€290
Total South	€91,768,557	€406	€416
Dublin South	€18,555,140	€810	€867
Dublin South City	€28,676,815	€1,558	€1,563
Dublin South East	€5,331,800	€315	€319
Dublin South West	€12,777,393	€439	€444
Dublin West	€16,944,323	€584	€576
Kildare/West Wicklow	€9,820,697	€209	€208
Laois/Offaly	€11,886,972	€382	€387
Longford/Westmeath	€16,075,156	€640	€654
Wicklow	€12,962,424	€558	€564
Total Dublin/Mid-Leinster	€133,030,720	€611	€620
Cavan/Monaghan	€6,104,113	€236	€245
Dublin North	€42,891,781	€932	€935
Dublin North Central	€30,884,208	€1,627	€1,672
Dublin North West	€30,240,360	€833	€811
Louth	€9,339,154	€380	€382
Meath	€7,688,867	€202	€200
Total Dublin/North East	€127,148,483	€702	€707
TOTAL	€452,890,987	€584	€595

Table 18: 2006 PCCC net expenditure by LHO according to the distribution by gender from the hospital sector national expenditure – children and families

LHO area	Year to date actual – children and families	PCCC net expenditure by gender	
		Males	Females
Clare	€8,069,061	€4,460,027	€3,609,034
Galway	€21,953,954	€12,134,649	€9,819,305
Limerick	€16,021,683	€8,855,694	€7,165,989
Mayo	€7,963,208	€4,401,519	€3,561,689
North Tipperary/East Limerick	€11,676,573	€6,454,014	€5,222,560
Roscommon	€4,801,293	€2,653,828	€2,147,466
Sligo/Leitrim/West Cavan	€30,457,454	€16,834,805	€13,622,650
Total West	€100,943,227	€55,794,535	€45,148,692
Carlow/Kilkenny	€9,265,369	€5,121,265	€4,144,105
Kerry	€6,923,572	€3,826,879	€3,096,693
North Cork	€6,810,345	€3,764,294	€3,046,050
North Lee – Cork	€27,233,795	€15,052,985	€12,180,810
South Lee – Cork	€8,386,898	€4,635,706	€3,751,193
South Tipperary	€8,214,605	€4,540,474	€3,674,132
Waterford	€12,343,177	€6,822,467	€5,520,710
West Cork	€4,285,888	€2,368,947	€1,916,941
Wexford	€8,304,906	€4,590,386	€3,714,520
Total South	€91,768,557	€50,723,403	€41,045,154
Dublin South	€18,555,140	€10,256,017	€8,299,124
Dublin South City	€28,676,815	€15,850,589	€12,826,227
Dublin South East	€5,331,800	€2,947,056	€2,384,745
Dublin South West	€12,777,393	€7,062,472	€5,714,921
Dublin West	€16,944,323	€9,365,667	€7,578,656
Kildare/West Wicklow	€9,820,697	€5,428,212	€4,392,485
Laois/Offaly	€11,886,972	€6,570,308	€5,316,664
Longford/Westmeath	€16,075,156	€8,885,250	€7,189,905
Wicklow	€12,962,424	€7,164,744	€5,797,680
Total Dublin/Mid-Leinster	€133,030,720	€73,530,314	€59,500,406
Cavan/Monaghan	€6,104,113	€3,373,938	€2,730,176
Dublin North	€42,891,781	€23,707,653	€19,184,128
Dublin North Central	€30,884,208	€17,070,685	€13,813,523
Dublin North West	€30,240,360	€16,714,810	€13,525,550
Louth	€9,339,154	€5,162,048	€4,177,106
Meath	€7,688,867	€4,249,882	€3,438,985
Total Dublin/North East	€127,148,483	€70,279,014	€56,869,469
TOTAL	€452,890,987	€250,327,265	€202,563,722

Table 19: Population distribution by gender for individuals under 15 years – 2006 Irish Census of Population, CSO – children and families

LHO area	Males	Females	Total
Clare	12,120	11,853	23,973
Donegal	17,182	16,244	33,426
Galway	23,692	22,354	46,046
Limerick	15,028	14,507	29,535
Mayo	12,917	12,492	25,409
North Tipperary/East Limerick	10,569	9,941	20,510
Roscommon	6,088	5,889	11,977
Sligo/Leitrim/West Cavan	9,351	8,702	18,053
Total West	106,947	101,982	208,929
Carlow/Kilkenny	13,013	12,508	25,521
Kerry	13,843	13,405	27,248
North Cork	8,285	8,088	16,373
North Lee - Cork	17,760	17,116	34,876
South Lee - Cork	17,846	16,766	34,612
South Tipperary	9,566	9,083	18,649
Waterford	12,995	12,203	25,198
West Cork	5,694	5,472	11,166
Wexford	14,897	14,341	29,238
Total South	113,899	108,982	222,881
Dublin South	11,775	11,139	22,914
Dublin South City	9,296	9,111	18,407
Dublin South East	8,711	8,203	16,914
Dublin South West	15,111	13,999	29,110
Dublin West	14,900	14,103	29,003
Kildare/West Wicklow	24,116	22,780	46,896
Laois/Offaly	15,872	15,249	31,121
Longford/Westmeath	12,849	12,265	25,114
Wicklow	11,921	11,329	23,250
Total Dublin Mid-Leinster	124,551	118,178	242,729
Cavan/Monaghan	13,351	12,537	25,888
Dublin North	23,640	22,383	46,023
Dublin North Central	9,761	9,225	18,986
Dublin North West	18,671	17,624	36,295
Louth	12,519	12,049	24,568
Meath	19,705	18,445	38,150
Total Dublin North East	97,647	92,263	189,910
TOTAL	443,044	421,405	864,449

Table 20: Gender-adjusted 2006 PCCC net expenditure per capita by LHO – children and families

LHO area	Year to date actual – children and families	Year to date actual per capita	Gender-adjusted PCCC net expenditure per capita
Clare	€8,069,061	€337	€336
Galway	€21,953,954	€477	€476
Limerick	€16,021,683	€542	€542
Mayo	€7,963,208	€313	€313
North Tipperary/East Limerick	€11,676,573	€569	€568
Roscommon	€4,801,293	€401	€400
Sligo/Leitrim/West Cavan	€30,457,454	€1,687	€1,683
Total West	€100,943,227	€575	€617
Carlow/Kilkenny	€9,265,369	€363	€362
Kerry	€6,923,572	€254	€254
North Cork	€6,810,345	€416	€415
North Lee – Cork	€27,233,795	€781	€780
South Lee – Cork	€8,386,898	€242	€242
South Tipperary	€8,214,605	€440	€440
Waterford	€12,343,177	€490	€489
West Cork	€4,285,888	€384	€383
Wexford	€8,304,906	€284	€284
Total South	€91,768,557	€412	€411
Dublin South	€18,555,140	€810	€808
Dublin South City	€28,676,815	€1,558	€1,556
Dublin South East	€5,331,800	€315	€315
Dublin South West	€12,777,393	€439	€438
Dublin West	€16,944,323	€584	€583
Kildare/West Wicklow	€9,820,697	€209	€209
Laois/Offaly	€11,886,972	€382	€381
Longford/Westmeath	€16,075,156	€640	€639
Wicklow	€12,962,424	€558	€556
Total Dublin/Mid-Leinster	€133,030,720	€548	€585
Cavan/Monaghan	€6,104,113	€236	€235
Dublin North	€42,891,781	€932	€930
Dublin North Central	€30,884,208	€1,627	€1,623
Dublin North West	€30,240,360	€833	€831
Louth	€9,339,154	€380	€380
Meath	€7,688,867	€202	€201
Total Dublin/North East	€127,148,483	€670	€668
TOTAL	€452,890,987	€545	€682

5. Building a health resource allocation formula for Ireland - principles

This chapter describes the principles that should guide the development of, and the justification for, a model of allocating resources for Irish healthcare provision. Such a model is a good first step towards a fairer, more sustainable, and a more effective process for resource allocation in the Irish health services.

- There are many different types of RA model in operation around the world.
- A useful division of these RA models is into 'direct' and 'indirect' models, based respectively on direct assessment of health needs, usually based on morbidity, and on indirect measures derived from utilisation and other sources.
- A direct model is preferable for Ireland, given the data issues in the typical small area-based indirect models.
- A structure for such a model is suggested.

There are two main ways to use health data or to build a resource allocation model – the direct approach and the indirect approach. The direct approach uses morbidity data to measure health service needs. The indirect approach is a two-stage process where health service utilisation data is used to measure needs – firstly, by examining the effects of age and gender and secondly, by accounting for additional needs due to influences (e.g. deprivation) over and above the age/gender effects.

5.1 Indirect versus direct needs approach

5.1.1 Indirect approach

Gordon *et al.* (2001) identified the components of an indirect approach as the resources required by a health authority and proportional to the population by age/gender multiplied by:

1. Cost or volume weights by age/gender group
2. Index of additional needs
3. Index of unavoidable excess costs of service provision

Both the direct and indirect approaches require similar (national) costs of treatment data, and both should account for the unavoidable excess costs of providing health services. The major difference between the two approaches relates to healthcare needs. The direct approach uses morbidity data to measure such needs. The indirect approach is a two-stage process where health service utilisation data is used to measure needs – firstly, on the grounds of age and gender and, secondly, according to additional needs due to influences (e.g. deprivation) over and above the age/gender effects. These give different patters of allocation (Asthana *et al.*, 2004).

Stage (1): Needs by age and gender

The health service utilisation data typically required are:

- hospital episodes by speciality and length of stay, and births for maternity services
- visits by community health service type
- GP consultations
- dispensed prescriptions

Stage (2): Additional needs

Additional needs are estimated statistically by relating utilisation of health services to proxy need measures, usually reflecting the socio-economic and, possibly, premature mortality and morbidity characteristics of the population.

According to Gordon *et al*. (2001), ideally, the relationships between utilisation and socio-economic and/or mortality factors should be investigated using data on individual patients. Given the lack of socio-economic information at this level, small area analyses are seen as the next best alternative. Areas should not be too large to avoid substantial intra-area variations in socio-economic conditions being hidden.

One of the drawbacks of the indirect approach is the lack of transparency and comprehensibility of the statistical analysis required to derive the additional needs part of a resource allocation formula. This has been acknowledged in the literature. In the absence of adequate direct needs data, it can be difficult to disentangle the effects of true need on utilisation from the effects of supply and demand. Resources should only be allocated to try and meet needs and should not be allocated on the basis of past supply patterns or in response to different levels of demand for the same underlying need. The analysis can be represented in the following way:

Current utilisation is influenced by:

1. Needs
2. Supply of services
3. Socio-economic factors

Supply of services has been influenced by:

1. Previous utilisation
2. Socio-economic factors

Service supply is 'endogenous', meaning that it both influences utilisation and is itself influenced by previous utilisation. If this is not recognised in the statistical analyses, then biased weights on the proxy need indicators of health needs will result (Gordon *et al.*,, 2001).

Gordon *et al*. (2001) also identify further complications: the effect on utilisation of variations in policies between health authorities, i.e. possibly greater use of community services for post-operative care in some authorities than in others. They recommend that health authority effects should be built into the statistical analyses in order to allow for such policy influences. For GP prescribing, additional supply characteristics such as the number of partners in the practice and the practice's dispensing and training status – which have been identified as affecting prescribing costs – are usually included in the statistical analyses. Biased weights on health needs indicators can occur if these policy and supply effects are ignored in the analyses.

If an indirect approach were to be adopted in Ireland, the following data and analytical requirements would need to be considered:

- The indirect approach is very demanding in data and analytical terms, and this has implications for the time and cost commitments that have to be devoted to developing a formula.
- Obtaining and processing utilisation data is likely to be (much) more problematic than assembling social, economic and demographic data as proxies for healthcare needs.
- There is a lack of small area data in Ireland.

In Scotland, postcode utilisation data are automatically allocated to postcode sectors for small area analyses, whereas in Wales (and England) procedures must be used to locate patients by wards or electoral divisions, using either a Geographical Information System (GIS) or a postcode/area look-up table. This level of small area data is not available for Ireland, as most data are only available at county level. In view of this it is recommended that relationships between utilisation and socio-economic/mortality factors be investigated using individual level data, with small area data being the next best alternative. County-level data are too coarse, and could eclipse any intra-county variations in socio-economic conditions that occur.

5.1.2 Direct needs-based formula

A novel and innovative needs-based resource allocation formula has been developed by David Gordon and colleagues, which is both more accurate and more reliable than previous methods. Their formula will result in a fairer allocation of NHS resources (Gordon *et al.*, 2001).

Throughout the work of Gordon *et al.* (2001) it is clear that a direct health resource allocation formula has a greater validity than the previous indirect formula (see also Asthana *et al.*, 2004). The research team argued that allocating maternity resources on the basis of the distribution of births, and allocating resources for cancer treatment on the basis of the distribution of cancer patients was better than allocating these resources on the basis of either the geography of death, or population size. Within the UK, England and Scotland have yet to develop direct resource allocation formulas of this kind as they lack the detailed local area health statistics that are now available in Wales. In particular, the Welsh Health Survey (WHS) and the General Practice Morbidity Database (GPMD) are unique Welsh health information resources that the other countries lack (Fuller *et al.*, 2008).

The direct resource allocation formula is based on the principle:

Area resource allocation = amount of health needs * costs of meeting the health needs

This provides a very flexible allocation mechanism, which is both independent of geography (it works equally well at both Local Health Group and Health Authority area level), and is easy to amend, in order to include additional factors such as an additional rural health cost factor. This is important because although the formula they put forward is the best currently achievable given the available information on health needs and the costs of meeting those needs, this approach allows new health information to be easily included, according as it becomes available. An indirect formula would not easily allow new information to be included. The authors suggest a number of areas where future amendments to the formula may be desirable, according as improved health information becomes available:

1. Additional rural costs
2. Children's health
3. The communal establishment population, e.g. care homes, nursing homes, etc.
4. Community services

In an ideal world, and if suitable data were available, the model of choice for Ireland would definitely be the matrix approach to setting capitation based on individual level data, as used in the Stockholm County model (Diderichsen and Whitehead, 1997). It represents the most methodologically sound approach to setting capitation as it minimises the effects of "ecological fallacy" associated with the use of aggregate data. However, give the lack of individual level data available in Ireland, this is not an

option available at this stage. Future developments in information technology could lead to rapid increases in the availability of individual level data and use of the matrix approach in the years to come.

At present, the index approach is the most appropriate option where aggregate measures of the characteristics of a certain population are pooled in order to create an index that seeks to indicate the aggregate healthcare spending needs of the population in question.

Most of the resource allocation models assessed earlier have estimated healthcare needs based on sophisticated explanatory models for small area utilisation data. These models may not be appropriate for Ireland as they may be based on the simple assumption that contextual effects are very important. Irish data systems at small area level are still very limited, and therefore would not support such models at a national level. Having reviewed several existing resource allocation models, this study concluded that a system based on individual direct indicators of health need rather than small area-level indirect indicators would be both preferable and more practical for Ireland. It is hoped that a resource allocation model that would focus on health needs, and would use directly available data on population health, could be devised.

It is important to draw attention to two issues that affect Irish data sources as, currently, there is a lack of reliable small area data available and available data for primary care is very limited. On the other hand, there is a great deal of high-quality morbidity data available. Data is used from a variety of different sources such as HIPE (hospital data), vital statistics, psychiatric and disability data, survey and registry data (SLÁN, The National Cancer Registry, Quarterly National Household Survey), General Medical Services (prescriptions and GP consultations).

Having reviewed the Irish data systems, small area hospital data currently covers about one-third of the population. Current survey data are adequate to support a demonstration of a resource allocation model for Ireland; moreover, the necessary additional data for a complete model could be collected quickly and at a modest cost. Survey data could be used to estimate population prevalence of ill health as a proxy for need. Clearly, this measure of need is not perfect; equally, Irish health survey data do not provide all of the information required in order to fully implement this type of resource allocation. Other data systems such as HIPE and NPIRS could provide valuable data, both as primary inputs to a model and as important validation of the conclusions of this model.

The development of a framework within which it would be possible to directly estimate the costs of delivering care equitably to people with equal healthcare needs at regional and sub-regional level in the Republic of Ireland is proposed in this study. This proposed Irish model will be based closely on the Welsh experience, following closely on the procedures used in that model The direct needs-based approach used in Wales is probably the best solution for Ireland, given that it is a flexible allocation mechanism that is independent of geography and also given that it makes allowances for amendments to be added once data becomes available at a later date.

In order to implement this model, the following data would be required:

- Costs for providing a specific set of services in primary care
- Population-level burden of the diseases for which those services are provided, estimated from available survey data, prescribing data, and hospital utilisation data

Health needs are estimated from population data or sample prevalence data, using a combination of samples from health surveys, HIPE data and other available data sources.

5.2 Model justification and design principles

5.2.1 The application of a direct resource allocation formula to the Irish healthcare system

As stated earlier, the application of an appropriate model must be based on the appropriate data.

The main limitations that arose when considering the construction of a resource allocation formula, using an indirect approach, in Ireland were:

- Data-demanding process that requires the use of complex statistical analyses.
- Patient-level data is essential in order to carry out the required statistical analyses. Where this is not available, small area level data is essential.
- The persistence of healthcare budgets based on historical costs, makes the application of an indirect approach highly unstable, by emphasising patterns of utilisation and supply that have not been responsive to population needs.
- The need for the continuous generation of healthcare data as inputs to statistical analysis of additional needs indicators.
- Lack of transparency and comprehensibility of the statistical analysis required to derive the additional needs indicators required by the resource allocation formula (these analyses tend to be too complex for non-specialists to understand).
- Persistent difficulties in separating the effects of true need on the utilisation of healthcare from the effects of the existing pattern of supply and demand. There is a fundamental problem of endogeneity in service supply that needs to be dealt with in the statistical analysis in order to avoid biased weights.

The use of a direct approach, as proposed by Gordon *et al*. (2001) in the development of the Wales NHS resource allocation formula, is suggested in this study. The justification for this is summarised as follows:

- The direct approach is less data-demanding, and relies on data sources that are already available in Ireland i.e. the 2006 Irish Census of Population as a source for vital statistics, long-term illness and impairment, Irish Cancer Registry, SLÁN – for primary care - Quarterly National Household Survey (CSO), HIPE, etc.
- The differences in the geographical distribution of sickness and death, as shown for the UK, confirm that mortality rates, widely used in resource allocation formulae using the indirect approach, are not the best indicator of health need. It seems preferable to allocate resources for the treatment of mental illness, for example, on the basis of reliable measurements of morbidity, rather than on the age, gender and social class distribution of the population, weighted by death rates.
- Empirical evidence from countries/regions using the indirect approach in their resource allocation formulas (England, Northern Ireland and Scotland in particular), which suggest the merits of the introduction of more direct measures of need in their models.

The proposed model emphasise that the main factor influencing the allocation of resources to any area for almost all services will be the population to be served by that service.

5.3 Principles of the proposed Irish RA formula

The fundamental principles of a resource allocation model within the Irish context are efficiency and equity in healthcare provision. The Irish health system is largely based on the historic allocation of resources. A proposed resource allocation model (RAM) aims to direct funding to meet the health needs of the population in line with the principle of equity, which is defined as "equal access to healthcare for those in equal need".
The guiding principle of the proposed model is consistent with that set out in *Quality and Fairness*: equity, people-centred, quality of care and accountability (Department of Health and Children 2001).

5.3.1 Economic principles

Healthcare RA is guided by two economic principles. First, the opportunity cost of a particular health programme, which measures the cost of using a particular resource, as its value, in its best alternative use, or in other words, the best possible health gain from that expenditure of resources. Efficiency is the process of maximising benefits and minimising opportunity costs. The second principle is that of the margin, which is about analysing how to allocate resources when there is a change in the resource mix.

5.3.2 Objectives of the Irish RA formula

The primary aim of the RA formula is to help ensure equal access for equal need, by geographical areas. The objective is to allocate money and not resources. The RAM is a decision-support tool, not a decision-making tool, and it will be integrated into the Health Atlas. The RAM does not consider the proportion of resources to be allocated to each programme. Instead, this is taken as a given. Neither does it consider the total amount of resources to be allocated to healthcare in Ireland.

The model starts with the PCCC 2007 expenditure (not budgets) allocated to each PCCC care groups and LHO. It focuses on PCCC resource allocation and it shows the allocation by LHO that would result from the implementation of the model.

The following general formula is used:

Area resource allocation = health needs * costs of meeting the health needs

5.3.3 Advantages/limitations of the proposed formula

Advantages:

- Data requirements are already present in current Irish health information systems.
- RAM designed for the "sick", not based on mortality rates.
- Transparency and comprehensibility for non-specialists.

Limitations:

- Integrated health data available at the county/LHO level, which over-simplifies the level of detail required in resource allocation modelling.
- Extensive analysis of data sources needed to evaluate the validity of potential measures of need.

5.3.4 Data inclusions/exclusions:

Inclusions:

- PCCC
- Psychiatric and disability data (subject to obtaining access to data)

Exclusions:

- Capital expenditure
- Costs of the CEO's office
- Superannuation and pension payments

5.3.5 Approach to dealing with cross-boundary patient flows

The geography for PCCC net expenditure is at LHO level. The model uses the PCCC cross-boundary patient flow assumptions from the PCCC resource distribution review undertaken by Dr Valerie Walshe in February 2007.

5.4 Resource allocation model for Ireland: outline of proposed model

Currently, there is no formal method of needs-based resource allocation in the Irish health services. Resources are allocated to areas, services and agencies, and decisions are mainly determined by previous resource allocations, with modifications made for new service developments, and for dealing with specific problems. Figure 1 shows a crude and simplified version of the current model.

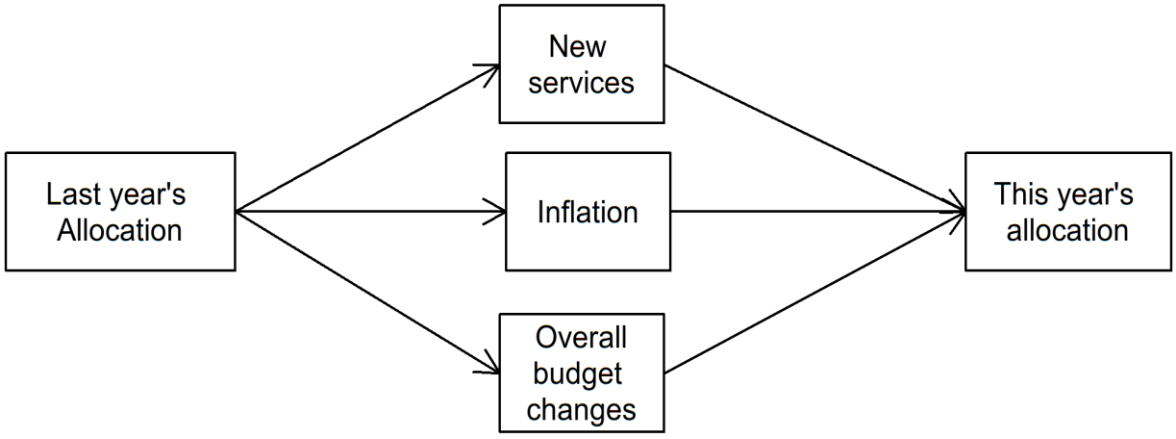

Figure 1: Current RA system in Republic of Ireland

Decisions on the future allocation of resources is dominated by the previous year's allocations and, as a result, many elements of the structure of Irish healthcare delivery demonstrate an impressive continuity from prior to World War II and, to an extent, from prior to World War I to the present day. This produces a system that is both opaque and indefensible. There is no focused attempt in Ireland to link allocation of resources to health needs.

Section 5.3 outlined the principles that should guide an RAM. This section describes preliminary ideas for operationalising such a model. It should be noted that a key objective of this process is to reduce the impact of the current spatial patterns (geographical distribution) of supply of healthcare on resource allocation. The main problem with using utilisation data as a proxy for healthcare need is that such data inevitably reflect, at least in part, the existing pattern of supply.

Figure 2 is a schematic of the proposed model.

The total PCCC budget, and the amount allocated to each programme within PCCC are taken as given. The size of the total budget and the relative distribution of resources between sectors are important issues to be addressed, but both lie outside the remit of this study.

When assessing any individual programme, the first question to ask is whether it is a national or supra-regional service: examples include expensive services, such as paediatric oncology, residential care services for at-risk children, transplant services, and neurosurgery. Also included are services such as the HSE CEO's office, public health, and health promotion. In the case of these services, two questions arise. First, 'what is the budget?', and second 'how is it apportioned between centres?' For single-site national services, this is easy to determine. For services such as neurosurgery and health promotion, the logic applied below for other services would argue for a procedure based directly on need. For neurosurgery, activity in the two centres offering this service reflects need and may, in fact, underestimate need. There is almost no 'elective' neurosurgery. For health promotion, for example, the population in each area drives the service need directly.

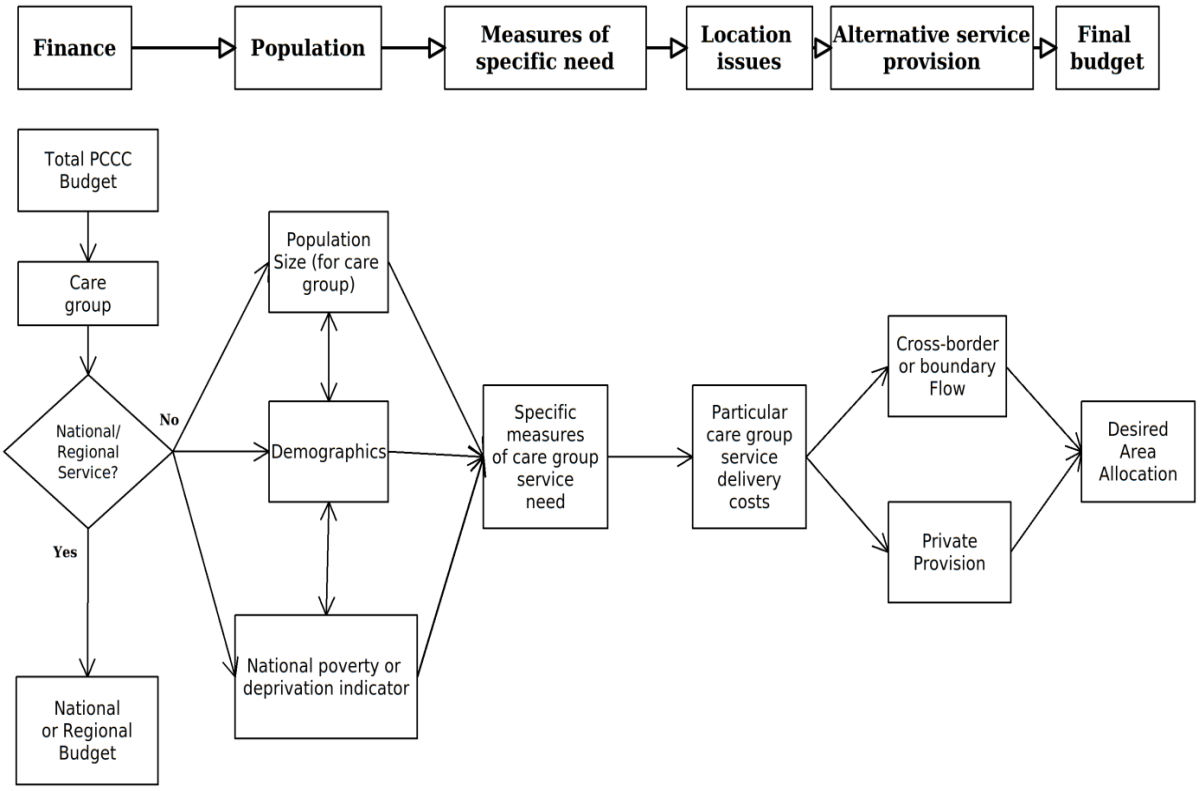

Figure 2: Outline of proposed RA model for Ireland

For other services, the main driver of resources must be the population size. Whichever unit for allocating resources is finally selected – county, LHO, region or other unit – resources will have to be largely proportional to population size. The Dublin catchment area will always require more resources for almost any service than, say, Roscommon, simply because it is a much bigger geographical area. The model proposes to modify the purely population-based allocation system in a number of ways, in order to develop a more refined system.

The next factor to consider after population size is the demography of the populations. It is well-known that service utilisation varies widely, depending on the patients' ages. Data from HIPE demonstrates this very clearly for hospital services, and similar results are found for other services, for example, in the recent Insight '07 survey (Boilson *et al.*, 2007). For certain services – most obviously maternity services – and but also for mental health services, rehabilitation services, general practice services and many others – there are significant differences between service utilisation by men and by women. In many cases (although by no means all), these differences reflect real differences in the epidemiology of the various conditions. Certain primary care services are delivered to defined demographic groups only – for example child protection services, services for older people, and so on. All of these services need to be included in a RAM.

The third factor that needs to be examined is the effect that poverty has on need. As is well-recognised, poverty and the incidence of ill health are closely linked. The limited Irish data available are fully in line with international experience on this issue. There are two main choices for dealing with poverty in a RAM: the first is to aggregate population i.e. weighted small-area indicators such as the SAHRU index (Kelly and Teljeur, 2004), or the Haase-Pratschke index (Haase and Pratschke, 2008). The second choice is to use summed individual data from a population census. There is reasonable evidence to suggest that access to general practice varies markedly between catchment areas with poor and rich populations. There seems to be no comparable published data for other PCCC services.

The final factor is specific evidence of need. An ideal measure of health need is simple to determine: it is objective, has high validity; is transparent, and is not affected by service provision. Data on specific

evidence of need is also inexpensive to gather; is accurate, and is available relevant geographical areas. Specific evidence of need is not based on service utilisation, either directly or indirectly: these are not mutually consistent requirements. In practice, health need is often very hard to measure. There is good data available for some acute hospital services. For example, cancer services, trauma services and neurosurgical services all have quite credible measures of need that either meet, or almost meet the specifications above. For other services, specific evidence of need is more difficult to obtain. For disability services, using demographic data and census data on disability will be of some assistance. For many services, utilisation data (perhaps crossed-referenced against available survey data) will have to be used. However, this may introduce current resource allocation patterns into future allocation decisions, but that may be unavoidable, given the available data.

A particularly important element to be considered is the differential costs of providing services in different catchment areas. These costs play out in several different ways. For example, rental costs, transport costs and other service costs may be significantly higher in urban areas, and particularly in parts of Dublin. It may cost a great deal more to provide certain services, particularly home-based services, in rural areas. Scottish data suggest that it may cost 25% more to provide primary care services on islands off the coast of Scotland as it costs to provide these services in cities such as Edinburgh and Glasgow (Health and Community Care Committee, 1999). Northern Ireland research data indicate that measures of population dispersion in relation to sites at which care is provided can be a useful measure of the additional costs of providing rural services (Capitation Formula Review Group, 2004).

The model also considers two modifying factors. The first is private supply of healthcare, which serves as a substitute, however inefficiently, for public healthcare. At the time of publication, requests for access to such data were unmet. Obviously, private suppliers have a very strong incentive to increase utilisation, irrespective of more objective measures of need, and therefore the use of such data is quite problematic. This is, in any event, less important for PCCC than it is for acute hospital care.

The second modifying factor is cross-boundary patient flow, which arises for two reasons. First, according to research carried out by the Department of Health and Social Security in Northern Ireland (DHSS NI), some people living in border areas may use NHS facilities in Northern Ireland but give a Republic of Ireland address as their domicile. This is a direct substitute for public provision in the Republic, but at the same time is not necessarily a sustainable one. A recent evaluation by the DHSS NI (Capitation Formula Review Group, 2008) suggests that the net impact of these flows may be very small. The second issue relates to people who avail of health services outside their own LHO catchment area in the Republic of Ireland and provide the services with an address other than their actual home address. It is not clear how significant the latter cross-boundary patient flows actually are.

This entire process (Figure 2) leads to a desired allocation for a given service to a given area, which can be compared with the actual allocation. The magnitude of the difference between the actual allocation and the desired allocation serves as an important guide to the feasibility of adopting the specific model proposed in this study, and of the time-scale required. The pattern of current allocations and the differences between the current pattern and the desired allocation are important tests of the credibility of the resource allocation model that is being proposed.

6. A resource allocation model for PCCC – components and structure

This chapter begins by providing details of the current budgets by care area and LHO, and the corresponding expenditure for each area. The data components of RA the model being proposed in this study are then described, along with their limitations, their relative impact, and how they can be adjusted. Basic models are constructed using the data available for PCCC services at LHO level and are then developed to first implementation stage. The central points addressed in this chapter are as follows:

- PCCC budgetary data are not available at LHO level.
- No suitable direct measures of need can be identified from existing Irish data.
- Estimated PCCC and GP utilisation, based on the literature and the limited Irish survey data available, are proposed as proxies for need.
- The impact of LHO-level deprivation on health service need can be estimated, albeit very crudely, and is likely to be significant.

6.1 Budgetary data

When analysing the budgetary data, the first step is to determine the extent of the current flow of resources. As discussed in the Introduction section of this report, this could be considered on several levels. For example:

- The financial resources that should be allocated specifically to health services out of the total Exchequer budget;
- The balance between government spend and private spend on health services;
- The balance between direct government spend on health services and indirect spend (largely a subsidy for private care through the tax system);
- The level of resources that should be allocated to PCCC out of total HSE resources;
- How total PCCC resources should be divided between the main components of PCCC;
- How the resources allocated to components of PCCC expenditure should be divided between geographical areas (specifically LHOs).

Of the various issues listed above, the last is dealt with here. This study concentrates exclusively on the 2007 outcome data i.e. what was actually spent, as opposed to what was budgeted for, as the main source of budgetary information used for further analysis. These data were provided by the HSE in the form set out below (See Table 21).

Table 21: HSE PCCC budget for 2007, Actual, Plan and Variance by CRS cost centre

CRS Sub service	Data	Total Result
ADMINISTRATION & SUPPORT	Sum - 2007 Actual	€17,351,540.13
	Sum - 2007 Plan	€18,217,499.46
	Sum - 2007 Variance	-€865,959.33
CHILDREN, ADOLESCENTS AND FAMILIES	Sum - 2007 Actual	€572,787,570.82
	Sum - 2007 Plan	€513,758,339.43
	Sum - 2007 Variance	€59,029,231.39
DISABILITY SERVICES	Sum - 2007 Actual	€1,499,175,971.42
	Sum - 2007 Plan	€1,491,435,071.98
	Sum - 2007 Variance	€7,740,899.44
FINANCE	Sum - 2007 Actual	€292,299.52
	Sum - 2007 Plan	
	Sum - 2007 Variance	€292,299.52
GP FEES & ALLOWANCES	Sum - 2007 Actual	€420,888,882.60
	Sum - 2007 Plan	€429,635,000.00
	Sum - 2007 Variance	-€8,746,117.40
MENTAL HEALTH	Sum - 2007 Actual	€769,607,991.07
	Sum - 2007 Plan	€752,039,451.69
	Sum - 2007 Variance	€17,568,539.38
MULTI CARE GRP SERVICES	Sum - 2007 Actual	€611,490,189.87
	Sum - 2007 Plan	€655,429,664.48
	Sum - 2007 Variance	-€43,939,474.61
OLDER PERSONS	Sum - 2007 Actual	€1,089,077,173.60
	Sum - 2007 Plan	€1,095,216,658.61
	Sum - 2007 Variance	-€6,139,485.01
PALLIATIVE CARE	Sum - 2007 Actual	€74,733,288.89
	Sum - 2007 Plan	€71,721,739.66
	Sum - 2007 Variance	€3,011,549.23
PCCC CORPORATE	Sum - 2007 Actual	€35,820,340.12
	Sum - 2007 Plan	€68,197,004.79
	Sum - 2007 Variance	-€32,376,664.67
PHARMACISTS CLAIMS	Sum - 2007 Actual	€1,160,531,960.67
	Sum - 2007 Plan	€1,143,216,000.00
	Sum - 2007 Variance	€17,315,960.67
POPULATION HEALTH	Sum - 2007 Actual	€28,970,033.22
	Sum - 2007 Plan	€54,559,199.61
	Sum - 2007 Variance	-€25,589,166.39
PRIMARY CARE	Sum - 2007 Actual	€1,232,967,297.91
	Sum - 2007 Plan	€1,072,198,261.71
	Sum - 2007 Variance	€160,769,036.20
SOCIAL INCLUSION	Sum - 2007 Actual	€121,779,843.59
	Sum - 2007 Plan	€132,495,727.06
	Sum - 2007 Variance	-€10,715,883.47
Total Sum - 2007 Actual		€7,635,474,383.43
Total Sum - 2007 Plan		€7,498,119,618.48
Total Sum - 2007 Variance		€137,354,764.95

The PCCC spend for 2007 was just over €7.6 billion. Table 22 shows the overall breakdown between resources spent at LHO level and those spent at higher levels (regional or central).

Table 22: Breakdown of 2007 PCCC actual expenditure between LHO level expenditure and other expenditure

Component	Value	Percentage
LHO spend	€4,931,829,262	65%
Non-LHO spend	€2,703,645,122	35%
Total spend	€7,635,474,383	100%

The €4.9 billion LHO expenditure is the main focus of the rest of this chapter.

Table 23: Breakdown of 2007 national PCCC budget by functional area and percentage of total

Area	National budget €1,000	% of total
FINANCE	€292	0.0%
ADMINISTRATION AND SUPPORT	€17,352	0.2%
POPULATION HEALTH	€28,970	0.4%
PCCC CORPORATE	€35,820	0.5%
PALLIATIVE CARE	€74,733	1.0%
SOCIAL INCLUSION	€121,780	1.6%
GP FEES AND ALLOWANCES	€420,889	5.5%
CHILDREN, ADOLESCENTS AND FAMILIES	€572,788	7.5%
MULTI-CARE GROUP SERVICE	€611,490	8.0%
MENTAL HEALTH	€769,608	10.1%
OLDER PERSONS	€1,089,077	14.3%
PHARMACIST CLAIMS	€1,160,532	15.2%
PRIMARY CARE	€1,232,967	16.1%
DISABILITY SERVICES	€1,499,176	19.6%
Total	€7,635,474	100.0%

Table 23 shows a more detailed breakdown of PCCC expenditure by 'cost-reporting system sub-areas' i.e. effectively functional areas of expenditure. Each represents a major programme of expenditure by the HSE, and most programmes provide services to a specific client group.

The 'multi-care group service' covers payments made by the HSE where the specific client group in receipt of services cannot be better defined. One example of this is the salary of a public health nurse, who, during the course of his/her day-to-day work may provide services to children, older people, people with disabilities and others. Two significant items merit particular comment, namely payments to pharmacists and GPs under the PCRS system. These payments total just over €1.5 billion (slightly over 21% of the total PCCC budget), and are currently managed separately from other PCCC expenditure, by the PCRS. The most significant portion (€16 million of €17.3 million) of the Administration and Support grant) goes to the PCRS also.

Table 24: 2007 PCCC actual budget divided by functional area, giving the breakdown by LHO-based expenditure and non LHO-based expenditure

Area	LHO budget €1,000	Non-LHO budget €1,000	% Non-LHO budget
FINANCE	-	€292	100%
ADMINISTRATION AND SUPPORT	-	€17,351,540	100%
POPULATION HEALTH	€26,088	€2,882	10%
PCCC CORPORATE	€8,007	€27,814	78%
PALLIATIVE CARE	€40,952	€33,781	45%
SOCIAL INCLUSION	€107,403	€14,377	12%
GP FEES AND ALLOWANCES	-	€420,889	100%
CHILDREN, ADOLESCENTS AND FAMILIES	€539,790	€32,998	6%
MULTI-CARE GROUP SERVICES	€590,439	€21,051	3%
MENTAL HEALTH	€737,186,862	€32,421	4%
OLDER PERSONS	€1,027,943	€61,134	6%
PHARMACIST CLAIMS	-	€1,160,531	100%
PRIMARY CARE	€1,031,620	€201,348	16%
DISABILITY SERVICES	€822,405	€676,776	45%
Total	€4,931,829	€2,703,645	35%

Table 24 shows how these areas of expenditure divide between LHO-based expenditure, and non LHO-based expenditure. Two areas with very large non-LHO expenditure merit special comment. For both disability services and palliative care services, a very large proportion of the total resource is spent through direct contracts with voluntary service providers. Any effective resource allocation system will have to ensure budgetary stability for these providers.

Table 25: Per capita LHO-level expenditure, 2007, all areas, by LHO, and the difference between that expenditure and the median expenditure for all LHOs

LHO	Total expenditure per capita	Change from median
Dublin West	€1,220	-€2,101
Dublin South	€2,084	-€1,237
North Lee – Cork	€2,104	-€1,217
Dublin North	€2,255	-€1,066
Meath	€2,369	-€952
North Tipperary/East Limerick	€2,485	-€836
Wicklow	€2,525	-€795
Galway	€2,591	-€729
Wexford	€2,760	-€560
Kildare/West Wicklow	€2,845	-€476
Clare	€2,867	-€453
Waterford	€2,928	-€393

LHO	Total expenditure per capita	Change from median
South Lee – Cork	€3,034	-€287
North Cork	€3,053	-€267
Mayo	€3,181	-€140
Dublin South West	€3,307	-€13
Roscommon	€3,334	€13
Cavan/Monaghan	€3,355	€34
Limerick	€3,374	€54
Dublin South City	€3,413	€92
Carlow/Kilkenny	€3,425	€105
Laois/Offaly	€3,507	€186
South Tipperary	€3,628	€307
Louth	€3,660	€339
Longford/Westmeath	€3,818	€497
Kerry	€3,960	€640
Donegal	€4,430	€1,109
Sligo/Leitrim/West Cavan	€5,070	€1,750
Dublin North West	€5,368	€2,047
Dublin North Central	€5,911	€2,590
West Cork	€7,860	€4,540
Dublin South East	€8,782	€5,461

Table 25 shows the per capita expenditure at LHO level only plus the difference between the expenditure in each LHO and the median expenditure for all LHOs (which was €3,321). There is a very high level of variation between LHOs in this measure (the range is €1,220 to €8,782). As discussed below, this does not directly reflect PCCC expenditure on the LHO populations.

At the time of writing, LHO-level budgets and outcomes for PCCC services were not available. While it is, in principle, possible to obtain these, in practice, the necessary resources to extract this data could not be made available. The practical issue to be addressed is that for many elements of what is now the PCCC budget, different LHOs hold the budget for different elements of PCCC services for neighbouring LHOs. This explains much, but by no means all, of the very large variations in expenditure between LHOs for PCCC services. A special exercise carried out by Dr Valerie Walshe of the HSE for the 2006 budget used manually collated LHO data to try to gross back these variations in expenditure to the LHOs for which the services are provided. The work presented in more detail earlier in this report showed that this does not account for most of the variation documented.

6.1.1 Limitations

Currently, the HSE's financial reporting systems are disparate, although efforts are being made to integrate them. One major implication of having disparate financial reporting systems is that it is not possible to demonstrate in this report how the implementation of the proposed RA model would impact on current budget allocations. This is not an issue for the modelling process, since current budgets and expenditures at LHO level do not figure in the calculations used here. However, it is highly advisable that any attempt to allocate resources to LHO level using the RA model proposed here, or any other model, should be postponed until existing expenditure on the services provided for LHO populations can be reliably estimated, which could be done relatively quickly i.e. within one or two months. The consequences of attempting to implement resource allocation without a solid knowledge of the current distribution of resources are likely to be both negative and severe.

6.2 Population-derived and census-derived measures of specific need

A number of census-derived variables are used in the models presented here. These variables, which are described in Table 26, fall into three groups: population figures, deprivation measures, and disability measures.

The first, and least problematic, group of census derived variables is population figures. It is important to note that while the Central Statistics Office does not conduct a post-census survey to identify people missed in the census-taking process, it provides a good baseline population estimate. It would be essential to base future resource allocation decisions not on the 2006 population estimates but on the best available population estimates at LHO level. These estimates will, of course, be derived from the census. However, it would be sufficient to rely solely on census data.

Table 26: List of census-derived variables used in this study

Variable	Derivation	Comments
LHO	Name of LHO	
HP_absolute	Haase Deprivation score	Relative to 1996
HP_relative	Haase Deprivation score	Relative to 2006
Population	Total population as of 2006 census	
Proportion: 0-14 years	Proportion of total population aged 14 years and under	
Proportion: 65+ years	Proportion of total population aged 65 years and over	
Proportion: 75+ years	Proportion of total population aged 75 years and over	
Proportion: 85+ years	Proportion of total population aged 85 years and under	
Proportion: Disabled	Proportion of total population responding 'yes' to the disability and long-term illness question	Crude, but useful measure of disability
Proportion 65+ years Disabled	Proportion of the population aged 65 years and over responding 'yes' to the disability and long-term illness question	
Male/female ratio	Ratio of males to females in the LHO population	
Dependency ratio	Ratio of those aged 0 to 14 years, those aged 64 years and over, to those aged 15 to 64 years	Crude measure of economic capacity

The second group of census derived variables considered, are two census-derived indicators of socio-economic status i.e. the 'Absolute' and the 'Relative' indicators of deprivation that were derived by Trutz Haase and Jonathan Pratschke (2008). The indicators differ in their baselines: for the 'Absolute' the baseline is the 1996 Census, and for the 'Relative' the baseline is the 2006 Census. The latter indicator is the appropriate one to use for the purposes of this study. Both indicators are based on a

statistical analysis of a large number of census variables putatively related to material deprivation, combined to produce a single score.

The box and whisker plots presented in Figure 3 for the deprivation variables and the rest are simple graphical summaries of numerical variables. The two ends of the box are drawn at the 25th and 75th centiles of the observed data. The darker vertical line in the box indicates the median of the data. The whiskers are drawn to the most extreme data point, which is no more than 1.5 times the length of the box away from the box. Points further away from the box than this (outliers) are indicated by small circles.

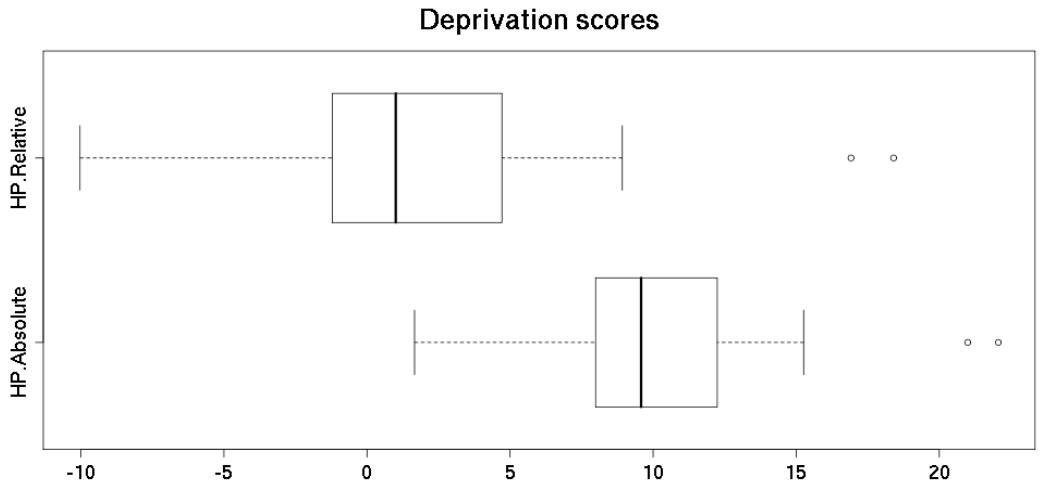

Figure 3: Box and whisker plot for the Haase and Pratschke relative and absolute deprivation scores, by LHO

The third group of census derived variables, (i.e. the disability figures) are derived from two census questions – Question 15 and Question 16 (Figures 4 and 5).

Question 15 asks if each person covered by the census is affected by any of a number of chronic conditions. Question 16 asks if the person is affected by one of these conditions and if, for example, that condition limits them in carrying out any of a number of daily activities – a definition that is recognised as one of the specific measurements used to determine disability. The variable that has been used in this study is set to 1 (where the census participant responded 'yes' to any part of Question 15 and to at least one part of Question 16). This approach is a crude measure of disability, but it is likely to be proportional to the truth. The more detailed disability study, which was carried out after the census and focused on a number of people who reported disability at the time of the 2006 Census, will probably be useful for the purpose of preparing more refined resource allocation models for disability services.

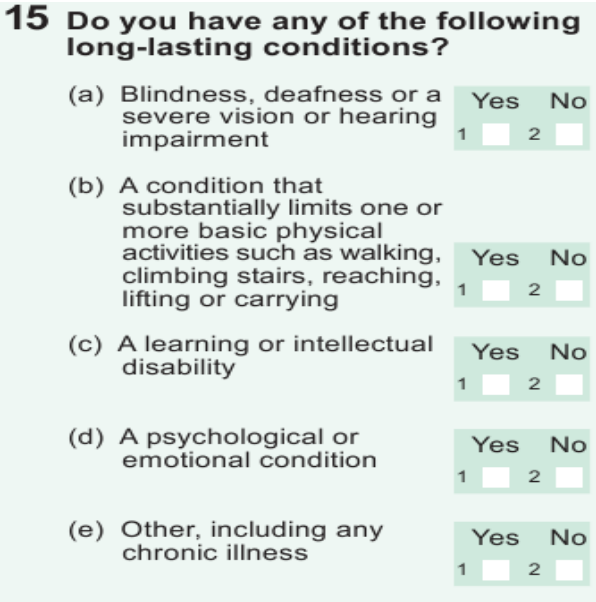

Figure 4: Question 15 from the 2006 census sample form

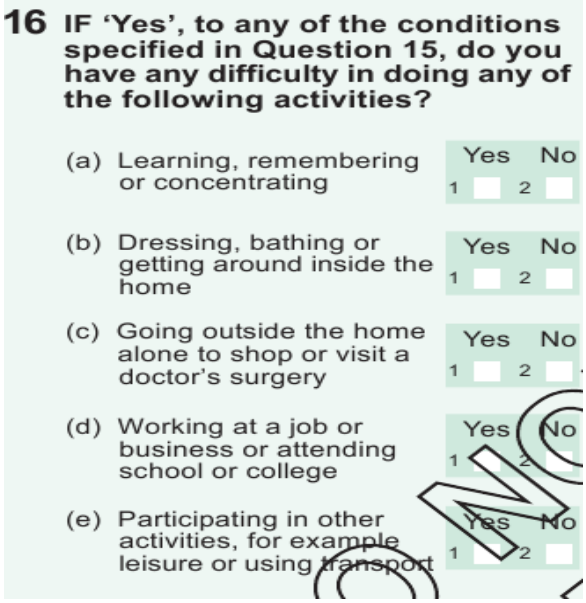

Figure 5: Question 16 from 2006 census form

Figure 6 shows the variation in 'disability' prevalence within LHOs for all ages and for those aged 65 years and over

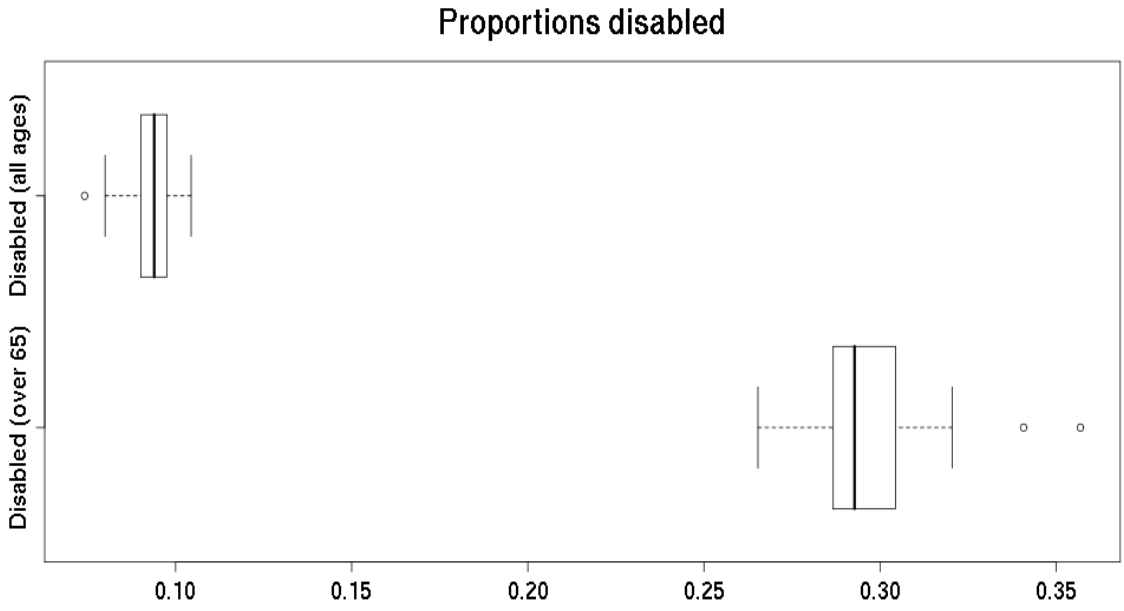

Figure 6: Box and whisker plot of the proportion of people responding 'yes' to a census disability question – all ages, and those aged over 65 years, by LHO

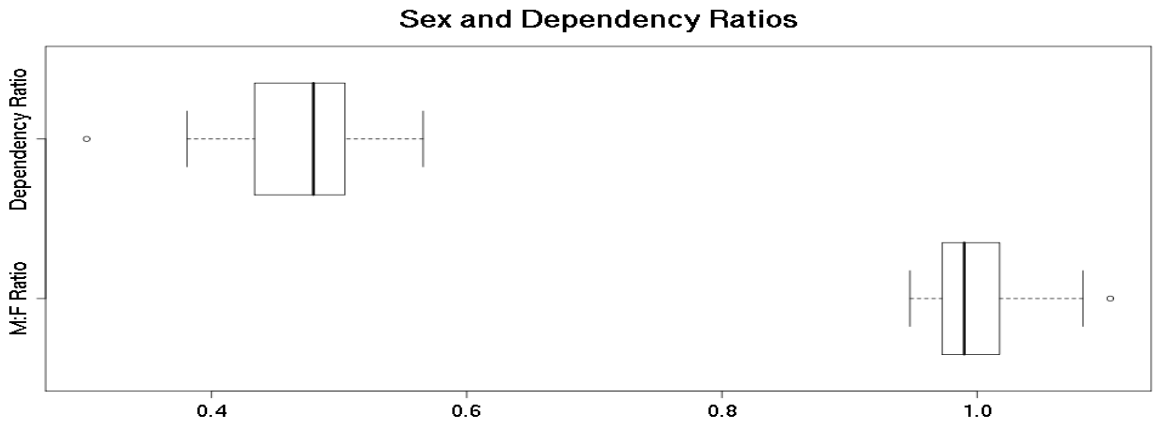

Figure 7: Box and whisker plot for the gender and dependency ratios at LHO level

Figure 7 shows the gender ratio and the dependency ratios for LHOs, and Figure 8 shows the age distributions. Again, there are large variations. These have implications for service demand and also for the mix of services required at LHO level.

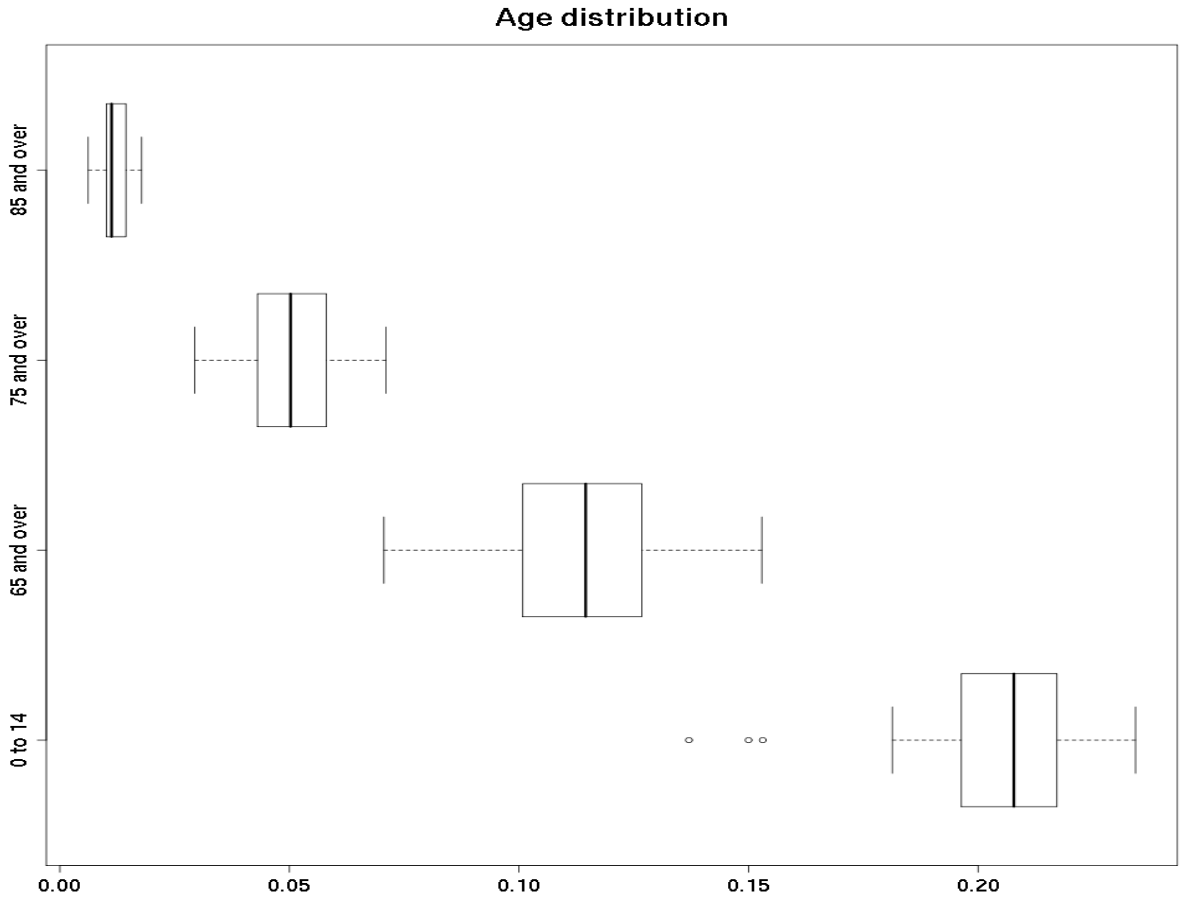

Figure 8: Box and whisker plots illustrating the proportion of people at different ages, 0-14 years, 65 years and over, 75 years and over, by LHO

6.3 Relationship between LHO measures

A preliminary principal components analysis suggests that there are a number of important relationships between LHO-level variables. Many of these are unsurprising – for example the various population variables are likely to be closely related at LHO level.

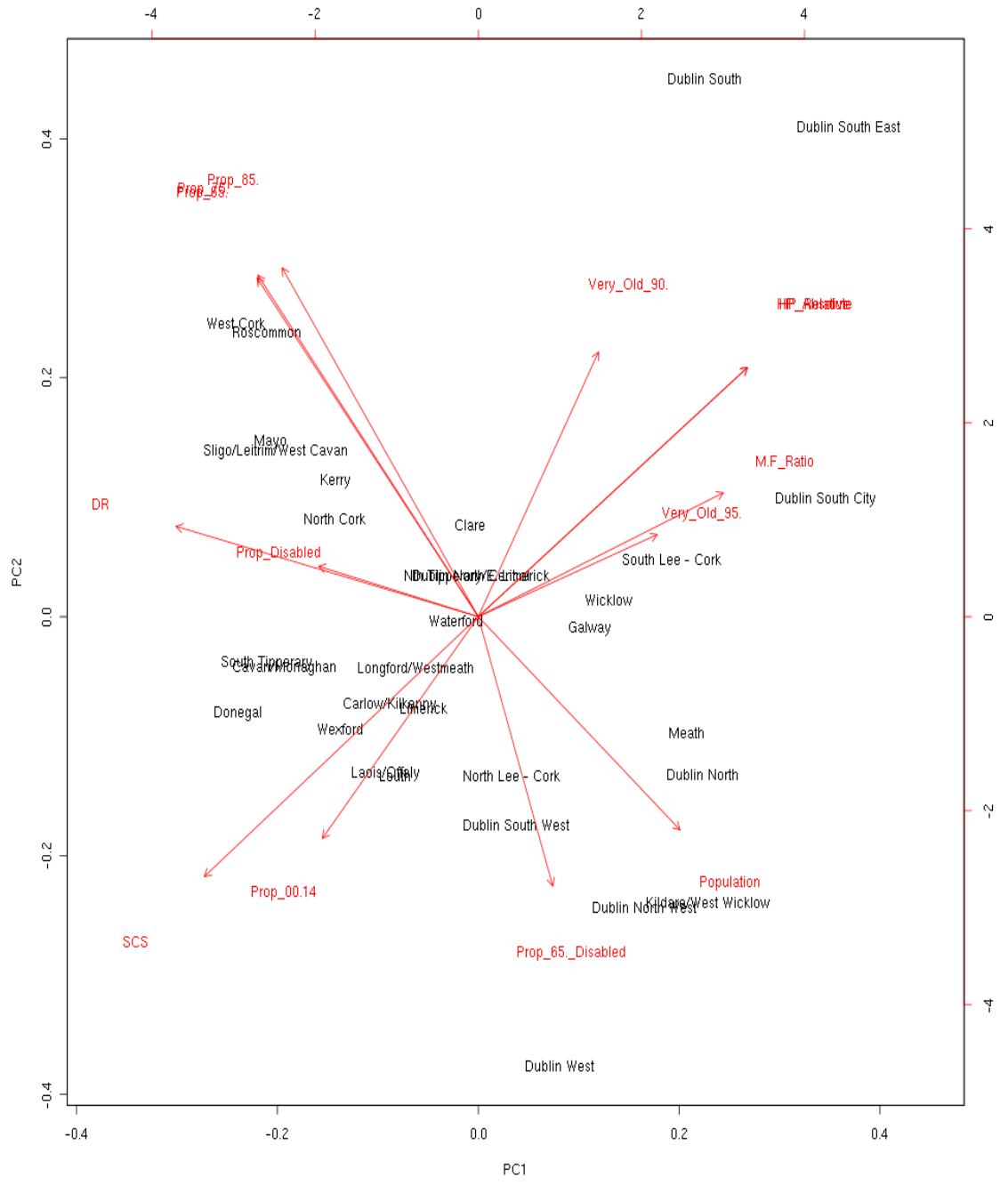

Figure 9: Biplot of LHO data – showing both the relationship between the LHOs (black) and the variables (red arrows)

A biplot represents two elements of a dataset on one graph and can be used as a graphical tool for displaying principal components analysis (PCA). PCA is a method for data reduction that provides a simpler summary of a dataset. PCA is useful because it lends itself to a simple graphical inspection

that shows, on the same plot, aspects of the relationship between the objects studied (in this case LHOs) and the variables recorded on these objects i.e. the set of census-derived variables used.

Figure 9 shows a biplot, indicating both the relationship between the LHO-level variables and the first two principal components, and the relationship between the LHOs themselves. Notable features are the dispersion of the LHOs with the Dublin area, which are very different from each other and from the rest of the LHOs; the close relationship between the dependency ratio and the proportion of the population who are disabled; the relationship between poverty and the proportion of the population under the age of 15 years.

6.4 Other measures of specific need

One of the disappointments of this study has been the failure to identify any other measures of specific need at LHO level. It is worth explaining why this has been a problem and what features a national data source should have in order to be useful at LHO level.

The challenges facing any potential measure of specific need are relatively daunting. For example, one obvious source of data for measuring disability is the extensive national survey of disability conducted by the HRB. As this is a study of people with disabilities in receipt of services, it covers the vast majority of Ireland's most severely disabled population. Unfortunately, there is very substantial geographical variation in coverage of this survey. For this reason, these data serve no useful purpose in the context of this study. This situation may change in the future, as the HRB moves to achieve more complete geographical coverage for the Disability Survey.

The SLÁN survey could be another potential source of information. However, two problems have been identified with this survey. First, the study was not designed to produce results at LHO level and, in fact, at the time of writing, none have as yet been published. The original sampling was carried out in order to produce a representative sample at regional level. The view of the study leaders was that the sample size was not sufficient to provide stable estimates at LHO level. Second, there are few questions in SLÁN relevant to this study. This is not intended as a criticism of this very important survey. It provides an excellent overview of health-related behaviours, and a number of medical conditions; however, it provides limited information on the coverage of health service utilisation.

A third possible source of information was the National Psychiatric In-patient Reporting System (NPIRS). This provides detailed data on psychiatric in-patient care, analogous to that provided by HIAP for in-patient care in acute general hospitals. Unfortunately, while the NPIRS system does collect the data required for this study, the HRB was unable to make it available in the form required to analyse LHO-level data.

As a general guide, any data source to be used for resource allocation at LHO level must be geographically complete. Any variation in completeness, data quality, or coverage between LHOs runs the risk of creating corresponding errors in allocations. Any such data source will need to reliably capture data, which has a direct bearing on either need itself or the costs of meeting needs.

6.5 Resource utilisation weights from Insight '07

The Insight '07 survey (Boilson *et al.*, 2007) was commissioned by the HSE to examine satisfaction with health service provision nationally. A total of 3,517 people were recruited to take part in this study. This study used data from Insight '07 as a primary source in order to estimate the relative utilisation of different services by different age groups. Insight '07 asked participants to answer the question: "In the last 12 months, how often have you used this service?"

The same question was posed in relation to a number of services, and answers were coded: "never", "once", and "more than once". To estimate relative utilisation, it was decided to weight these answers as follows (see Table 27 and Table 28).

Table 27: Weighting for responses to Insight '07 utilisation questions

Code	Weight
Never	0
Once	1
More than once	3

A weighting of 3 for "more than once" is an arbitrary choice. It is probable that the actual utilisation represented by the response 'more than once' differs substantially between services. There is, as yet, no national collection of utilisation data for the services that are of most interest here i.e. PCCC services. As a result, utilisation data must be estimated from such survey data. In addition, this study was unable to locate any comparable data for children aged 15 years and under.

Table 28: Table of variables used from the Insight '07 study, and the distribution of responses to each variable

Group	Variable	Meaning	Answer		
			0	1	3
Hospital	X46	Hospital as an in-patient	3,065	296	133
Hospital	X47	Hospital as a day patient	3,156	218	106
Hospital	X48	Hospital as an out-patient	2,916	279	292
Hospital	X49	A&E (Accident and Emergency)	3,069	290	103
GP	X50	GP (General Practitioner) services	1,186	637	1687
PCCC	X51	Mental Health Services[5]	3,429	12	44
PCCC	X52	Public health nurse	3,279	82	131
PCCC	X53	Physiotherapist	3,314	47	130
PCCC	X54	Occupational therapist	3,456	8	25
PCCC	X55	Psychology services	3,467	5	18
PCCC	X56	Social worker	3,449	18	24
PCCC	X57	Community Welfare Officer	3,411	43	38
PCCC	X58	Home Help Services	3,420	14	56
PCCC	X59	Chiropody/Podiatry	3,398	41	52
PCCC	X60	Drug/Alcohol Outreach Services	3,477	4	10
PCCC	X61	Speech therapy	3,478	4	8
PCCC	X62	Dietician	3,427	43	21
PCCC	X63	Ophthalmology	3,427	48	14
PCCC	X64	Audiology	3,465	17	9
PCCC	X65	Dental Services (public only)	3,230	178	82
PCCC	X66	Palliative care (care of the dying)	3,484	2	2
PCCC	X67	Residential services for older people	3,473	9	7
PCCC	X68	Day services for older people	3,442	7	40
PCCC	X69	Respite services for older people	3,468	9	11
PCCC	X70	Home support for older people	3,464	3	23
PCCC	X71	Residential services for the	3,485	3	2

5 Including non-acute Psychiatric hospitals.

Group	Variable	Meaning	Answer		
			0	1	3
		intellectually/physically/sensorily disabled			
PCCC	X72	Day services for the intellectually/physically or sensorily disabled	3,484	3	3
PCCC	X73	Respite services for the intellectually/physically or sensorily disabled	3,485	2	2
PCCC	X74	Home support for the intellectually/physically or sensorily disabled	3,476	3	8

These weightings are shown in Table 29. The utilisation curves differ in detail, but are qualitatively similar. As can be seen, each curve rises fairly steadily i.e. from the youngest age group to the second oldest but, in the case of the very oldest age groups, most curves fall.

Table 29: Relative utilisation of different major services by age (Source: Insight '07)

Age	Hospital in-patient	Hospital day case	Hospital out-patient	A&E	GP	Community services
15 – 19	0.08	0.02	0.09	0.14	1.02	0.26
20 - 24	0.13	0.05	0.19	0.17	1.19	0.18
25 - 29	0.12	0.04	0.19	0.15	1.25	0.31
30 - 34	0.2	0.08	0.25	0.15	1.46	0.34
35 - 39	0.17	0.11	0.24	0.21	1.49	0.4
40 - 44	0.08	0.1	0.29	0.17	1.39	0.3
45 - 50	0.15	0.14	0.27	0.19	1.6	0.3
51 - 54	0.13	0.11	0.21	0.13	1.56	0.3
55 - 59	0.27	0.2	0.44	0.17	1.8	0.41
60 - 64	0.21	0.23	0.5	0.15	1.93	0.39
65 - 69	0.32	0.29	0.43	0.15	2.12	0.43
70 - 74	0.4	0.29	0.66	0.2	2.37	0.64
75 - 79	0.5	0.5	0.84	0.3	2.36	0.94
80 - 84	0.49	0.53	0.89	0.24	2.58	0.84
85 +	0.3	0.65	0.74	0.09	2.39	1.3

6.5.1 General practice data

For general practice data (although not for other PCCC services), a number of additional sources of information were located. Because each study used different sets of data, had different objectives, and reported their results differently, it is not easy to summarise the results.

Table 30: Data on GP visitation rates by gender and age from Ireland (2001), with the ratio of visitation rates for each group, in addition to data on the male: female ratio for visitation rates, by age groups, and for all ages. (Source: Nolan and Nolan, 2007).

Ireland	Males		Females		M:F
	Rate	Ratio	Rate	Ratio	Ratio
16-24	1.4	0.54	3	0.75	0.47
25-34	2.1	0.81	3.4	0.85	0.62
35-44	1.7	0.65	3.3	0.83	0.52
45-54	2.5	0.96	4.1	1.03	0.61
55-64	3.5	1.35	4.1	1.03	0.85
65-74	5.1	1.96	6	1.5	0.85
75 and over	6.3	2.42	7.4	1.85	0.85
Total	2.6	1	4	1	0.65

Nolan and Nolan (2007) reported on GP utilisation derived from an analysis of the 1995-2001 Living in Ireland Surveys, 2001 Quarterly National Household Survey, and 2004 EU Statistics on Income and Living Conditions (Table 30). When these rates are compared with the rates in Insight '07 (Table 31), it suggests a substantial underestimation i.e. higher in the younger age groups than in the older age groups, and higher in women than in men.

Table 31: GP visiting rates, comparing Insight '07 with Nolan and Nolan (2007), by age and gender

Ireland	Males		Females		Ratio Insight: Nolan	
	Nolan	Insight	Nolan	Insight	M	F
16-24	1.4	0.9	3	1.42	0.65	0.47
25-34	2.1	1	3.4	1.77	0.48	0.52
35-44	1.7	1.15	3.3	1.66	0.67	0.5
45-54	2.5	1.4	4.1	1.79	0.56	0.44
55-64	3.5	1.9	4.1	1.94	0.54	0.47
65-74	5.1	2.19	6	2.31	0.43	0.39
75 and over	6.3	2.62	7.4	2.36	0.42	0.32
Total	2.6	1.41	4	1.81	0.54	0.45

The differences between the columns of Table 31 relate partly to the different questions posed to participants in the two studies. For example, Insight '07 enquired only whether the respondents had accessed a service 'not at all', 'once', or 'more than once in the last 12 months', while the Living in Ireland Survey (the source of the data in the Nolan and Nolan study) focused on the number of visits to a GP in the previous 12 months. It would be possible to ameliorate this discrepancy by recoding the Insight '07 variable, so that 'more than once' represents more than three visits. Setting the scores to 7 for women and 6 for men reproduced the totals in the Nolan and Nolan paper quite well (Table 32). However, this remains an arbitrary choice, and there is no evidence that it is correct. Neither is there any evidence that would permit the transfer of these estimates to the PCCC utilisation rates.

Table 32: GP visiting rates, comparing Insight '07 with Nolan and Nolan (2007), using the alternative scoring of the response 'more than once' as 7 for women and 6 for men, by age and by gender

Ireland	Males		Females		Ratio Insight: Nolan	
	Nolan	Insight	Nolan	Insight	M	F
16-24	1.4	1.59	3	3.06	1.14	1.02
25-34	2.1	1.79	3.4	3.92	0.85	1.15
35-44	1.7	2.06	3.3	3.59	1.21	1.09
45-54	2.5	2.56	4.1	3.94	1.03	0.96
55-64	3.5	3.63	4.1	4.34	1.04	1.06
65-74	5.1	4.23	6	5.23	0.83	0.87
75 and over	6.3	5.17	7.4	5.44	0.82	0.74
Total	2.6	2.63	4	4.01	1.01	1

GP utilisation data from other countries is also informative. The HURA group (HURA, 2006) used data specifically collected for their study by a network of general practices in New Zealand. The main aim of the HURA group's study was to analyse GP utilisation by ethnic group (Table 33).

Table 33: Data on GP visitation rates by gender and age from New Zealand (2001), with the ratio of visitation rates for each group and both genders to the total (Source: HURA, 2006)

Age	Rate	Ratio
0–1 years	6.6	1.78
2–6	4	1.08
7–14	2	0.54
15–24	2.5	0.68
25–44	3.1	0.84
45–64	4.4	1.19
65 and over	7.2	1.95
Gender	**Rate**	**Ratio**
Male	2.9	0.78
Female	4.4	1.19
Total	3.7	1

In the UK, Saxena *et al.* (1999) and McNeice and Majeed (1999) produced papers that were a combined analysis of the fourth UK national survey of morbidity in general practice; the survey was carried out between September 1991 and September 1992 (Table 34). While the information contained in these papers is now out of date, it provides some indication of possible patterns of service utilisation.

Table 34: Data on GP visitation rates by gender and age from the UK (1996), with the ratio of visitation rates for each age group and both genders relative to the total, as well as modelled relative risks by ages and gender, adjusted for social class (Sources: Saxena *et al.*, 1999 (children); McNeice and Majeed, 1999 (older people))

Age group	Rate	Ratio	Relative risk
0–4 years	6.11	1.65	1
5–9	2.52	0.68	0.41
10–4	2.21	0.6	0.36
Gender	**Rate**	**Ratio**	
Boys	3.67	0.99	1
Girls	3.73	1.01	1.02
Total	3.7	1	-
Age group	**Rate**	**Ratio**	**Relative risk**
65–74	4.32	0.93	1
75–84	5.04	1.09	1.17
85 and over	5.09	1.1	1.21
Total	4.64	1	-
Gender			**Relative risk**
Male	-	-	1
Female	-	-	1.07

Another Irish analysis of GP visits by children is provided by Fallon *et al*. (2007) who examined service utilisation data from the Lifeways study cohort for children aged 0 to 3 years. They found consultation rates of 5.4 per year in boys and 5.6 per year in girls. A follow-up study of these children in 2009 found consultation rates of 2.4 per year in boys and 2.6 per year in girls aged 4 to 6 years (Murrin C, personal communication).

Taken overall, these data suggest that GP visits may be under-reported in Insight '07, relative to the rates reported in the literature, especially for older people (Table 35). This under-reporting is probably due to the compression of higher visiting rates imposed by the question asked and the coding methods used in Insight '07.

Table 35: Reported GP visits rates for older people in four studies (Sources: Insight '07; Nolan and Nolan, 2008; HURA, 2006; McNeice and Majeed, 1999)

Insight '07		Ireland			New Zealand		UK Study	
Age	GP visits rates	Age	Gender M	Gender F	Age	GP visits rates	Age	GP visits rates
60 – 64	1.93	65-74	5.1	6	65 and over	7.2	65-74	4.32
65 - 69	2.12						75-84	5.04
70 - 74	2.37						85 and over	5.09
75 - 79	2.36	75 and over	6.3	7.4				
80 - 84	2.58							
85 and over	2.39							

A similar analysis of the data for children and younger adults (Table 36) suggests that reasonable estimates of the visitation rates for younger children would be about six for the under fives, falling to three visits for older children.

Table 36: Reported GP visits rates for children and younger adults in four studies (Sources: Saxena, 1999; HURA, 2006; Nolan and Nolan, 2007; Fallon *et al.*, 2007; Insight '07)

UK			NZ		Ireland			Insight '07	
Age group	Rate	Relative risk	Age	Rate	Age	Males	Females	Age	Rate
0 – 4	6.11	1	0–1	6.6	0 to 3	5.4	5.6		
5 – 9	2.52	0.41	2–6	4	4 to 6	2.4	2.6		
10 -14	2.21	0.36	7–14	2					
			15–24	2.5	16-24	1.4	3	15-19	1.02
								20-24	1.19

6.5.2 Modelling Insight '07

A slightly different approach to using the Insight data is to directly model them. This offers a major advantage over the direct calculations summarised in Table 29, in that it allows the variability in the estimated utilisation to be seen. A reasonable model for this type of data is a general additive model, which permits the use of a smooth curve in order to estimate the relationship between age and utilisation. Fitting the data to such a model gives the results shown in the panel below, and again in Figure 10.

In the case of the Insight '07 survey of general practice data, seven people declined to answer; 1,186 people had not visited a general practitioner in the previous 12 months; 637 people had used the service once, and 1,687 people had used it more than once. The main interest for this study is in the relationships between utilisation and gender and age.

```
Family: gaussian
Link function: identity

Formula:
GP ~ Gender + s(Exact.Age, by = Gender)

Parametric coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.81331    0.03044  59.566   <2e-16 ***
GenderM        -0.39378    0.04379  -8.993   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                     edf Ref.df     F p-value
s(Exact.Age):GenderF 4.883  5.383 16.54  <2e-16 ***
s(Exact.Age):GenderM 2.581  3.081 75.76  <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.103   Deviance explained = 10.5%
GCV score = 1.6837   Scale est. = 1.6791    n = 3510
```

Essentially, the data in the above panel shows that a model for GP utilisation – with a term for gender and a smooth term for age fitted separately for males and females – fits the data reasonably well, and shows that all of the terms included are highly significant statistically.

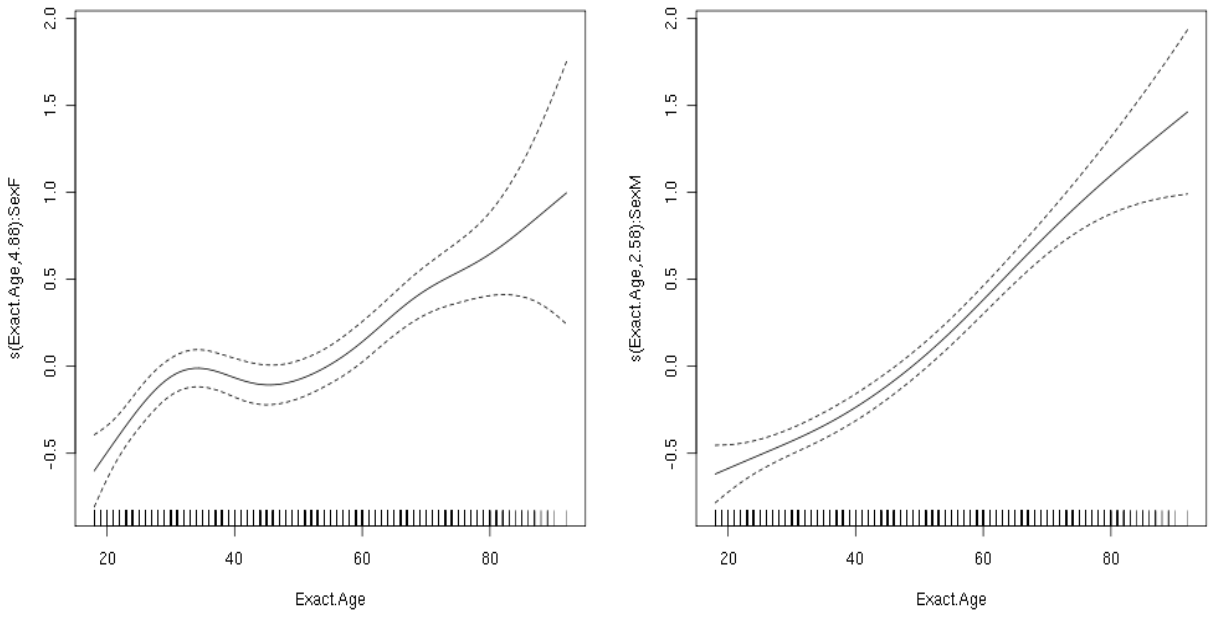

Figure 10: Modelled relative utilisation of general practitioner services by males and females, by age (Source: Insight '07)

Figure 10 shows the estimated relative utilisation of general practitioner services by males and females by age, with 95% confidence intervals for the utilisation. The pattern is distinctly different for

males and females. For males, relative utilisation increases almost linearly with age. Females have a bimodal age-utilisation curve, with one peak at about 30 years of age (probably corresponding with child-bearing), and then a linear increase from the age of 50 years approximately. Female utilisation rates are notably higher than those for males below the age of 50 years.

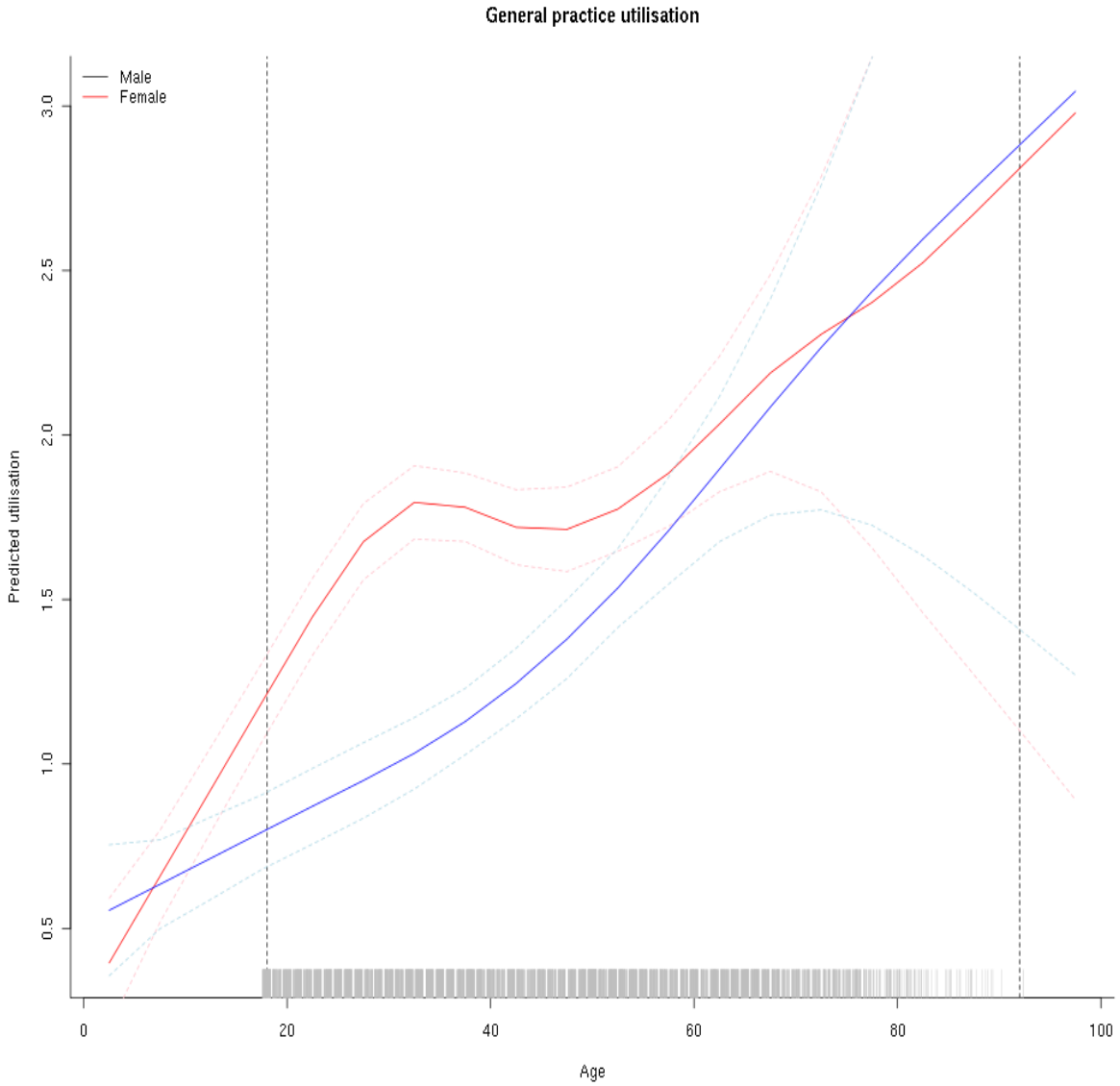

Figure 11: Predicted GP utilisation from the Generalized Additive Model (GAM) by gender and age

A more useful way to present the same data would be to first generate predicted values from the model, and plot these values for males and females on the same axes. The statistical modelling allows us to estimate 95% confidence intervals for the estimated utilisation; these are plotted above and below the estimated utilisation curves in a lighter colour. A rug-plot was also added on the x-axis, placing a light vertical stroke at every x-value for which there is data. The light grey vertical lines indicate the limit of the Insight '07 data. Figure 11 shows the results of this analysis while Figure 12a repeats these data and compares them with similar data for PCCC services (12b) and hospital services (12c).

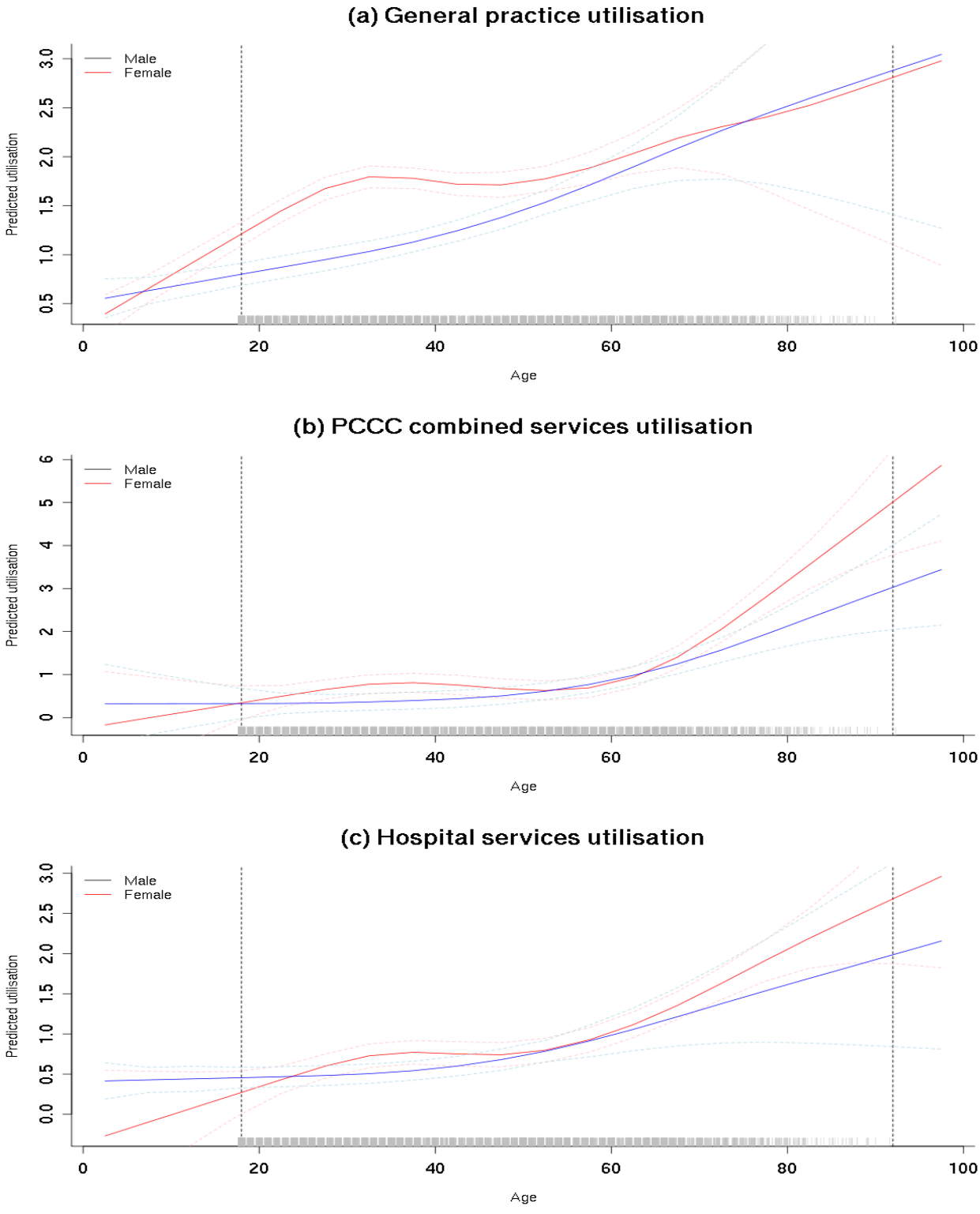

Figure 12: **Estimated utilisation (and 95% confidence intervals) for (a) general practice services, (b) combined PCCC services, and (c) combined hospital services, by age and gender. (The light grey dotted vertical lines on each graph indicate the limits of the data; each grey tick on the x axis represents one respondent) (Source: Insight '07).**

6.6 Other PCCC-funded services

The PCCC provides a wide range of services. Many of these services were used by rather small numbers of people in the Insight '07 study.

After some consideration, a single resource utilisation indicator for PCCC services was used, derived by simply adding the utilisations of individual services. The resulting variable is very skew, with a mode of 0 and a range from 0 to 47 (Table 37).

Table 37: PCCC utilisation data from the Insight '07 survey

Utilisation	0	1	2	3	4	5	6	7	8	9	10 and over
Number	2,734	262	238	61	74	22	27	7	6	5	30

An analysis of the relationship of the PCCC utilization to age and sex proceeds along the same lines as that for GP services (Figure 12b). The results are qualitatively similar. There is a female excess at most ages, although this excess is less than for the GP services. Male utilisation is quite flat up to age 60, and rises steadily thereafter. Female utilisation is equal to male utilisation at about age 20, and also at age 50, but exceeds male rates from the mid-twenties to the mid-forties. Female utilisation rates rise faster than rates for males from the age of 50 onwards. PCCC utilisation by older people is notably higher than GP utilisation by older people.

Unlike the situation that pertained with general practice (where there is substantial literature on GP utilisation), little has been published on the utilisation of other community services, and this study was unable to source references for any previous work on this topic in Ireland.

6.6.1 Hospital services

While Insight '07 did provide data on hospital services utilisation, it is evident that the HIPE system is a much better source of information. An analysis of the Insight '07 data is of interest for the purpose of identifying some of the limitations of these data; this analysis was carried out as described for GP utilisation and PCCC utilisation above. The results are shown in Figure 12c.

6.6.2 HIPE data

A similar analysis can be undertaken for HIPE data. For this data, what is modelled is already provided as a table of utilisation rates by age and gender, expressed either as discharge rates or as acute hospital bed days used. A weighted analysis is carried out using the census populations as weights. From one perspective, this is an uninformative model, as the result is simply the table generated by HIPE. However, for comparison purposes, it is useful to present the HIPE data in the same form as the Insight '07 data (Figure 13).

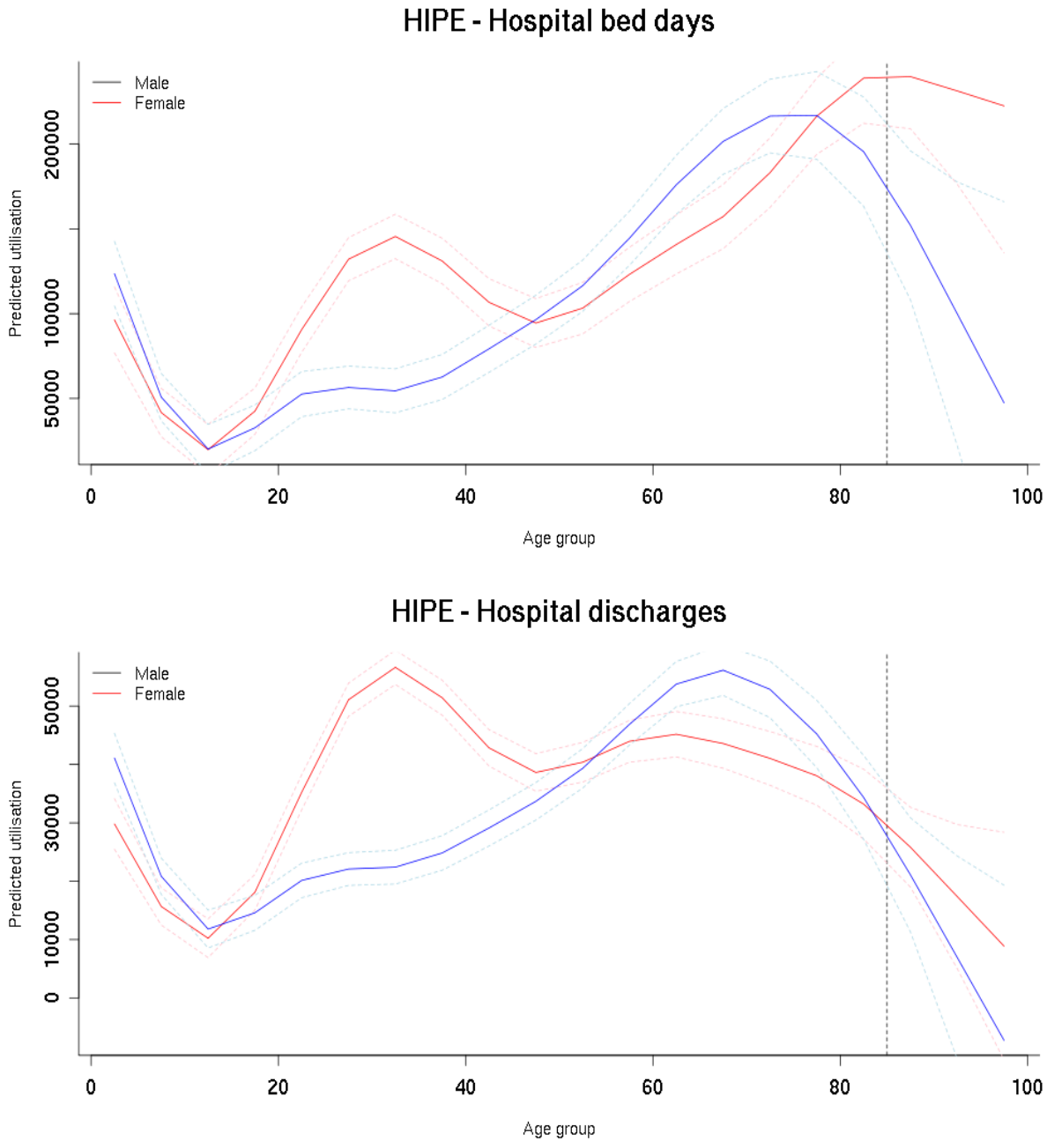

Figure 13: HIPE utilisation data (2006) by age and gender, for bed days used, and for hospital discharges. (The dashed vertical line shows the upper limit of recorded (grouped) ages in HIPE; Source: HIPE).

As is evident in Figure 13, there are striking differences between these graphs. The most obvious difference is that hospital utilisation, as measured by HIPE, is substantially higher in early childhood than it is in late adolescence. Another feature of the graphs is that there are substantial differences between the utilisation curves based on discharges and those based on bed days occupied. It is far from obvious which of these is the better option for a resource allocation model. There are also significant differences between HIPE data and Insight '07 data. In particular, the female excess in the child-bearing years is much bigger in the HIPE data, and there is a definite decline in utilisation in the oldest age groups in HIPE.

6.6.3 Adjusting the estimated utilisation rates

As discussed earlier in this report, the Insight '07 data do not cover those aged under 18 years. As a result, the models based on the Insight '07 data incorrectly extrapolate the trend of the data relating to young adults and back to early childhood. This study used the GP utilisation data from the studies described above to remedy this deficiency.

Specifically, it is assumed that the actual utilisation of GP services by children and young adolescents is equal to utilisation by this age group in the four GP utilisation studies; it is also assumed that the ratio of utilisation rates for PCCC services in the youngest age groups compared with utilisation rates in the young adult age groups is the same as the equivalent utilisation rates by group for GP services. For older people, it is likely that Insight '07 underestimates this group's use of GP services. Rates of 5 to 7 seem more credible than the rates of 1.9 to 2.4 reported by the Insight '07 data. The same procedure is used in this study for deriving estimates of utilisation from studies other than Insight '07, and it is assumed that the relationship between age and utilisation is the same for PCCC services as it is for GP utilisation.

In this study, the smallest observed utilisation rates were used as estimates, which are referred to as the 'minimum' estimates because this fits better with the Insight '07 data, and the transition from the Insight '07 data to the data from other sources has been smoothed. However, it may be that the Insight '07 data significantly under-represents the actual utilisation at a wider range of ages. In any event, this under-representation should be uniform between LHOs. The effect is to give relatively smaller weights to very elderly and very young people (Figure 14).

The process described above is both crude and simplistic, and involves a number of value judgements including whether to use the smallest of the observed age and gender-specific utilisation rates and whether to ease the transition from the 55-59 years age group to the 60-64 years age group. All of these decisions are, to an extent, arbitrary. However, some choices must be made, and given the very limited existing data, these choices are not unreasonable. The effect is to moderate the impact of small changes in the number of very elderly people and very young people on the overall budget for any particular LHO.

To explore the impact of some of these choices three other sets of weightings have been prepared. The first two (the 'median' and the 'maximum' estimates), are derived exactly as the 'minimum' estimate, but using, respectively, the median value and the largest observed utilisation value.

The final 'Irish estimate' (Irish GP and Irish PCCC) is derived by combining the Nolan and Nolan (2007) data for adults, the Lifeways data (Fallon *et al.*, 2007) for young children, and the UK data (Saxena *et al.*, 1999) for older children. It assumes that the observed relationship between PCCC and GP utilisation rates in Insight '07 for those age groups, where there is substantial data, is correct. For those age groups (under 20 years and over 80 years) for which there is no data, it is assumed that the ratio observed at 15 to 19 years applies at all younger age groups, and that at 75 to 79 years applies to all older age groups.

The four estimates described above for GP utilisation and PCCC service utilisation respectively are shown in Figure 15 and Figure 16. The full set of weights is provided in Table 38. While the 'Irish', the 'minimum' and the 'median' models look credible, the 'maximum' model predicts a large increase in estimated utilisation for males and females in their late teens and early twenties, does not seem credible. Accordingly, these sets of weights were not used in any further work in this study.

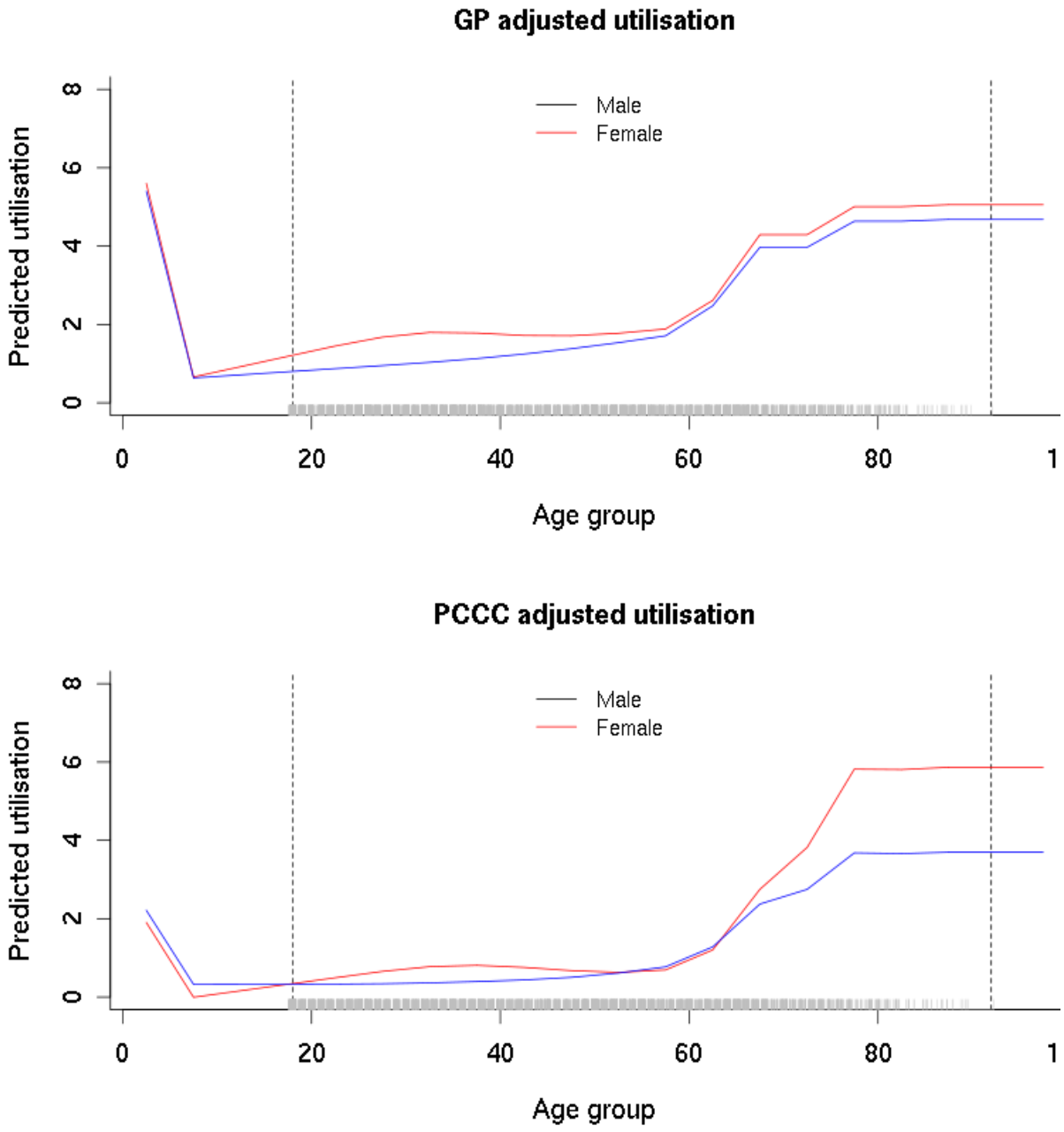

Figure 14: Adjusted utilisation for GP services and PCCC services

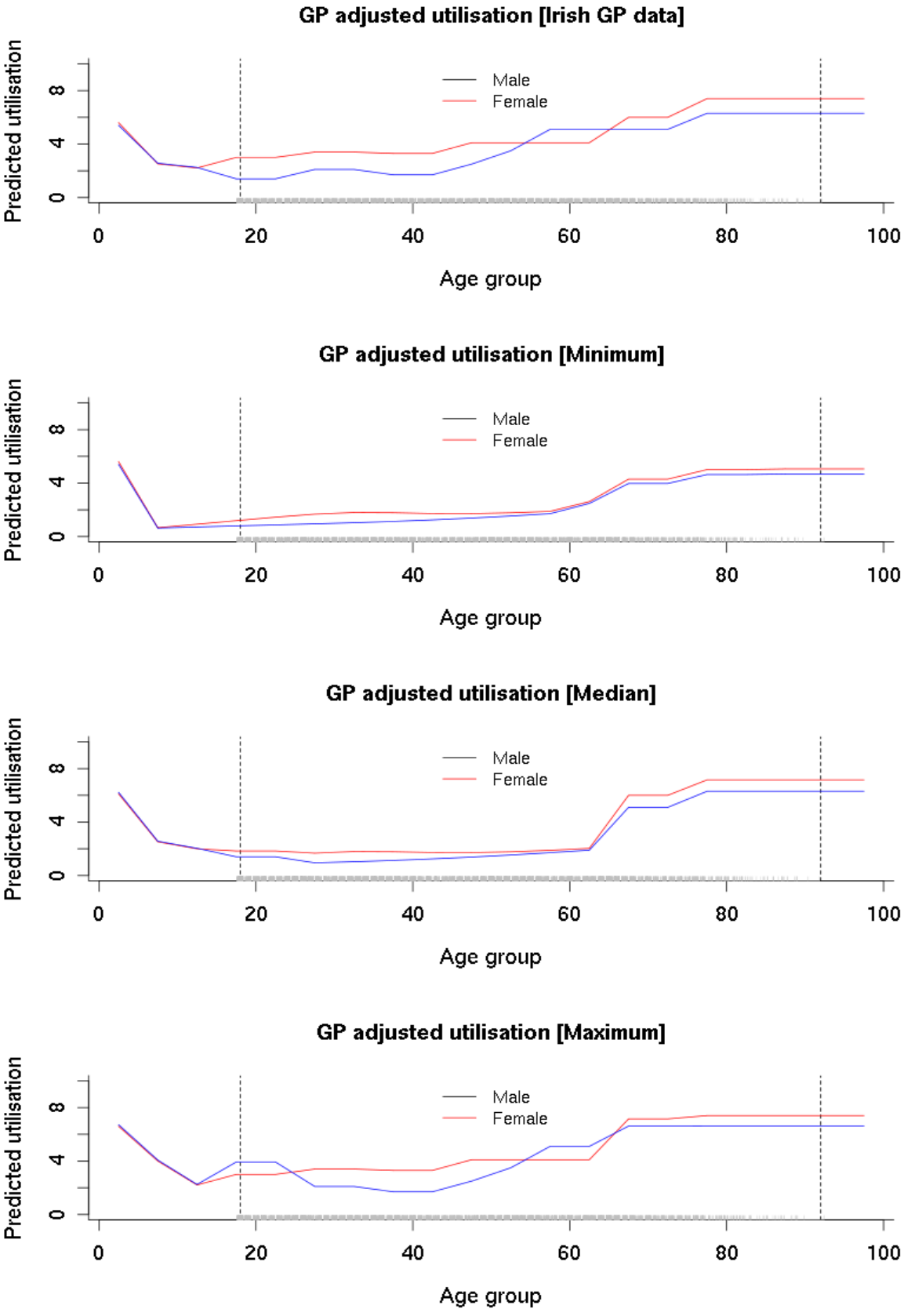

Figure 15: Four proposed adjusted utilisation estimates by age and gender for GP services

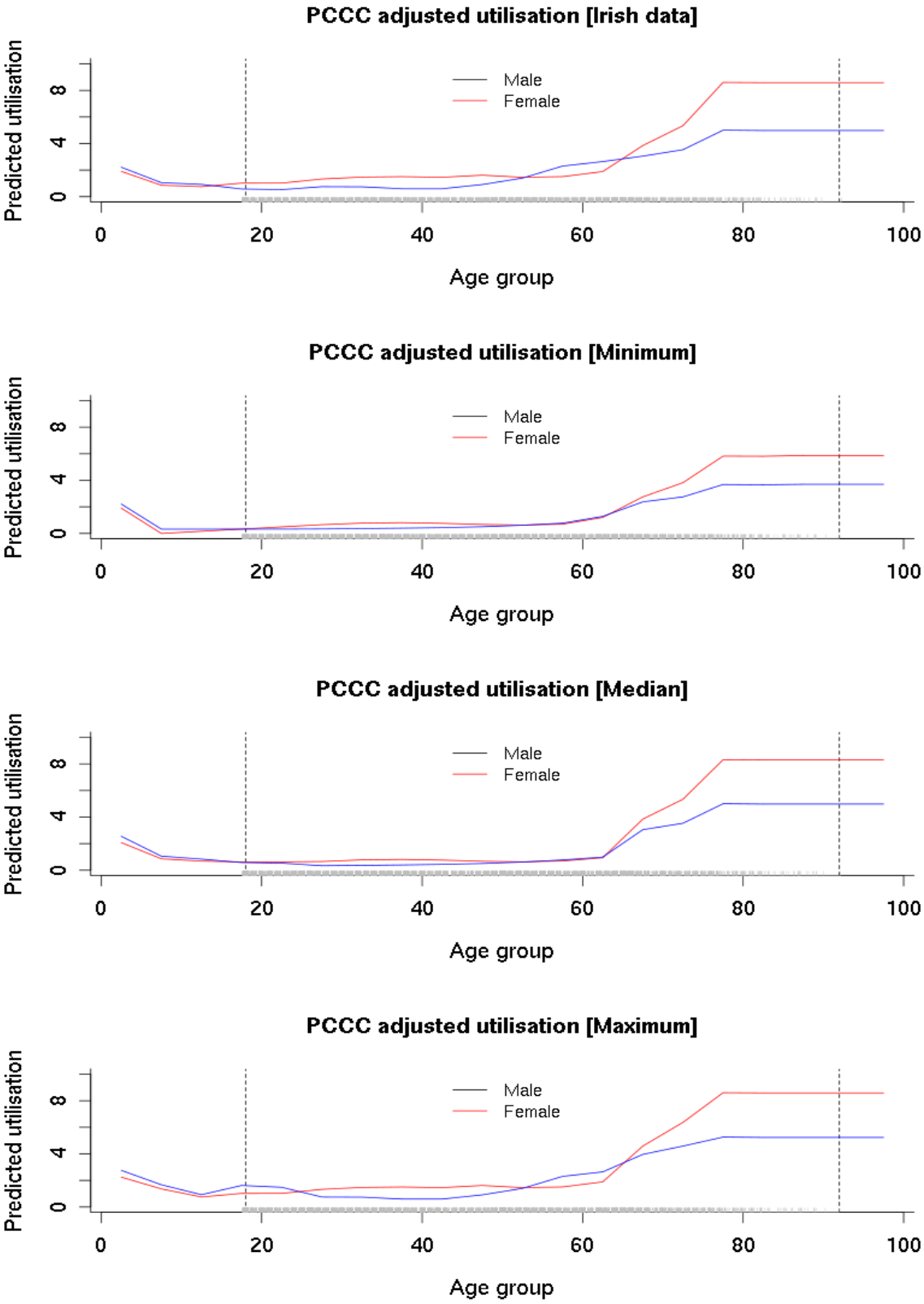

Figure 16: Four proposed adjusted utilisation estimates by age and gender for PCCC services

6.7 Utilisation as a proxy for need

The original intention of this study was to model resource allocation for all programmes in the HSE, placing a particular emphasis on acute hospitals, an area for which there is a great deal of detailed information available. However, in parallel with the work of this study the HSE established another group to work specifically on hospital resource allocation. As a result the work of this study was focused instead on PCCC allocation.

Despite making significant efforts, it was not possible to obtain data that would provide a reasonable and testable basis for the assessment of need in the Irish population. Section 6.4 of this report outlined some of the difficulties associated with deriving measures of need from existing survey data. The authors believe, however, that a case can be made for using national estimates of utilisation by age and gender as the first stage of a resource allocation model. The assumption here is that at LHO level the many differences in need between individuals will average out sufficiently, and that age and gender alone provide a reasonable estimate of need.

It is not being argued in this study that utilisation is a good proxy for need; merely that it is good enough in the initial stages of a model. A supplementary question is which of the eight age-gender utilisation curves developed by this study should be used for allocation. It is possible that the choice of curves will make a significant difference to the outcome for individual LHOs. The only curve that can be excluded from further consideration is the one based on the maximum observed utilisation recorded in the various research studies reviewed here. The large spike in utilisation in the teens and twenties age group implied by these weights is unlikely to reflect the actual situation.

Two additional issues must also be considered: poverty and spatial isolation – factors that are known to significantly affect health needs and the cost of delivering healthcare.

6.8 Poverty

There are very substantial variations in socio-economic status within Ireland, and these have a major effect on mortality, on birth weight, and on perceived health status in the population (Farrell *et al.*, 2008; Institute of Public Health, 2006; Balanda and Wilde, 2001; 2004). Most resource allocation systems use some process to allocate additional resources to people or to areas of lower socio-economic status, and, in some instances, to institutions serving people and those areas. For example, the Northern Ireland system models utilisation as a function of area-level deprivation, and uses the results to allocate additional resources to deprived areas.

By analysing Irish census data, a strong relationship can be seen between area-level socio-economic status and long-term illness or disability (Figure 17). In this analysis a generalised additive model has been fitted, in order to demonstrate the relationship between the ED-level data on long-term illness (derived from questions 15 and 16 in the 2006 Census), and a deprivation score i.e. the Haase and Pratschke relative deprivation score. This model fits well, with a $\chi 2$ of 7,043 on 8.5 effective degrees of freedom for a p-value that is less than 2 by 10-16.

A similar model fitted to LHO-level data is illustrated in Figure 18. Here, the model is a generalised linear one rather than a generalised additive one, but the interpretation is identical, indicating a strong relationship between social status, and long-term illness/disability. This model also fits well, with a $\chi 2$ of 437.5 on 1 d.f., for a p-value that is less than 2 by 10-16.

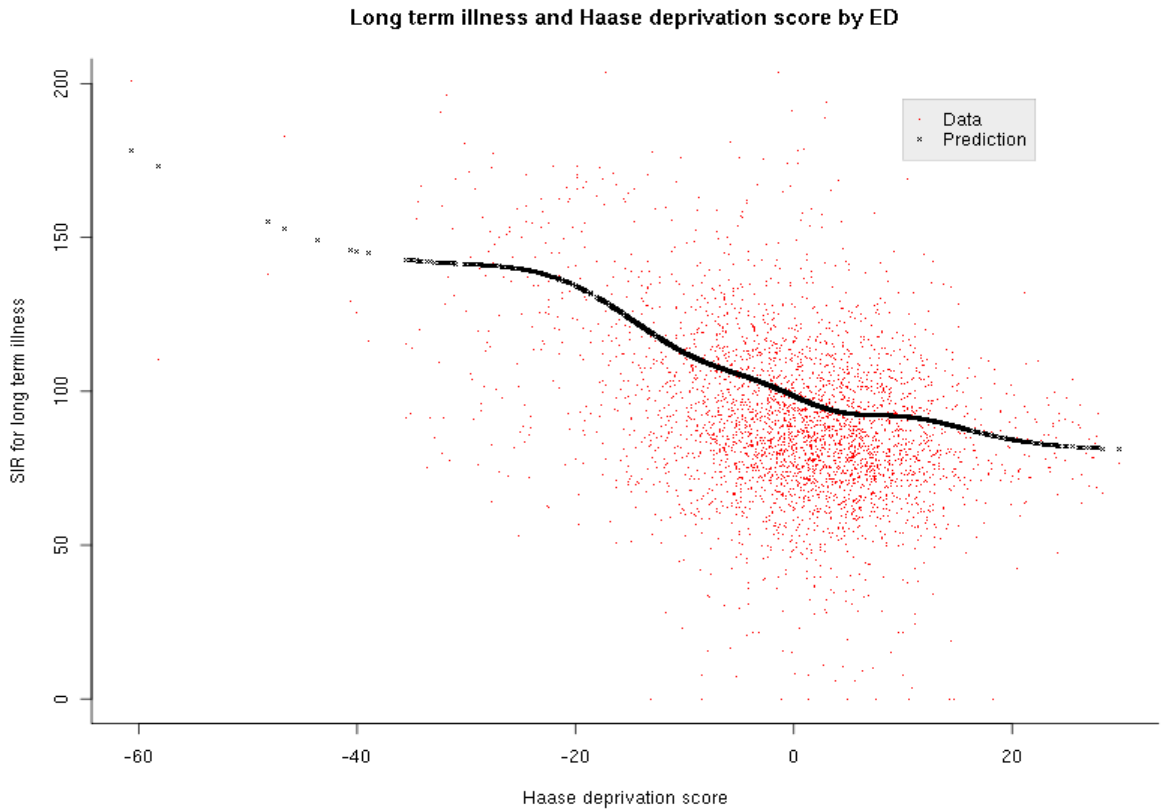

Figure 17: **Observed (.) and predicted (*) standardised incidence ratio for long-term illness plotted against the Haase and Pratschke deprivation score by ED (Source: Census 2006, Health Atlas Ireland; 54 data points with Standardized Incidence Ratios (SIRs) from 200 to 2000 omitted from the graph for clarity)**

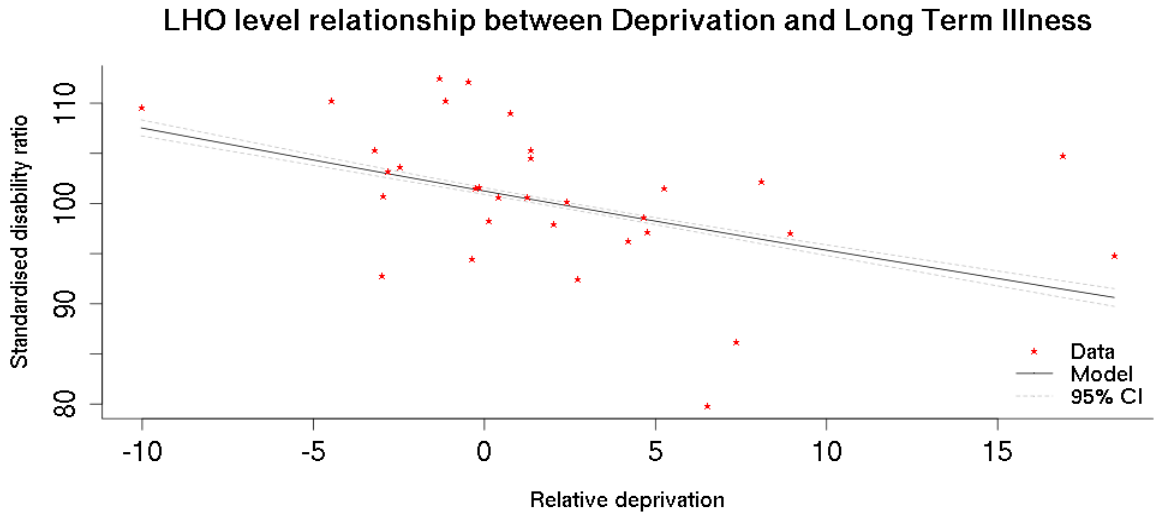

Figure 18: **Observed (.) and predicted standardised incidence ratio for long-term illness plotted against the Haase and Pratschke deprivation score by LHO (Source; Census 2006, Health Atlas Ireland)**

Unfortunately, there is little data available on health services utilisation in Ireland by socio-economic status. While there have been a number of recent studies on GP utilisation in Ireland, these have mainly focused on the impact of payment of GP services on utilisation. The most comprehensive study was that carried out by Nolan and Nolan (2007). The data from this study, as well as some comparable international data, are summarised in Table 38. Each study has used its own measure of social status: family income for the Irish study, the small area deprivation score linked to the home addresses of patients in the New Zealand study, and household-based occupational social class for the two UK studies. These have been ordered by social status to facilitate comparisons between the studies.

The process of interpreting these data is not straightforward. The modelling studies described in the various publications from which the data are sourced show that the relationship between measures of social status and utilisation is very complex. For example, the UK data for older people (McNeice and Majeed, 1999) show a strong relationship between utilisation and social status for those aged 65 to 74 years, hardly any relationship for those aged 75 to 85 years, and an inverse (albeit weak) relationship for those aged over 85 years.

Table 38: GP utilisation, by measure of social status. For each section, the first column is the measure of social status used; the second column is the GP visit rate per year, and the third column is the relative utilisation i.e. the ratio of the rate for each group relative to that for the entire study. The results are ordered by social status, from low to high, in order to facilitate comparison (Sources: Ireland – Nolan and Nolan, 2007; New Zealand – HURA, 2006; UK (Children) – Saxena, 1999; UK (older people) – McNeice and Majeed, 1999).

Ireland			New Zealand			UK Children			UK Older People		
Income decile	Rate	Ratio	Deprivation score	Rate	Ratio	Social class	Rate	Ratio	Social class	Rate	Ratio
1	5.6	1.7	10	4.1	1.11	IV-V	4.18	1.13	V	5.02	1.08
2	5.8	1.76	9	4.2	1.14	Other	4.15	1.12	Other	4.96	1.07
3	3.7	1.12	8	4.1	1.11	-	-	-	IV	5.05	1.09
4	3.2	0.97	7	4	1.08	IIIM	3.95	1.07	IIIM	4.96	1.07
5	3.1	0.94	6	3.8	1.03	-	-	-	-	-	-
6	2.6	0.79	5	3.9	1.05	-	-	-	-	-	
7	2	0.61	4	3.8	1.03	IIIN	3.95	1.07	IIIN	4.87	1.05
8	2.7	0.82	3	3.6	0.97	-	-	-	II	4.96	1.07
9	2.2	0.67	2	3.5	0.95	-	-	-	-	-	-
10	2.3	0.7	1	3.4	0.92	I-II	3.54	0.96	I	4.41	0.95
-	-	-	-	-	-	Unknown	2.43	0.66	Unknown	2.63	0.57
Total	3.3	1	Total	3.7	1	Total	3.7	1	Total	4.64	1

It is also not obvious how to relate the income deciles to the area-level deprivation scores. A simple but crude way to do this is to split the area deprivation score into deciles, using the LHO data, and then applying these deciles to the utilisation data for Ireland and New Zealand in Table 38. These deciles can then be used to identify the corresponding relative utilisation. This gives the results shown in Table 39.

Table 39: Relationship between the LHO-level Haase and Pratschke relative deprivation score and the relative GP utilisation ratio estimated from Irish and New Zealand data

LHO name	Haase and Pratschke relative deprivation score	Deciles of Haase and Pratschke relative deprivation score	Predicted GP utilisation			
			Ireland (rough)	Ireland (smooth)	New Zealand (rough)	New Zealand (smooth)
Carlow/Kilkenny	1.24	6	2.6	2.83	3.9	3.88
Cavan/Monaghan	-3.01	1	5.6	5.1	4.1	4.13
Clare	4.2	7	2	2.25	3.8	3.68
Donegal	-10.03	1	5.6	6.15	4.1	4.15
Dublin North	4.76	8	2.7	2.23	3.6	3.64
Dublin North Central	-1.3	3	3.7	4.14	4.1	4.05
Dublin North West	0.13	5	3.1	3.33	3.8	3.96
Dublin South	16.92	10	2.3	2.29	3.4	3.38
Dublin South City	8.09	9	2.2	2.2	3.5	3.47
Dublin South East	18.41	10	2.3	2.31	3.4	3.39
Dublin South West	-4.48	1	5.6	5.65	4.1	4.16
Dublin West	-2.83	2	5.8	5.01	4.2	4.12
Galway	2.73	7	2	2.41	3.8	3.78
Kerry	-0.25	4	3.2	3.54	4	3.98
Kildare/West Wicklow	7.36	9	2.2	2.2	3.5	3.5
Laois/Offaly	-0.38	4	3.2	3.61	4	3.99
Limerick	-1.13	3	3.7	4.04	4.1	4.04
Longford/Westmeath	-0.16	4	3.2	3.49	4	3.98
Louth	-2.94	2	5.8	5.06	4.2	4.13
Mayo	-3.22	1	5.6	5.19	4.1	4.13
Meath	6.51	9	2.2	2.2	3.5	3.54
North Cork	2.02	7	2	2.58	3.8	3.82
North Lee – Cork	1.35	6	2.6	2.79	3.9	3.87
Nth Tipperary/East Limerick	4.67	8	2.7	2.23	3.6	3.65
Roscommon	1.36	6	2.6	2.79	3.9	3.87
Sligo/Leitrim/West Cavan	0.77	5	3.1	3.03	3.8	3.91
South Lee – Cork	8.92	10	2.3	2.2	3.4	3.45
South Tipperary	-0.47	3	3.7	3.66	4.1	4
Waterford	0.4	5	3.1	3.2	3.8	3.94
West Cork	2.4	7	2	2.48	3.8	3.84
Wexford	-2.47	2	5.8	4.82	4.2	4.11
Wicklow	5.26	8	2.7	2.21	3.6	3.61

The pattern of relative utilisation ratios is not smooth. In fact, it is well-established that the actual relationship between deprivation and health is monotonic. Therefore, a reasonable alteration designed to improve the credibility of the estimates would be to impose such a constraint. The last column in Table 39 shows the smoothed estimates of GP utilisation ratios based on the Irish data. Figure 19 shows the predicted utilisation as well as the smoothed predictions.

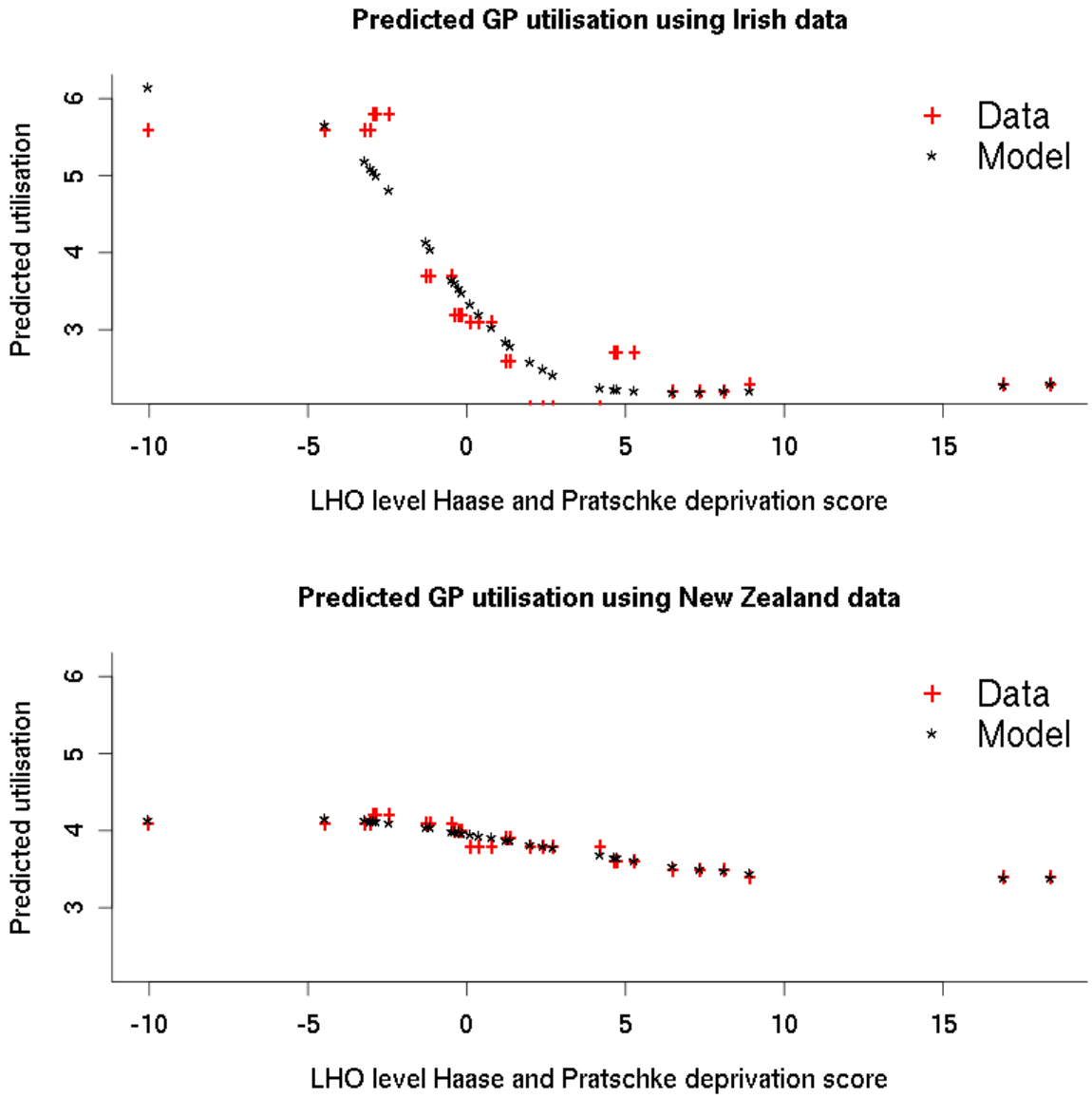

Figure 19: Predicted GP utilisation ratios by the Haase and Pratschke deprivation score at LHO level, showing both the predictions and the smoothed predictions, based respectively on Irish data and on New Zealand data

The Irish data (based on individual-level deprivation) predicts a very wide range of GP utilisations. The New Zealand data (based on an area-level deprivation score) produces results that seem more credible. It was not possible to find any Irish data on spatial variation in primary care utilisation against which these results could be compared and contrasted and, in the absence of such data, it is suggested that the New Zealand-derived estimates should be used. (It is noted that there is great variation in general practice supply in Ireland (Johnson H, personal communication), and that poorer patients without medical cards are deterred from GP utilisation (O'Reilly *et al.*, 2007). However, neither of these studies focuses on utilisation as such).

6.9 Full set of weights for GP and PCCC utilisation

For ease of reference, the estimated weights used are set out below:

Table 40: Weights by gender and age for GP services and PCCC services; GP utilisation, and the GP: PCCC utilisation ratio used in the model development

Gender	Age	Irish		Minimum		Median		Maximum		Corrected GP/PCCC Ratio	GP utilisation data		
		GP	PCCC	GP	PCCC	GP	PCCC	GP	PCCC		UK	NZ	Ireland
Male	2.5	5.4	2.21	5.4	2.21	6.22	2.55	6.72	2.76	0.41	6.22	6.72	5.4
	7.5	2.57	1.05	0.63	0.32	2.57	1.05	4.07	1.67	0.41	2.57	4.07	0
	12.5	2.25	0.92	0.71	0.33	2.04	0.84	2.25	0.92	0.41	2.25	2.04	0
	17.5	1.4	0.58	0.79	0.33	1.4	0.58	3.93	1.62	0.41	0	3.93	1.4
	22.5	1.4	0.53	0.87	0.33	1.4	0.53	3.93	1.48	0.38	0	3.93	1.4
	27.5	2.1	0.75	0.95	0.34	0.95	0.34	2.1	0.75	0.36	0	0	2.1
	32.5	2.1	0.74	1.03	0.36	1.03	0.36	2.1	0.74	0.35	0	0	2.1
	37.5	1.7	0.6	1.13	0.4	1.13	0.4	1.7	0.6	0.35	0	0	1.7
	42.5	1.7	0.6	1.24	0.44	1.24	0.44	1.7	0.6	0.35	0	0	1.7
	47.5	2.5	0.91	1.38	0.5	1.38	0.5	2.5	0.91	0.36	0	0	2.5
	52.5	3.5	1.4	1.53	0.61	1.53	0.61	3.5	1.4	0.4	0	0	3.5
	57.5	5.1	2.3	1.71	0.77	1.71	0.77	5.1	2.3	0.45	0	0	5.1
	62.5	5.1	2.64	2.48	1.28	1.9	0.98	5.1	2.64	0.52	0	0	5.1
	67.5	5.1	3.05	3.97	2.37	5.1	3.05	6.62	3.96	0.6	3.97	6.62	5.1
	72.5	5.1	3.53	3.97	2.75	5.1	3.53	6.62	4.58	0.69	3.97	6.62	5.1
	77.5	6.3	5	4.64	3.68	6.3	5	6.62	5.26	0.79	4.64	6.62	6.3
	82.5	6.3	4.98	4.64	3.66	6.3	4.98	6.62	5.23	0.79	4.64	6.62	6.3
	87.5	6.3	4.98	4.68	3.7	6.3	4.98	6.62	5.23	0.79	4.68	6.62	6.3
	92.5	6.3	4.98	4.68	3.7	6.3	4.98	6.62	5.23	0.79	4.68	6.62	6.3
	97.5	6.3	4.98	4.68	3.7	6.3	4.98	6.62	5.23	0.79	4.68	6.62	6.3
Female	2.5	5.6	1.9	5.6	1.9	6.11	2.08	6.6	2.24	0.34	6.11	6.6	5.6
	7.5	2.52	0.86	0.66	0	2.52	0.86	4	1.36	0.34	2.52	4	0
	12.5	2.21	0.75	0.92	0.16	2	0.68	2.21	0.75	0.34	2.21	2	0

Gender	Age	Irish		Minimum		Median		Maximum		Corrected GP/PCCC Ratio	GP utilisation data		
		GP	PCCC	GP	PCCC	GP	PCCC	GP	PCCC		UK	NZ	Ireland
	17.5	3	1.02	1.19	0.33	1.83	0.62	3	1.02	0.34	0	1.83	3
	22.5	3	1.02	1.45	0.49	1.83	0.62	3	1.02	0.34	0	1.83	3
	27.5	3.4	1.33	1.68	0.65	1.68	0.65	3.4	1.33	0.39	0	0	3.4
	32.5	3.4	1.47	1.8	0.78	1.8	0.78	3.4	1.47	0.43	0	0	3.4
	37.5	3.3	1.5	1.78	0.81	1.78	0.81	3.3	1.5	0.46	0	0	3.3
	42.5	3.3	1.46	1.72	0.76	1.72	0.76	3.3	1.46	0.44	0	0	3.3
	47.5	4.1	1.62	1.71	0.68	1.71	0.68	4.1	1.62	0.39	0	0	4.1
	52.5	4.1	1.45	1.77	0.63	1.77	0.63	4.1	1.45	0.35	0	0	4.1
	57.5	4.1	1.51	1.88	0.69	1.88	0.69	4.1	1.51	0.37	0	0	4.1
	62.5	4.1	1.89	2.61	1.2	2.03	0.94	4.1	1.89	0.46	0	0	4.1
	67.5	6	3.85	4.29	2.75	6	3.85	7.15	4.59	0.64	4.29	7.15	6
	72.5	6	5.34	4.29	3.82	6	5.34	7.15	6.37	0.89	4.29	7.15	6
	77.5	7.4	8.6	5.01	5.82	7.15	8.31	7.4	8.6	1.16	5.01	7.15	7.4
	82.5	7.4	8.58	5.01	5.81	7.15	8.3	7.4	8.58	1.16	5.01	7.15	7.4
	87.5	7.4	8.58	5.06	5.87	7.15	8.3	7.4	8.58	1.16	5.06	7.15	7.4
	92.5	7.4	8.58	5.06	5.87	7.15	8.3	7.4	8.58	1.16	5.06	7.15	7.4
	97.5	7.4	8.58	5.06	5.87	7.15	8.3	7.4	8.58	1.16	5.06	7.15	7.4

7. Developing and assessing an allocation model for PCCC services in Ireland

This chapter provides a step-by-step account of how the final RA model is constructed in order to provide a budget for PCCC services.

- It is feasible to develop an RA model in accordance with the principles proposed in the earlier chapters.
- The construction of the proposed model is described, and is based on 2007 PCCC outcome data.
- A model based on LHO populations, weighted by the estimated PCCC utilisation by age and gender, with an adjustment for LHO-level deprivation, is recommended.
- This model greatly reduces between-LHO variation in per capita spending.
- The model does not take into account the additional cost of delivering care to rural areas, whereas a viable model would need to do this.
- The relative impact of different choices of weights on per capita LHO spend is quite modest.
- A carefully phased implementation process is recommended.

It is worth briefly reiterating the principles of the proposed model and seeing where they apply. The basic principle is that equal health service resources should be allocated for equal need. It is argued that for each service the total national service budget should be allocated to the population of each area in a way that reflects the respective population size, age and gender distribution of the population, and population need for these services, as well as an adjustment for additional cost factors such as a dispersed rural population or a high-cost area. As a proxy for need, the use of the population weighted by the age and gender-specific national utilisation figures for that service is suggested. Below, is set out how these estimates would be adjusted for deprivation.

7.1 LHO utilisation-based weights

The process used to develop the proposed RA model would be as follows: for each LHO, the product of the age and gender-specific utilisations and the corresponding populations is calculated. In the case of the proposed model the available resources would simply be distributed in direct proportion to these products. The 'corresponding population' differs between various services, and the recommendations set out Table 41 are suggested as the initial basis for such allocations.

Table 41: Major areas of expenditure and the basis on which the resources provided are recommended to be allocated at LHO level

Area	LHO budget €1,000.00	Basis for allocation
FINANCE	-	-
ADMINISTRATION AND SUPPORT	-	-
POPULATION HEALTH	€26,088	Whole population
PCCC CORPORATE	€8,007	Whole population
PALLIATIVE CARE	€40,952	Whole population
SOCIAL INCLUSION	€107,403	Whole population
GP FEES AND ALLOWANCES	-	-
CHILDREN, ADOLESCENTS AND FAMILY	€539,790	People aged 0-19 years
MULTI-CARE GROUP SERVICE	€590,439	Whole population
MENTAL HEALTH	€737,186,862	Whole population
OLDER PERSONS	€1,027,943	People aged 65 years +
PHARMACIST CLAIMS	-	-
PRIMARY CARE	€1,031,620	Whole Population
DISABILITY SERVICES	€822,405	People with disabilities
Total	€4,931,829	-

7.2 Adjustment for deprivation

A crude measure of the direct impact of LHO-level deprivation on healthcare need has derived and justified by applying the income group specific measures of GP utilisation from Nolan and Nolan (2007) and the area-level deprivation indicators from the HURA study (2006) to the LHO-level distribution of an area-level deprivation score (Haase and Pratschke, 2008).

In assessing the Irish data, it is necessary to make a key (and dubious) assumption that if a person is in the lowest level income group, that factor has the same effect on GP utilisation as if the person had one of the lowest levels of LHO deprivation scores for any given LHO population. This assumption seems unlikely to be correct; in addition, the range of LHO-level estimates seems wide.

Using the New Zealand data, it must be assumed that the relationship between two area-level deprivation indicators of different construction is identical in the two different countries. There is, of course, no substantial justification for this view, but, pending access to actual LHO-level utilisation data, it serves as a good starting point. It is purely a matter of judgement whether the possible risks of using an unverifiable estimate of the impact of deprivation outweigh the certain risks of ignoring deprivation altogether in a population-based resource allocation model. It is felt is that it is better to

use an unverifiable estimate and examine the impact of that estimate on budgets, rather than ignore the effect of that estimate and assume that the deprivation factor does not have an impact on the need for healthcare.

7.3 Adjustment for rural populations

There is a substantial body of evidence in the literature on the issue of delivery of care to rural populations (e.g. Boland *et al.*, 2005; Hughes *et al.,* 2004; Institute of Medicine, 2005; Shortt *et al.,* 2003; Tiainen *et al.*, 2008). For purely physical reasons it often costs more to deliver services to rural populations; as a result, many resource allocation models, including those in Northern Ireland, Scotland and New Zealand make allowances for this. The English model does not make such allowances, and some of the problems that this creates are summarised in a review by Asthana and Halliday (2004). In the view of this study, it is very likely that there are significant differences in the costs of providing equivalent care in different types of rural areas.

The DHSS in Northern Ireland has done a significant amount of work in the area of delivery of care to rural population. The DHSS researchers' main findings were that the additional costs are dominated, not by travelling costs, but by the need to provide additional staff in rural areas to deliver services to a dispersed population. These costs are directly related to the spatial distribution of the population in relation to health centres.

While it is quite possible to measure population distribution – and indeed work on this is already at an advanced stage in the Health Atlas – the absence of costs at LHO level means that this information cannot be used. All that can be done for the moment is to flag the issue, and urge the rapid acquisition of LHO service-based financial data.

7.4 Relation to original conceptual map

This study proposed a conceptual outline of an RA model (Figure 20), and that was approved by the study Steering Group. Each element of the model is numbered, and each of these elements will be discussed in turn.

1. Total PCCC budget: this is determined as part of the HSE budgetary process, and totals €7.63 billion (using the 2007 outcome data).
2. Care group: the total budget is divided into 14 elements.
3. National/regional service: the budgets are further divided into those elements that are spent at LHO level and those that are spent at regional or national level.
4. The LHO-level budget is then apportioned to each LHO, taking into account three elements:
    a. The population for whom the budget allocation is being provided.
    b. A breakdown of the age and gender of that population at LHO level, derived from the 2006 Census.
    c. National poverty or deprivation indicator: an LHO-level measure of deprivation was used (Haaase and Pratschke, 2007).
5. Specific measures of care group need: As discussed earlier, it did not prove feasible to estimate specific measures, and so therefore it is propose to use estimated GP and PCCC utilisation by age and gender as a proxy for these measures.
6. In relation to particular care group service delivery costs, it is the view of this study that the costs of service delivery are likely to be noticeably higher in dispersed rural populations than in denser urban populations or village populations. At present, there are no HSE data that would permit any quantification of this effect. It is recommended that when these data are collated consideration should be given to using a variant of the GIS-based system used for this purpose in Northern Ireland. The study team have held discussions with the Health Atlas group in the HSE about this; work is well underway on these calculations (for other purposes).

7. Cross-boundary patient flow: it was widely believed that there is substantial utilisation of services in Northern Ireland by people normally resident in the Republic of Ireland. While absolute certainty on this issue is not possible, in the view of the Northern Ireland resource allocation unit a significant number of Republic of Ireland residents are registered with the NHS in Northern Ireland; however, these residents do not make much use of the NHS – apart from using services for which formal agreements exist between the two jurisdictions (Capitation Formula Review Group, 2004). Therefore, it is not proposed to take further account of cross-border patient flow in this report. While it is noted that for acute hospital services, cross-border patient flow is very important; it is also well documented.

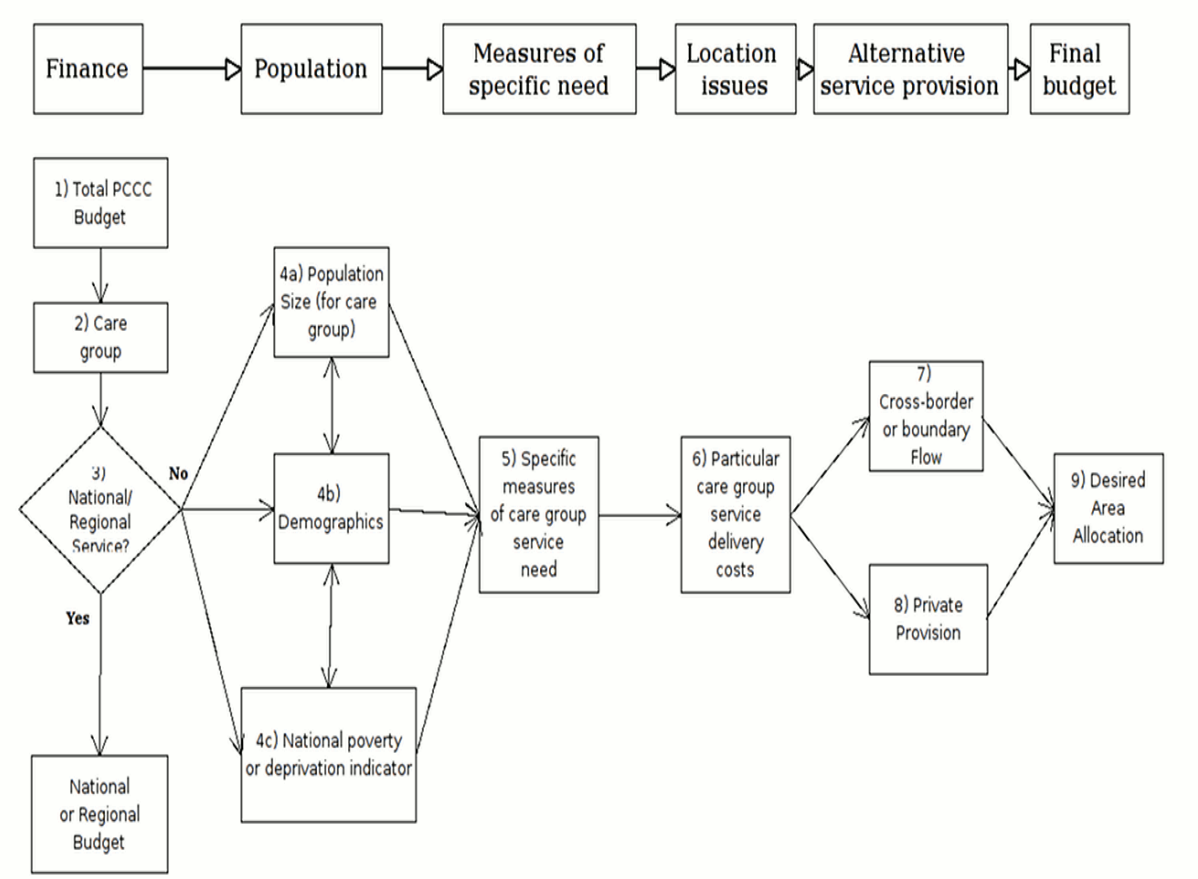

Figure 20: Conceptual map of the proposed resource allocation model

8. Private provision of services: the private sector is not well-developed in most of the service areas that are examined in this study. While the HSE is the dominant funding agency, many of the services are provided by private agencies (both for-profit and not-for-profit agencies). The issue of substitution for services is believed to be far less important in PCCC services, than in either the acute hospital sector or in general practice provision. In any event, no data can be found that would enable a further exploration of this question.

9. Desired area allocation: this is calculated by taking the population of each LHO, broken down by age and gender, and multiplying the relevant population by the relevant age and gender-specific estimated utilisations. These weights are then adjusted for LHO-level deprivation, and the total LHO budget for that service is distributed in direct proportion to the adjusted weights.

Table 42 presents the final primary care budgets for LHO-level expenditure derived from following the above process and using PCCC weights, both with and without the adjustment for deprivation proposed earlier in this report.

Table 42: Primary care budget by LHO in euros per capita based on the 2007 outcome and Irish PCCC-derived weights unadjusted and adjusted for LHO-level deprivation

Budget area	Plan per capita	PCCC weights	PCCC weights adjusted
LHO Carlow/Kilkenny	€66	€244	€247
LHO Cavan Monaghan	€79	€252	€271
LHO Clare	€187	€249	€239
LHO Donegal	€259	€254	€275
LHO 8 Dublin North	€78	€232	€220
LHO 6 Dublin North	€1,211	€250	€263
LHO 7 Dublin North	€53	€225	€232
LHO Area 1 Dun Laoghaire	€68	€268	€236
LHO Area 3 Dublin South City	€66	€230	€208
LHO Area 2 Dublin South East	€50	€253	€224
LHO Area 4 Dublin South West	€1,633	€237	€257
LHO Area 5 Dublin West	€237	€217	€233
LHO Galway	€375	€242	€238
LHO Kerry	€249	€263	€273
LHO Area 9 Kildare/West Wicklow	€74	€217	€198
LHO Area 11 Laois/Offaly	€59	€241	€250
LHO Limerick	€192	€246	€259
LHO Area 12 Longford	€70	€246	€255
LHO Louth	€106	€241	€259
LHO Mayo	€303	€269	€290
LHO Meath	€85	€224	€207
LHO North Cork	€441	€258	€257
LHO North Lee	€265	€236	€238
LHO Nth Tipperary	€218	€244	€232
LHO Roscommon	€215	€271	€273
LHO Sligo/Leitrim	€287	€265	€270
LHO South Lee	€220	€240	€216
LHO South Tipperary	€116	€256	€266

Budget area	Plan per capita	PCCC weights	PCCC weights adjusted
LHO Waterford	€61	€249	€256
LHO West Cork	€278	€273	€271
LHO Wexford	€54	€247	€264
LHO Area 10 Wicklow	€138	€238	€224

The most striking feature of Table 42 is the very high variation in spend per capita in the current system and the far smaller variation in budget per capita in either of the proposed new systems. As one would expect, there is more variation in the budget adjusted for area-level deprivation. Table 43 shows the proposed per capita budgets for all LHOs and for all service groups, which were derived by using the estimated PCCC utilisation, adjusted for deprivation, as described above.

Table 43: LHO level budgets for all service groups, based on 2007 outcome expenditure data, with weights derived from the estimated PCCC utilization based on the Nolan and Nolan (2007) GP utilization data, and the corrected GP:PCCC utilization ratios from Insight '07, adjusted for LHO level deprivation

LHO	Children, adolescents and families	Disability services	Mental health	Older persons	Multi-care group services	Palliative care	PCCC corporate	Population health	Primary care	Social inclusion	Total
Carlow/Kilkenny	€469	€197	€177	€2,210	€141	€10	€2	€6	€247	€26	€3,485
Cavan/Monaghan	€497	€216	€194	€2,392	€155	€11	€2	€7	€271	€28	€3,774
Clare	€448	€191	€171	€2,097	€137	€9	€2	€6	€239	€25	€3,325
Donegal	€500	€219	€197	€2,360	€157	€11	€2	€7	€275	€29	€3,756
Dublin North	€448	€175	€157	€1,979	€126	€9	€2	€6	€220	€23	€3,144
Dublin North Central	€480	€210	€188	€2,383	€151	€10	€2	€7	€263	€27	€3,722
Dublin North West	€503	€185	€166	€2,287	€133	€9	€2	€6	€232	€24	€3,548
Dublin South	€394	€188	€169	€1,964	€135	€9	€2	€6	€236	€25	€3,129
Dublin South City	€417	€166	€149	€2,059	€119	€8	€2	€5	€208	€22	€3,156
Dublin South East	€408	€178	€160	€2,010	€128	€9	€2	€6	€224	€23	€3,148
Dublin South West	€505	€205	€183	€2,330	€147	€10	€2	€6	€257	€27	€3,671
Dublin West	€516	€186	€167	€2,337	€133	€9	€2	€6	€233	€24	€3,614
Galway	€458	€190	€170	€2,157	€136	€9	€2	€6	€238	€25	€3,391
Kerry	€475	€218	€195	€2,272	€156	€11	€2	€7	€273	€28	€3,639
Kildare/West Wicklow	€439	€158	€142	€1,964	€114	€8	€2	€5	€198	€21	€3,049
Laois/Offaly	€489	€200	€179	€2,261	€143	€10	€2	€6	€250	€26	€3,567

LHO	Children, adolescents and families	Disability services	Mental health	Older persons	Multi-care group services	Palliative care	PCCC corporate	Population health	Primary care	Social inclusion	Total
Limerick	€484	€206	€185	€2,300	€148	€10	€2	€7	€259	€27	€3,627
Longford/Westmeath	€484	€203	€182	€2,292	€146	€10	€2	€6	€255	€27	€3,606
Louth	€509	€206	€185	€2,374	€148	€10	€2	€7	€259	€27	€3,727
Mayo	€492	€231	€207	€2,395	€166	€11	€2	€7	€290	€30	€3,832
Meath	€446	€165	€148	€2,002	€119	€8	€2	€5	€207	€22	€3,123
North Cork	€466	€205	€184	€2,224	€147	€10	€2	€7	€257	€27	€3,529
North Lee – Cork	€476	€189	€170	€2,180	€136	€9	€2	€6	€238	€25	€3,430
North Tipperary/East Limerick	€438	€185	€166	€2,083	€133	€9	€2	€6	€232	€24	€3,278
Roscommon	€464	€218	€195	€2,246	€156	€11	€2	€7	€273	€28	€3,600
Sligo/Leitrim/West Cavan	€467	€215	€193	€2,267	€154	€11	€2	€7	€270	€28	€3,614
South Lee – Cork	€414	€172	€154	€1,971	€123	€9	€2	€5	€216	€22	€3,088
South Tipperary	€478	€212	€190	€2,286	€152	€11	€2	€7	€266	€28	€3,632
Waterford	€480	€204	€183	€2,226	€146	€10	€2	€6	€256	€27	€3,540
West Cork	€452	€216	€193	€2,177	€155	€11	€2	€7	€271	€28	€3,512
Wexford	€502	€211	€189	€2,286	€151	€10	€2	€7	€264	€27	€3,649
Wicklow	€442	€179	€160	€2,042	€128	€9	€2	€6	€224	€23	€3,214

7.5 Choice of weights

The choice of weights is, of course, a central question. There are many possible sets of weightings. The ones that were examined in this study are based on minimal, median and Irish estimates of GP service utilisation and PCCC service utilisation. Just to reiterate, these weights are substitutes for measures of need, derived by assuming that national estimated GP and PCCC utilisation rates by ages and gender are reasonable proxies for need at LHO level. There is no 'correct' set of weights. It is very likely that there are many sensible sets of weights that could be employed.

One important question is how much difference does choosing one set of weights over another actually make? The data contained in Table 44 provides one possible approach to answering this question. It shows the range of per capita budgets divided by the median per capita budget across all the weightings expressed as a percentage. In some areas, the choice of weights has a major impact on budgets. However, this is a little misleading because the table conflates budgets that are adjusted for LHO-level deprivation as well as those that are not adjusted in this way.

Table 44: The range of budgets at LHO level as a percentage of the median budget per capita for groups of services supplied to young people, the whole population, and people aged over 65 years.

LHO	Children, adolescents and families	All other services	Older persons
Carlow/Kilkenny	1.6%	1.5%	1.1%
Cavan/Monaghan	9.3%	11.3%	8.1%
Clare	5.1%	5.5%	4.7%
Donegal	9.2%	11.8%	8.0%
Dublin North	6.6%	10.6%	9.2%
Dublin North Central	8.0%	10.6%	7.5%
Dublin North West	9.1%	9.2%	3.8%
Dublin South	18.6%	20.6%	14.1%
Dublin South City	11.2%	15.4%	13.0%
Dublin South East	13.6%	18.2%	15.5%
Dublin South West	8.4%	12.0%	9.4%
Dublin West	10.8%	16.7%	7.6%
Galway	2.0%	1.8%	1.9%
Kerry	6.6%	9.1%	3.7%
Kildare/West Wicklow	12.2%	19.3%	10.8%
Laois/Offaly	4.6%	6.1%	4.5%
Limerick	6.9%	6.2%	5.2%
Longford/Westmeath	4.0%	5.1%	4.1%
Louth	8.4%	9.1%	7.6%
Mayo	10.3%	15.3%	8.2%

LHO	Children, adolescents and families	All other services	Older persons
Meath	11.8%	15.4%	9.0%
North Cork	0.7%	5.3%	1.9%
North Lee – Cork	2.0%	4.2%	1.8%
North Tipperary/East Limerick	6.9%	6.3%	5.3%
Roscommon	2.8%	10.0%	1.8%
Sligo/Leitrim/West Cavan	4.5%	8.5%	2.7%
South Lee – Cork	12.2%	11.2%	11.1%
South Tipperary	6.2%	8.2%	4.0%
Waterford	2.6%	4.5%	3.1%
West Cork	4.7%	10.6%	1.6%
Wexford	7.3%	7.9%	8.6%
Wicklow	6.8%	9.1%	7.0%
MEDIAN	6.9%	9.2%	6.2%

Table 45 shows the same analysis. However, in this case it uses weights adjusted for LHO-level deprivation only. The range of variation arising from any one particular choice of weights is much smaller, and arises as a result of differences in the relative weightings of different age groups and gender groups, amplified by age and gender distributions at LHO level.

Table 45: The range of budgets, using only weights adjusted for LHO-level deprivation as a percentage of the median budget per capita for service groups supplied to young people, the total population, and people aged over 65 years.

LHO	Children, adolescents and families	All other services	Older persons
Carlow/Kilkenny	0.6%	0.4%	0.2%
Cavan/Monaghan	2.1%	4.0%	1.0%
Clare	0.8%	1.3%	0.3%
Donegal	1.5%	4.0%	0.5%
Dublin North	1.4%	5.4%	3.8%
Dublin North Central	2.7%	5.2%	2.4%
Dublin North West	6.1%	6.3%	1.0%
Dublin South	5.8%	7.9%	1.3%
Dublin South City	1.2%	5.5%	2.9%
Dublin South East	1.2%	5.7%	2.9%

LHO	Children, adolescents and families	All other services	Older persons
Dublin South West	0.4%	3.9%	1.5%
Dublin West	3.8%	9.6%	0.6%
Galway	0.4%	0.2%	0.1%
Kerry	2.9%	5.4%	0.2%
Kildare/West Wicklow	3.1%	10.2%	1.5%
Laois/Offaly	0.7%	2.2%	0.7%
Limerick	1.9%	1.1%	0.2%
Longford/Westmeath	0.5%	1.5%	0.7%
Louth	1.2%	1.9%	0.6%
Mayo	3.0%	7.9%	1.0%
Meath	3.8%	7.5%	0.9%
North Cork	0.3%	4.9%	1.3%
North Lee – Cork	1.2%	3.4%	1.1%
North Tipperary/East Limerick	1.7%	1.2%	0.1%
Roscommon	2.1%	9.1%	1.1%
Sligo/Leitrim/West Cavan	2.7%	6.5%	1.0%
South Lee – Cork	1.4%	0.5%	0.2%
South Tipperary	2.2%	4.1%	0.1%
Waterford	0.1%	1.9%	0.8%
West Cork	3.7%	9.5%	0.4%
Wexford	0.6%	1.1%	2.0%
Wicklow	0.7%	3.1%	0.8%
MEDIAN	1.5%	4.0%	0.8%

Deciding which of the sets of weights to use involves an exercise of judgement, both organisational as well as technical. Without LHO-level budgets, which would permit a more direct evaluation of the impact of the choice of service provision, the choice is difficult. It is the author's view that the choice should be guided by the following considerations:

- Use one of the PCCC weights, because resources are being allocated for PCCC services, and this should reflect the higher utilisation of these services by older people.
- Use the weights adjusted for LHO-level deprivation, using the New Zealand area-level deprivation effect, as this is an important indicator of service need in its own right.
- Use the weights derived from GP utilisation data from the Nolan and Nolan (2007) study, as these are closer to data from other countries than data derived from Insight '07.

The implication of these considerations is that the weights used to derive the per capita budgets in Table 43 are those recommended by this study. The full set of weights (as well as the budgets for each LHO and service area that were calculated using each set of weights) is provided in a separate spreadsheet.

7.6 Implementation

At the time of writing, it is not possible to implement the model being proposed. In the author's view this is not due to any fundamental defect in the model itself. Rather, it is because the basic facilities required for the safe implementation of any resource allocation process are not as yet in place. The HSE is still working with a series of legacy financial systems that are not fully integrated. Until this is completed, any attempt to allocate resources using the approach proposed here (or any other approach) is likely to fail because it will not be feasible to estimate the impact of the resource allocation process on LHO budgets.

There is considerable international experience available on how to implement resource allocation models. One of the international members of the research team, (Professor Roy Carr-Hill of York University), summarised this literature and his personal experience for this study. The following lessons have been learned about implementation:

(a) Missing facilities or staff

Where there are clear gaps in service provision, then, for equity reasons alone, filling that gap has to be a clear priority. Assuming that the ideal level of facilities or staffing levels cannot be attained within one year, the weighting would have to correspond to the capacity of the procurement system or the education system to supply the facilities or the required trained healthcare personnel. This means that the annual adjustment should take the estimated net new supply of facilities or the supply of healthcare personnel as the overall capacity constraint for that adjustment i.e. if only 100 new units of facility can be commissioned, or if only 1,000 new units of staffing can be trained (relative to an overall estimated need of 1,000 or 10,000 people respectively), these can be allocated either at a rate of 10% of the estimated need for new staffing in each area or the areas with the most need can be supplied first until the new supply of 100 or 1,000 is exhausted.

(b) Complementarity with the private sector

Levels of private medical insurance (and, more generally, the use of private healthcare facilities or State subsidies of private services) are subject to substantial variation between geographical areas and social classes. An increased use of private or subsidised facilities may lead to reduced use of the State's healthcare facilities. (Alternatively, where private clinicians promote the use of healthcare, it may lead to increased use). Should resource allocation formulae explicitly reflect the extent to which different populations make different use of private or subsidised health care? Where data are available, one can make alternative estimates. There is probably no single correct answer: the choice depends on the factors that are associated with the use of private or subsidised healthcare.

(c) Clear and agreed policy environment

Without clarity and agreement on policy, the crucial initial decisions on formula funding cannot be taken – irrespective of whether they relate to the proportions of the total budget that is to be allocated by formula, or whether they relate to guiding the relative proportions of resources that are to be assigned to various sub-components. Only reliable and valid indicators should be used.

(d) Adequate technical infrastructure

A sound information base permits various alternative formulae to be modelled and compared prior to implementation. Only appropriate indicators should be used. This is essential for ensuring a smooth transition between established funding procedures and formula funding.

(e) Transparency and open dialogue

Free access to data gives stakeholders confidence in the fairness and impartiality of the process and it also places great pressures on data providers to deliver accurate information. There are problems of differential ability to access the data and differential capacity to manipulate the data. There is no simple technical fix for this.

(f) Earmarking and flexibility

Earmarking of funding restricts flexibility for those who are likely to know best what is required at a local level. In principle, therefore, no matter how complicated the derivation of the formula, the preferred approach is to distribute the budget allocations to the LHOs in one large envelope. However, where formula funding is being introduced for the first time, and where LHO-level capacity is relatively weak, it is probably appropriate to be prudent about the amount of flexibility in terms of viring[6] that is permitted between these notional envelopes.

(g) Moving towards actual allocations

It is often the case that allocations based on formulae are very different from those based on historical precedent or the political clout of different districts. Inasmuch as this study has proposed that it would be useful to move towards formula allocation (for the reasons stated above), then it would also be prudent to treat formulae-based allocations as targets towards which one aims to move relatively slowly. This is the procedure that has been adopted in the UK as well as in a number of other countries.

(h) Counting the population

It might come as something of a surprise to discover that one of the main issues in relation to resource allocation is estimating the size of the population covered by the organisation. For example, as a result of recent developments in the English NHS, capitation should be based on the size of a general practitioner's list. Such lists are known to be unreliable for a variety of reasons, and therefore compromise the reliability of the distribution of funds. More generally, in cases where people frequently change between organisations providing their healthcare, or are registered only at the point where they avail of particular services, there can be considerable uncertainty as to the size and characteristics of the population at risk. This is exacerbated if the basic data for resource allocation is derived from household surveys.

(i) Attempts to link resource allocation to outcomes and performance

Monitor the way in which funds allocated by formulae are actually used is a major challenge. Even where funds are earmarked for specific purposes, or are earmarked to respond to specific social problems, it is rare for the use of the funds to be audited in such a way as to prove that they have actually been used as intended.

Originally, the logic of devolution meant that it was more sensible to give the healthcare organisation flexibility to use the resources allocated to it within its overall budgetary envelope, as long as it adhered to the regulatory framework. However, pressure to monitor what healthcare organisations actually do is increasing, with a resultant proliferation of performance indicators and targets.

7.7 Implications for Ireland

The considerations above suggest that it would be best to take a stepped approach to introducing formal resource allocation processes at LHO level in the HSE. The first stage is to identify the actual current LHO-level allocation. Without this step, the remainder of the process will be built on sand and will collapse. The LHO-level budget allocation will need to be constructed on the same basis as the proposed resource allocation model. The actual budgets can then be compared with the proposed allocation. This will assist

[6] The authority to move expenditure between different headings in a budget; a technical legal and accountancy term.

with two basic questions: which set of weights to use and what time-scale to allot for changes in allocations.

When the first stage is completed, the next stage will be to ensure that there is sufficient support for the principle of resource allocation. The recent establishment of a taskforce on resource allocation by the Minister for Health and Children, Mary Harney TD, will facilitate this. Full support at the most senior HSE level will be required, and therefore a campaign to win over key staff at LHO level should begin immediately. It is recommended that a systematic and thorough programme of meetings with senior staff at LHO level is established. The basis of the argument for resource allocation is the perceived unfairness and irrationality of the existing allocations. In the author's view, any effort to produce a resource allocation model that is not accepted and supported by these key managers will not be realised. While every manager is not expected to like every aspect of the new process, the general model must be both familiar and acceptable to them.

Given the completion of stages one and two, and a set of agreed LHO budgets and outcomes being made available, a gradual process of introducing changes in budgets is recommended, based on the Irish experience of introducing case mix-based payments in the acute hospital sector, and international experience of introducing RA models, especially in Wales and England. When the existing LHO budgets are compared with those proposed under the model, there will in all likelihood be substantial differences between the two. An implementation process that would run over a period of eight to ten years is suggested, with timings being clearly agreed and also clear agreement in advance on how the changes would be managed. Ideally the process would operate by allocating growth money to LHOs that were in deficit relative to the model; growth money would not be allocated to LHOs that had a surplus. Given the current national economic situation, however, this is unlikely to be possible.

The proposed RA model will need to be maintained. This report emphasises the critical importance of updating the model at least annually during this time. As new data become available it should be possible to greatly refine the very crude model. To take two examples, Healthstat data for services to the elderly, and to people with disabilities, should permit a much more refined estimate of need in the near future, than that presented in this report. It is particularly important for this type of model, where the major driver of resources is demography, that the underlying population estimates are updated regularly.

This major responsibility will need to be undertaken in-house. It is advisable that people intimately familiar with the population data, and health service utilisation data, resource data, and financial data, be given this task, perhaps as a partnership between HSE Health Intelligence and HSE Finance. The process used in Northern Ireland could be adopted here where a group, including academics, civil servants, and health services staff, has this responsibility, with the support of a small number of full time staff."

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