Moving beyond formulae: a review of international population-based resource allocation policy and implications for Ireland in an era of healthcare reform [version 1; peer review: awaiting peer review]

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Abstract

Background: Population-based resource allocation is a specific approach to population health planning that is used to address differences in population need to promote equity and efficiency in health and health system outcomes. However, while previous studies have described this type of funding model, they have not compared how such policies and practices have been implemented across jurisdictions. This research examined the impacts and outcomes of population-based resource allocation across six high-income countries, with a view to informing strategic decision-making as Ireland progresses its universal healthcare reform agenda.

Methods: A concurrent multi-method approach was employed to examine the experiences of six jurisdictions selected for analysis: Australia (New South Wales), Canada (Alberta), England, New Zealand, Scotland and Sweden (Stockholm). A documentary analysis of key policy, strategy and planning publications was combined with a narrative rapid review of peer-reviewed and grey literature (n = 8) to determine how population-based resource allocation is specified and implemented. The findings were checked and verified by national experts.

Results: Notable differences were observed across countries in terms of the stated objectives and descriptions of models as well as the criteria for choosing variables and the variables ultimately used in funding formulae. While population-based resource allocation can help improve equity related to healthcare outcomes and access, a
number of tensions were revealed between the need to ensure alignment between policy goals and model design; transition between models; support regionalisation policies; and develop robust governance and monitoring mechanisms to maximise outcomes.

**Conclusions:** The review progresses ‘thinking’ about population-based resource allocation beyond the technical aspects of model or formulae construction. Population-based resource allocation should be viewed as just one lever of large-scale health system reform that can be thoughtfully developed, monitored and adjusted in a way that supports the goals of Sláintecare and the delivery of universal healthcare.

**Keywords**
Health reform, health system, health policy, Sláintecare, COVID-19, Ireland, population-based resource allocation

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Introduction
There is strong global consensus about the importance of implementing universal access to integrated healthcare services to achieve the ‘triple aim’ of improving health, improving quality of care and ensuring sustainability. Population-based (needs-based) resource allocation (hereafter PBRA) is a specific approach to population health planning that is used to address differences in population need to promote equity and efficiency in both health outcomes and the distribution of resources. PBRA has an associated toolkit that comprises a wide range of concepts and implementation mechanisms. However, while previous studies have described the ‘what’ of PBRA - such as the methods used to develop funding formulae or their key components - they have not compared PBRA policies and practices across countries. This is needed to facilitate better understanding of how PBRA is being implemented and the strategies that enable its full potential to be realised within different settings and contexts. Drawing on the learnings and experiences of other high-income countries, this research sought to uncover empirical insights into the impacts and outcomes of PBRA, with a view to informing decision-making in Ireland as we look to develop PBRA policy as part of a broader strategy for healthcare reform.

Population-based resource allocation and population health approaches to health systems
An important distinction between population health approaches and other approaches to health planning is that they encompass the entire range of determinants of health and wellbeing (e.g. education, housing, town planning) as well as the planning and management of health services. The core aim of PBRA frameworks is to facilitate strategic health service planning by shifting towards models that incorporate a more holistic assessment of needs, rather than focussing on specific diseases, settings or service utilisation patterns. PBRA is used to adjust funding across the population according to variation in need and the cost of providing required services and supports (i.e., cost weightings). PBRA policies are also considered to be crucial to the process of decentralisation since they help to ensure that allocation of healthcare resources is responsive to variation in regional/local population profiles.

PBRA frameworks comprise a core model that estimates the relative proportions of expenditure required to provide services based on a set of pre-defined circumstances. These circumstances should, in theory, reflect healthcare need and explain differences in service utilisation patterns. Measuring population health need is a complex and context-specific process that has been covered extensively in the literature; however, it typically incorporates population size, demographic characteristics and additional factors such as unmet need or variation in cost of supply. There are further issues to consider when implementing a PBRA model, including the level of ‘top slicing’ required, the need for transitional funding arrangements and how resources should be distributed at both the regional- and programme-level. It is worth noting that recent evidence from England has suggested that robust methods at the national- (or regional-) level may not necessarily translate to the local-level to help deliver services (e.g. payments to providers were not aligned with intended integration of services and needs of patients with multiple conditions).

While there are a number of population health planning methods that can be used to support PBRA implementation - including health needs assessments, population profiling, population segmentation or stratification and population health management - there is no standardised approach to the development and implementation of PBRA funding models. This means there is no consensus about the indicators that should be included in the modelling or the analytical approach that should be employed. Nevertheless, PBRA has assumed importance in many health systems because it is viewed as a valuable policy lever for promoting equity in health outcomes and access to services; helping to create incentives within the system to promote service reform; and providing explicit criteria for funding, thus promoting informed dialogue and acceptance of outcomes among stakeholders.

Population-based resource allocation and the reform agenda in Ireland
Established in 2005, the Health Service Executive (HSE) is responsible for the allocation of public resources as well as directly providing many of the health and social care services which it funds. However, current funding arrangements were neither designed to re-orient the Irish health system to primary and community care services, nor to support the delivery of integrated care. Indeed, the lack of PBRA arrangements have been repeatedly critiqued as being a weak point of the healthcare system in Ireland and although recent legislative developments provided powers to the Minister for Health to direct the conduct of a health needs assessment processes around linking these data with health service planning remain undeveloped.

Resources are allocated based on existing level of service (ELS) - that is, historic patterns of population demand amongst those who have presented for and received care - rather than being guided by current and projected needs in line with overall policy objectives (though it is worth noting a small but increasing proportion of resources for acute hospital services are allocated based on a case-mix programme). This approach is problematic since utilisation patterns may not accurately reflect population need, particularly where there are cost barriers and long waits to access care, thereby reinforcing structural inequities. Research has also pointed to significant limitations in the quality and availability of data to measure health need in the Irish context. As a consequence, Ireland’s health system lags behind those in other high-income countries where PBRA has become a key mechanism for delivering equitable, effective and efficient care.

1 Whilst beyond the scope of this paper, it is important to note that models can have notable weaknesses. For example, studies indicate that demographic data such as age and gender are poor predictors of health expenditure which means that funding models that rely only or primarily on these data are limited. Similarly, utilisation is not a reliable proxy for health need; however, all models currently rely on current utilisation patterns to predict future trends.
Ireland has recently embarked on a path of systemic and large-scale healthcare reform. Initiated in 2017, a 10-year programme or roadmap for change - Sláintecare1 – was published with the aim of transitioning to a universal health system that is based solely on need rather than ability to pay2. Put simply, it seeks to transform healthcare policy and service-level infrastructure to provide all citizens with the ‘right care’ in the ‘right place’ at the ‘right time’3,4. The 2017 report recommended the introduction of regions to facilitate population based resource allocation and clinical and managerial governance and accountability5. While some progress has been made6, the roll-out of Sláintecare has been characterised as slow7; nevertheless, the most recent Sláintecare Implementation Strategy and Action Plan 2021-2023 restated a commitment to universal access to integrated care8. Critically, it also specified two primary reform programmes: 1) improving safe, timely access to care and promoting health and wellbeing; and 2) addressing health inequalities on the journey towards universal healthcare.

In the case of the latter, there are two projects most relevant to PBRA: 1) the development of a Citizen Care Masterplan (CCMP); and 2) the establishment of Regional Health Areas (RHAs). Significantly, three of the work streams associated with developing the CCMP are directly related to population health planning, including: population profiling and segmentation; population needs assessment and service redesign; and the development of a PBRA model. The stated rationale for developing RHAs also includes explicit reference to improving a population-based approach to service planning and the integration of community and acute services. The action plan sets out specific quarterly targets, with a view to test, refine and implement PBRA in 2022 and 2023.

What is clear is that PBRA is intended as a key component of Irish health system planning and policy implementation, signalling that policy-makers view PBRA as instrumental to the goals of Sláintecare. As health system planners begin to consider the options for developing a PBRA framework, there is much to gain from examining how PBRA has been designed and implemented in other jurisdictions with transferrable knowledge for Ireland.

Aims and objectives
This review aims to inform Sláintecare’s strategic policy on healthcare reform by generating insights into what PBRA ‘looks like’ in other countries as well as how it has been experienced across countries via a documentary analysis and rapid review of international policy and practice. We address three research questions (RQs):

RQ1. How are population-based resource allocation policies specified and realised?

RQ2. What is known about the implementation or impact of population-based resource allocation policies?

RQ3. What lessons, if any, may be relevant for Sláintecare implementation in Ireland?

In line with the WHO health systems framework, where financing is one of six key building blocks used as a mechanism to ensure access and coverage to quality safe care, a core goal of this review is to progress thinking beyond the technical aspects of formula(e) construction into a broader health systems frame9. This review is also cognisant of the complexity of health systems and seeks to situate the findings in the context of a complex adaptive system10. Health systems and policy research continually highlights the importance of context for all of the health system building blocks, including financing and resource allocation11,12,13,14. This facilitates deeper understanding of the factors related to model development as well as how, and why, PBRA policies have delivered or not on their key objectives. In so doing, we identify aspects of model design and application that have important implications for Irish healthcare reform and present key learnings that could be useful for Sláintecare implementation during a critical window for transformation.

Methods
Study design
This study is one work package within the Foundations’ research project that aims to harness key learnings from Ireland’s health system response to COVID-19 and assess whether these insights can be used to inform Sláintecare implementation (for a detailed overview, see Burke et al.23). This particular component incorporated two qualitative methods - documentary policy analysis and a narrative rapid review - into an integrated methodology to generate robust findings to address the research questions. The combination of these methods is well suited to this form of inquiry, whereby the data collected and processes described are predominantly text-based and in which depth of detail is important to the audience. To this end, a concurrent multi-method approach was employed to create a fuller ‘picture’ of existing knowledge and understanding of international PBRA policy and practice24. This facilitated a comprehensive and nuanced analysis from which important implications for Sláintecare design and implementation emerged (addressing RQ3).

Sampling
Six jurisdictions are included in this review: Australia (New South Wales), Canada (Alberta), England, New Zealand, Scotland and Sweden (Stockholm). The cases represent a convenience sample and were selected based on the following criteria:

i. High-income country;

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1 At the time of writing, Ireland remained one of the few high-income country where citizens do not have universal access to public healthcare; rather, a complex set of eligibility arrangements based on age, health and socioeconomic status continue to be in place, many of which have been critiqued as antiquated and not fit-for-purpose2,14. Additionally, just under half of the population purchases voluntary health insurance for access to private health services, which are generally oriented towards elective acute hospital-based care. Thus, although individuals have access to acute hospital-based care that is free or with low-cost user charges, many face extensive and often prohibitive charges for access to primary and community services as well as extremely long waiting lists to access diagnostics, assessment treatment and care in public hospitals; all of which contributes to high levels of unmet need and health inequity.
ii. Established policy relating resource allocation and operational planning to population need; and

iii. Documentation the research team could access and review.

An overview of the health system and population characteristics of the six jurisdictions studied is provided in Table 1 and is presented alongside Ireland for comparative purposes. Healthcare funding in all six countries is predominately funded through general taxation. Private health insurance markets operate in all six, with policies offering supplementary or complementary coverage.

Data collection and analysis
1. Documentary analysis: Policy, strategy and planning documents relevant to the review were collected from relevant databases, websites and input from project partners or local experts. These documents were descriptively analysed using matrices in Microsoft Excel and qualitatively reviewed for content on how PBRA is specified and realised in the jurisdictions selected as case studies (addressing RQ 1). While the level of detail available varied substantially across countries, the following details were extracted from the selected policy documents where possible: country, year, policy context, reported policy aim or purpose and the description of the population-based approach (including reference to segmentation, oversight and evaluation).

Results were extracted into summary tables by one researcher (BMJ) and verified through discussion among team members (BMJ and SB). Once compiled, these tables were developed into country-level summaries. Each summary was reviewed and verified by local experts affiliated with academic institutions or national agencies, to maximise accuracy and completeness of the data.

2. Narrative rapid review: A rapid review of peer-reviewed and grey literature was completed to synthesise evidence on the impact, experience and implementation of PBRA policies across the six countries examined (addressing RQ2). A systematic search strategy was used; however, rather than attempting to identify all evidence, this review focused on synthesising key evidence related to the research questions. All results are reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Statement (PRISMA).

We did not restrict our search to any one design. The following inclusion criteria were used to identify materials relevant to this review:

- Reported on population-based resource allocation policy in Australia (New South Wales), Canada (Alberta), England, New Zealand, Scotland and Sweden (Stockholm).
- Published between 2010 and 2020.
- Published in English or Swedish.

A systematic search strategy was developed through discussion amongst the research team and employed in May 2020, using Pubmed (see Box 1). Supplementary searches for evidence were conducted through reference mining of all identified comparative studies and systematic reviews. In addition, Google Scholar was searched for grey literature sources and other studies using keywords from the database search. For Google Scholar, the first 100 items were collated. One team member (BMJ) reviewed each grey literature item for potential relevance to this review. Studies published in the peer-reviewed literature were discarded if they had already been returned by the database search.

References from the database and grey literature searches were managed using EndNote. All references from the database search were uploaded to the online reviewer tool Covidence to screen for relevance using title and abstract. Papers that did not meet the inclusion criteria were excluded at this point. Full texts were reviewed for inclusion by one researcher (BMJ), with all choices confirmed through discussions with another researcher (SB).

We decided a priori to extract data relating to publication date, country, overview of publication and reported findings. Narrative synthesis was conducted whereby all resources were appraised and the relevant findings collated into a coherent account to address the study’s research questions.

Our search of the Pubmed database and grey literature is summarised in Figure 1. A total of 1,562 papers were identified following a database search in Pubmed. An additional 191 resources were identified via searches on Google Scholar, government websites and subsequent reference mining. The total yield was 1,753 citations, of which 41 were duplicates. We reviewed the remaining 1,712 unique titles/abstracts, of which 1,657 did not meet the eligibility criteria. We reviewed the remaining 55 full texts, of which eight met the inclusion criteria. These eight articles were included in the narrative synthesis.

Ethical approval
This study was granted ethical approval by the Research Ethics Committee of the Centre for Health Policy and Management and Centre for Global Health at Trinity College Dublin as part of the Foundations’ Project.

Results
Documentary analysis
Table 2 presents a descriptive account of the stated objectives of PBRA policies in the six countries studied. Since there is no
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<tbody>
<tr>
<td>Ireland</td>
<td>No universal access to whole health and social care system. Acute hospital</td>
<td>74%</td>
<td>12.1%</td>
<td>Voluntary supplementary insurance for faster access, increased choice, elective hospital and some reimbursement of out-of-pocket costs for services. Accounted for 14% of total health expenditure in 2018.</td>
<td>Mix of fee-for-service and capitation.</td>
<td>Mix of global budgets case-mix adjusted payment.</td>
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<td>care financed through general taxation and available to all at no or low cost. Optional private insurance coverage available, focused on elective acute hospital care. Eligibility for no or low-cost primary and community care services for some citizens based on age, health and socioeconomic status, but most facing out-of-pocket payment.</td>
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<tr>
<td>Australia (New South Wales)</td>
<td>Universal access financed through federal and general taxation and a government levy. Optional private insurance coverage available.</td>
<td>67.6% (2013)</td>
<td>19.7% (2013)</td>
<td>Voluntary supplementary insurance for increased choice, elective hospital and community services and reimbursement of out-of-pocket costs for services. Accounted for 12.7% of total health expenditure in 2013.</td>
<td>Primarily fee-for-service.</td>
<td>Mix of activity-based funding and fee-for-service.</td>
</tr>
<tr>
<td>Canada (Alberta)</td>
<td>Universal access administered by provinces or territories. Primarily financed through general taxation.</td>
<td>69.8%</td>
<td>15.0%</td>
<td>Voluntary complementary insurance mostly paid for by employers. Covers services not provided in the public system, including vision and dental care, prescription drug costs, rehabilitation services and private hospital rooms. Accounted for 12% of total health expenditure in 2017.</td>
<td>Mix of fee-for-service and capitation.</td>
<td>Global budgets; some fee-for-service.</td>
</tr>
<tr>
<td>England</td>
<td>Universal access primarily funded through general taxation, including employment-linked contributions.</td>
<td>78.8%</td>
<td>16.0%</td>
<td>Voluntary supplementary insurance that can be purchased by both individuals and employers. Primarily provides convenient and quicker access to elective services in private hospitals. Accounted for 5.2% of health expenditure in 2017.</td>
<td>Mix of capitation/pay-for-service/pay-for-performance; salary payments for a minority of GPs.</td>
<td>Mainly case-based payments (60%) plus budgets for mental health, education, and research and training.</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Universal access financed mostly through general taxation.</td>
<td>78.6%</td>
<td>13.6%</td>
<td>Covers some out-of-pocket charges in public system, elective care in private hospitals, and private outpatient consultations. Accounted for 7.8% of total health expenditure in 2017.</td>
<td>Mix of capitation (approximately 50% of total) and fee-for-service patient payments (~50%).</td>
<td>Global budgets.</td>
</tr>
<tr>
<td>Scotland</td>
<td>Universal access through NHS Scotland. Primarily funded through general taxation, including employment-linked contributions.</td>
<td>78.8%</td>
<td>16.0%</td>
<td>Voluntary supplementary insurance that can be purchased by both individuals and employers. Primarily provides convenient and quicker access to elective services in private hospitals. Accounted for 5.2% of health expenditure in 2017.</td>
<td>Mix of capitation/pay-for-service/pay-for-performance; salary payments for a minority of GPs.</td>
<td>Mainly global budgets; some case based payments.</td>
</tr>
<tr>
<td>Sweden</td>
<td>Universal access with decentralised administration. Funded primarily through local and national general tax revenue with some national income tax contributions.</td>
<td>83.7%</td>
<td>15.0%</td>
<td>Voluntary supplementary insurance purchased primarily by employers. Can facilitate quick access to outpatient services and elective care. Accounted for 1.3% of health expenditure in 2017.</td>
<td>Mix of capitation (78% of total after adjusting also for the morbidity burden among enrolled people from 2020 onwards) and fee-for-service. Also limited pay-for-performance funding.</td>
<td>Mix of global budgets (~66% of total) and case-based payment. Also limited pay-for-performance funding.</td>
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standardised framework for PBRA models, the goals of PBRA policy differed across jurisdictions. While all broadly aimed to link resource allocation to population need, there were notable differences in their explicit commitment to policy objectives in official documentation. For example, England cites equity in access as the guiding policy objective, while New Zealand cites equity in health status.

In terms of how the six case studies translated policy into practice, an overview of the PBRA models, services covered and arrangements for funding outside of the models is provided in Table 3. Additionally, details on the specific factors used in population-based funding formulae are outlined in Table 4. Similar to other comparative reviews\(^3,6\), the findings presented in Table 3 demonstrate that all used population size as a starting point for determining resource allocation requirements and then adjusted based on factors that act as indirect measures of need (e.g. age, gender, deprivation) or more direct measures of need (e.g. morbidity); all of which are characteristics considered to influence demand for services. However, Table 4 highlights that some models were further adjusted for differences such as rurality (in the case of Scotland and Alberta, Canada) or included weightings for unmet need. In New Zealand, for instance, the model is adjusted for ethnicity to reduce known health disparities among ethnic-minority groups in the population.

Notably, there was also variation in terms of the stated criteria for choosing the variables to include in PBRA models (Table 5). Since there is no generally accepted working definition of ‘need’, decisions about adjusting PBRA models are largely subjective. It is perhaps unsurprising, then, that different countries used different variables in their modelling to account for population need. As can be seen however, the guiding principles across most countries were that variables should be feasible to include without risk of high administrative costs; be universally recorded, consistent, reliable and verifiable; be able to predict health service expenditure; be free from perverse incentives; and not be a measure of supply or vulnerable to manipulation or fraud.

Returning to Table 3, the findings revealed significant variation in the types of services funded by PBRA models as well as the additional funding arrangements implemented across countries.

\(\text{Figure 1. Database search and study selection.}\)
Table 2. Stated objectives of population-based resource allocation.

<table>
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<th>Country</th>
<th>Funding objectives</th>
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<tr>
<td><strong>Australia (New South Wales)</strong></td>
<td>Funding to the Area Health Services (AHS) by the NSW Department of Health has been guided by the objective of providing the AHS with a share of resources that allows the achievement of comparable access to health services, assuming the achievement of reasonable levels of efficiency. To guide the allocation of funds from the Department of Health to the geographically based AHS. In order to achieve equity in funding across populations. The formula identifies equitable shares of available resources for AHS on the basis of the assessed health needs of the population. A planning tool to guide the allocation of funding to AHS and to monitor progress towards the achievement of fairness in health funding.</td>
</tr>
<tr>
<td><strong>Canada (Alberta)</strong></td>
<td>Prior to establishing a single health authority, population-based funding from the Ministry of Health was allocated to each of the nine (previously 17) regional health authorities according to the population in the region and their estimated relative healthcare expenditure requirements. Under the current single health authority model, which is the largest in Canada, resources are allocated based on establishing budgets across 5 Geographic Zones as well as Provincial Programs (Programs that support all zones). This budget allocation accounts for local factors and needs as well as inter-zone activity (patients receive care in other Zones) and out of province activity (e.g. patients from other Jurisdictions). Budgets are reviewed and established annually during budget planning processes (i.e. demographic changes are monitored and budgets are then adjusted accordingly).</td>
</tr>
<tr>
<td><strong>England</strong></td>
<td>Resources should be distributed on the basis of equal opportunity of access for people with equal need across the country. Local areas with higher healthcare needs should get a larger share of NHS resources and allocations should be used in support of the aim of reducing health inequalities in access to services and also in health outcomes.</td>
</tr>
<tr>
<td><strong>New Zealand</strong></td>
<td>The aim of the population-based funding formula is to fairly distribute available funding between District Health Boards (DHB) according to the relative needs of their populations and the cost of providing health and disability support services to meet those needs. The population-based funding formula system aims to give each DHB a similar opportunity, in terms of health resources, to respond to the needs of its population.</td>
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<tr>
<td><strong>Scotland</strong></td>
<td>It is crucial that resources are distributed fairly across Scotland, taking account of the many factors that influence the need for healthcare in particular areas and the costs of supplying those services. The key objective for the NRAC formula is to measure relative need for healthcare services, so that resources can be allocated accordingly.</td>
</tr>
<tr>
<td><strong>Sweden (Stockholm)</strong></td>
<td>To adjust funding to match the characteristics of the population served, reduce administrative burden and promote proactive approaches to care, driven by innovation and new working practices. The principles guiding development were universality and social equity and the impetus for introduction of PBRA policy. Reforms from January 2016 was to stimulate the development of new forms of work and care that ensure accessibility and improve the care provided to people living with chronic illness or multimorbidity.</td>
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Table 3. Description of population-based resource allocation models.

<table>
<thead>
<tr>
<th>Overview</th>
<th>Services</th>
<th>Additional funding arrangements</th>
</tr>
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<tr>
<td><strong>Australia</strong></td>
<td>Global budgets are first decided for each of the nine core health programmes. Each geographical region's allocation of funding is adjusted taking into account: 1. Population size, weighted for age and gender in most instances; 2. Socioeconomic factors; 3. Rurality; 4. Unmet need (Ethnicity, homelessness); and 5. Private hospital utilisation.</td>
<td>- Population health  - Oral health  - Primary and community  - Outpatients  - Emergency services  - Acute inpatient  - Mental health (not in 2005)  - Rehabilitation and extended care  - Teaching and research</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td>The population's healthcare expenditure requirements are measured by taking into account: 1. Total population base of each region; 2. Age and gender of the population base; 3. Socio-economic composition of the population base; and 4. Services provided by regions to residents of other regions.</td>
<td>- Acute care  - Community-based services, including palliative care and home care  - Ambulance services  - Long-term care  - Mental Health  - Rehabilitation services  - Public health</td>
</tr>
<tr>
<td>Overview</td>
<td>Services</td>
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| **England** | Weighted capitation approach which involves calculating target allocations based on population size and then adjusting them for relative needs, unavoidable costs and health inequalities and unmet need. | • Acute services  
• Maternity  
• Community - district nursing and intermediate care  
• Mental health - community and acute mental health and learning disability services and Increasing Access to Psychological Therapies (IAPT) services  
• Primary care prescribing  
• Primary care  
• Public Health Grants to Local Authorities (outside of NHS) | • NHS England allocates budgets for Direct Commissioning of services (such as Public Health (Immunisations, screening etc.), certain specialised services, Armed Forces, Health and Justice, general practice and other primary care services (ophthalmology; dentistry, community pharmacy)), to support Providers, the Long Term Plan and central programmes and administration. |
| **New Zealand** | The population-based funding formula determines each District Health Board’s share of health and disability funding on the basis of:  
1. Its share of the projected 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 in reducing disparities between population groups; and  
3. A rural adjustment and an adjustment for overseas visitors, each of which redistributes set amounts of funding to recognise unavoidable differences in the costs. | • Preventative care  
• Public hospital services  
• Prescription drugs  
• Primary care (excluding adult dental services, orthodontics, physiotherapy and optometry)  
• Mental healthcare  
• Hospice care  
• Long-term care  
• Home care services  
• Disability support services | • DHBs are also allocated funding through permanent and temporary ‘top slices’, which consist of funding for national services (e.g. transplantation), transitional funding, temporary projects, bad debts, primary maternity services and a land adjuster. There are also transfers between DHBs to reimburse for inter-regional service utilisation and contributions to the tertiary adjuster. |
| **Scotland** | The ‘NRAC’ formula uses a weighted capitation approach with adjustments made to base population. Separate analyses are carried out for each health programme. The population size of an area is the starting point. This figure is then multiplied by the three indices to calculate a weighted population amount. The three factors that determine the indices are:  
1. Age/sex;  
2. Morbidity and life circumstances; and  
3. Unavoidable excess costs associated with service delivery in rural areas. | Hospital and Community Health Services:  
• Acute  
• Mental Health & Learning Difficulties  
• Maternity  
• Care of the Elderly  
• Community care programmes  
GP prescribing (considered separately) | • Revenue resources currently excluded from the NRAC Formula include allocations for general dental; general ophthalmic and community pharmaceutical services (Family Health Services); drugs misuse; and blood borne viruses. Some other funding streams, such as General Medical Services and capital allocations, are distributed using other formulae. |
| **Sweden** | The weighted capitation formula uses population size as the starting point. The factors used for adjustment are:  
1. Age;  
2. Adjusted Clinical Groups status, which classifies patients by a mixture of gender, age and morbidity burden/health situation; and  
3. Care Needs Index, which accounts for socio-economic circumstances including employment, education, and birth nation. | • Primary care  
• Basic home care | • Fee-for-service (encounters) (Primary care).  
• Goal oriented tasks (bonus-malus) (Primary care), accounting for approximately 22% of total allocation. |
Table 4. Variables used in population-based funding formulae.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Epidemiological</th>
<th>Unmet need</th>
<th>Adjusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td><strong>Gender.</strong></td>
<td><strong>NSW Health is exploring the potential for using these approaches. There are many practical issues to be dealt with before these approaches become feasible.</strong></td>
<td><strong>Aboriginal (excluded in 2005 revision).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Age in 5-year bands from 0-84 and then 85+.</strong></td>
<td></td>
<td><strong>Homelessness.</strong></td>
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<td></td>
<td><strong>NSW Health is exploring the potential for using these approaches. There are many practical issues to be dealt with before these approaches become feasible.</strong></td>
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<tr>
<td>Canada</td>
<td><strong>Gender.</strong></td>
<td><strong>Considered in planning phase but not included.</strong></td>
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<tr>
<td></td>
<td><strong>Age .</strong></td>
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<tr>
<td></td>
<td><strong>Ethnicity (Aboriginal).</strong></td>
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<tr>
<td></td>
<td><strong>Low-income status.</strong></td>
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<tr>
<td>England</td>
<td>Different models for different budget streams (e.g. acute and community). Each model includes some or all of the following:</td>
<td>Needs adjustments vary depending on the model. Examples include:</td>
<td><strong>Standardised mortality ratio &lt; 75 years.</strong></td>
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<tr>
<td></td>
<td><strong>Gender</strong></td>
<td><strong>Morbidity</strong></td>
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<td></td>
<td><strong>Age bands</strong></td>
<td><strong>Health status</strong></td>
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<tr>
<td></td>
<td><strong>Ethnicity</strong></td>
<td><strong>Utilisation of health services.</strong></td>
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<td></td>
<td><strong>Socioeconomic characteristics/ underlying indicators of deprivation.</strong></td>
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<tr>
<td>Country</td>
<td>Demographic</td>
<td>Epidemiological</td>
<td>Unmet need</td>
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<tr>
<td>New Zealand</td>
<td>• Gender.</td>
<td>Acute services:</td>
<td>• Māori or Pacific.</td>
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<tr>
<td></td>
<td>• 5-year bands from 0-84 and 85+.</td>
<td>• Standardised mortality ratio (age 0-74).</td>
<td>• deprivation quintiles 4&amp;5.</td>
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<td></td>
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<td>• Standardised long-term limiting illness (age sex standardised).</td>
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<td></td>
<td>Mental Health and Learning Difficulties services:</td>
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<tr>
<td></td>
<td>• Gender.</td>
<td>• Under 65 cohort: Scottish Index of Multiple Deprivation (employment and crime scores); hospital admissions due to alcohol; standardised mortality ratio with mental health as a cause of death for ages under 65.</td>
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<tr>
<td></td>
<td>• Age bands.</td>
<td>• 65 and over cohort: Hospital admissions due to alcohol; all-cause standardised mortality ratio for ages 65 and over.</td>
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<td></td>
<td>Maternity services:</td>
<td>• See Epidemiology column.</td>
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<td>• Mean house price; birth rate per female population; the Scottish Government Urban-Rural Category variable.</td>
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<td>Care of the Elderly services:</td>
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<td></td>
<td></td>
<td>• Same as Acute services.</td>
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<td>Community services:</td>
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<td></td>
<td></td>
<td>• No direct prediction of cost is done. The final MLC index for Community is calculated by using the predicted cost ratios from Acute Outpatients, Care of the Elderly, Mental Health &amp; Learning Difficulties and Maternity as proxy predictions for the various Community services.</td>
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<td>GP prescribing:</td>
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<td></td>
<td></td>
<td>• Same as Acute services.</td>
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<tr>
<td>Scotland</td>
<td>• Age (0-5; 6-64; 65-74; 75+).</td>
<td>Adjusted Clinical Groups (93 groups determined by a combination of morbidity, age and gender).</td>
<td>• Care Needs Index: elderly persons living alone, children under five, unemployed adults, adults with low education attainment, single parents, infants or elderly newly moved to the area, born in Eastern or Southern Europe (outside EU), Africa, Asia or South America.</td>
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<tr>
<td>Sweden</td>
<td>• Age (0-5; 6-64; 65-74; 75+).</td>
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Table 5. Criteria for choosing variables to include in population-based resource allocation.

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<th>Description</th>
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</table>
| **Australia**  | • Technical robustness  
• Minimising unintended incentives  
• Comprehensibility  
• Transparency and objectivity of the formula  
• Materiality  
• Use of reliable and up-to-date data  
• Stability and durability |
| **Canada**     | • Verifiable using local data  
• Parsimonious  
• Non-gameable  
• Equitable across all regions |
| **England**    | • Transparency and simplicity  
• Comprehensibility  
• Evidence base  
• Technical robustness  
• Objectivity  
• Flexibility  
• Parsimony  
• Plausibility  
• Clarity of contribution of indicators  
• Reliability of data  
• Freedom from perverse incentives  
• Durability and stability  
• Updateable |
| **New Zealand**| • Universally recorded, consistent and verifiable  
• Free from perverse incentives  
• Not vulnerable to manipulation  
• Reflects plausible determinants of individual need  
• Is not a measure of supply  
• Explains significant variation in the model  
• Feasible calibration to the model |
| **Scotland**   | • Equity  
• Practicality  
• Transparency  
• Objectivity  
• Avoid perverse incentives  
• Relevance  
• Stability  
• Responsiveness  
• Face validity |
| **Sweden**     | • Transparent  
• Provides robust predictions  
• Hard to manipulate |
In some jurisdictions - like Sweden - funding formulae are applied to specific services like primary or acute care, while in others - like New South Wales, Australia - PBRA models fund an explicit health benefits package or bundle of services offered nationally. The variation in services covered probably reflects differences in population entitlements, availability of data, degree of decentralisation and policy priorities. Moreover, across most jurisdictions studied, the arrangements for ‘top slicing’, transitional funding, and interregional or inter-programme transfers were poorly described and often lacked specific details on how models support service planning beyond the allocation of monetary resources.

Finally, a summarised account of the processes for reviewing and revising PBRA policy and model design across the six jurisdictions studied is presented in Table 6. Almost all had established expert advisory groups to review the structure of the formulae and the resource allocation estimates they generate. New Zealand, Scotland and England are examples of countries that publish reports and external audits of funding formulae on a regular basis. A small number described the explicit criteria guiding model development and refinement; however, overall, most policy documents provided limited details about how PBRA models are operationalised and evaluated.

Rapid Review

To develop a deeper understanding about the experience of PBRA, a rapid review was undertaken to summarise recent evidence on the impact and implementation of PBRA approaches in the six jurisdictions covered in this research. Eight relevant studies were selected for inclusion, reporting on PBRA in New Zealand (n=3); Stockholm, Sweden (n=2); England (n=1); Scotland (n=1) and Alberta, Canada (n=1). A comparative review that drew on data from these five regions as well as New South Wales, Australia and the Netherlands was also included in the analysis. Details on the selected studies as well as the key findings identified during the narrative synthesis are presented in Table 7 and are subsequently discussed in relation to three themes: the design, implementation and evaluation of PBRA policy.

**Design.** Evidence suggests that PBRA approaches have promoted technical efficiency1 in some cases, but that perverse incentives can remain if funding does not align with policy objectives. This emphasises the need to ensure a viable connection between policy goals and model design. In Stockholm, Sweden, for instance, evaluative data indicated that the transition to a fee-for-service approach in 2008 created incentives that were not aligned with the values underpinning the system (that is, equity). Because of this, they pivoted back to a needs-based system which demonstrably improved access for marginalised groups or those with greater health need28. Similarly, Alberta’s model employs a flexible needs-based resource allocation process rather than a hard formula to ensure that their funding model meets the stated aims of the policy, which is to ensure that all regions are able to operate on a more level playing field27.

**Implementation.** Since, in many countries, PBRA is still in a relatively early development stage, it is perhaps unsurprising that there is generally little evaluative research that moves beyond PBRA design to examine implementation, impact and outcomes. A key problem is the transition from the old allocation system to the new PBRA model, especially where that requires a significant shift in resources. This in turn raises questions as to how quickly to implement the new model and the availability of resources to do so. However, available research indicates that PBRA approaches can help to improve equity in terms of health outcomes28 and access29. In England, specifically, additional funding had a much greater impact in terms of reducing amenable mortality in areas of higher deprivation than in affluent ones28. The findings also suggest that funding models are critical to successful regionalisation policies22 and that variation in efficiency can be influenced by the provision (or lack thereof) of clear guidelines and direction provided by government30. All of this points to a degree of tension regarding decentralisation; that is, between providing structure and allowing for service delivery and planning to be informed by the local context.

**Evaluation.** As mentioned, robust governance and monitoring mechanisms can play a critical role in helping jurisdictions to assess and measure the extent to which their model design is delivering (or not) on their policy goals25. Importantly, however, even in countries like New Zealand where transparent evaluation processes exist (such as annual reports and external audits), there have been calls for improved accountability and public participation, particularly around model refinement31. Notably, civil servants and other stakeholders in Alberta, Canada played a crucial role in developing the design of the PBRA approach implemented, with strong stakeholder engagement being cited as a key factor for ensuring little opposition and a seamless transition to a needs-based funding model23.

**Discussion: Key implications for healthcare reform in Ireland**

PBRA features strongly in the literature as an approach to population health planning that can help to overcome many of the challenges associated with delivering effective and equitable care. Although the absence of progress on introducing any form of PBRA has been and continues to be a focus of criticism amongst Irish policy-makers and academics, it has more recently been presented as instrumental to SláinteCare implementation. This study undertook a documentary analysis and rapid review of international policy documents and published studies to examine the experience, impact and outcomes of population-based funding models in six high-income countries. Notably, despite the fact that PBRA is commonly referenced in the rhetoric around healthcare reform, there was limited available evidence to demonstrate whether (and how) it delivers. Nevertheless, this research finds that PBRA is viewed as a valuable policy lever to promote equity in health outcomes and access to services. A number of important lessons

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1 Technical efficiency refers to the process by which maximal outputs are obtained for a given set of inputs28.

27 This does not mean that regional disparities in health outcomes have been eliminated. In fact, they may have increased, as some regions have experienced greater improvements due to more effective resource allocation.

28 Technical efficiency refers to the process by which maximal outputs are obtained for a given set of inputs28.

29 Technical efficiency refers to the process by which maximal outputs are obtained for a given set of inputs28.

30 Technical efficiency refers to the process by which maximal outputs are obtained for a given set of inputs28.
<table>
<thead>
<tr>
<th>Country</th>
<th>Review Group</th>
<th>Review process</th>
<th>Transparency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Resource Distribution Formula Advisory Committee.</td>
<td>The Resource Distribution Formula was reviewed on an annual basis by the Advisory Committee.</td>
<td>The last report made available was the Resource Distribution Technical Paper written in 2001 but published in 2005. There are no yearly reports published to confirm the updates that occurred until the model was replaced with activity-based funding in 2014.</td>
</tr>
<tr>
<td>Canada</td>
<td>The Auditor General of Alberta.</td>
<td>The Office of the Auditor General, under the Auditor General Act, audits the financial statements of the Province of Alberta on a yearly basis.</td>
<td>The financial statements and the auditor general's reports are included in the annual reports published by the Government of Alberta, its ministries and their related entities.</td>
</tr>
<tr>
<td>England</td>
<td>Advisory Committee on Resource Allocation (ACRA) is responsible for the target model.</td>
<td>Ongoing review and development cycle by ACRA.</td>
<td>All documentation pertaining to annual reviews and final allocations are made public through the NHS website.</td>
</tr>
<tr>
<td>New Zealand</td>
<td>The Population-based Funding Formula Technical Advisory Group comprising members from the DHBs, the Treasury and the Ministry of Health.</td>
<td>Reviewed every five years by the technical advisory group. The 2015 Review report was also audited by an independent auditor. The review process considers the core model and adjusters separately. The overall aim of the review process is to examine the structure of the current PBFF to ensure it allocates funding equitably according to the relative need of PBFF populations.</td>
<td>The most recent review was completed in 2015 and is published on the Ministry for Health's website. The 2015 review also outlines the four criteria that guided their assessment of the population-based funding formula: 1) Robustness (based on appropriate methods with reliable data); 2) Legitimacy (a transparent framework); 3) Efficiency (all variables should be significant and legitimate determinants of need or spending); and 4) Effectiveness (generates actionable information and does not contribute to perverse incentives).</td>
</tr>
<tr>
<td>Scotland</td>
<td>Technical Advisory Group on Resource Allocation (TAGRA).</td>
<td>TAGRA initiates reviews of the formula components as judged appropriate in the light of service and data developments and monitors resulting allocations.</td>
<td>All data are made publicly available through Public health Scotland. Yearly reports from TAGRA are published on their website. NRAC reports have undertaken extensive research and consultation with the Final Report published in September 2007</td>
</tr>
<tr>
<td>Sweden</td>
<td>SKR - “SALAR” – the Swedish Association of Local Authorities and Regions.</td>
<td>In Swedish local governments, the Council elects at least five auditors, nominated from political parties, who examine the executives and committees with independence and objectivity. The auditors collaborate with professional auditors, who are experts in public sector and/or chartered accountants.</td>
<td>Reports from SKR are made publicly available through their website.</td>
</tr>
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</table>
Table 7. Details and key findings from selected studies on population-based resource allocation (n=8).

<table>
<thead>
<tr>
<th>Reference</th>
<th>Type</th>
<th>Country</th>
<th>Description</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| McIntosh et al.    | Peer-reviewed | Canada (Alberta)               | Description of development or implementation of population-based resource allocation policy. Uses a multi-methods design comprising literature reviews, policy analysis and semi-structured qualitative interviews. Thirty case studies were examined. | • All provinces that have implemented population-based resource allocation have done so in conjunction with regionalisation.  
• A needs-based funding model was developed in Alberta by civil servants with input from various stakeholders. The process drew on experience from other jurisdictions, in particular England.  
• The core principles the model needed to adhere to were established at the outset of the process. Similarly, four funding criteria were also identified and used to guide development and implementation.  
• The needs-based model ‘explicitly attempted to remove personal and political preferences from influencing the allocation of healthcare dollars’.  
• Key informant interviews found there was little opposition to implementing the needs-based funding model. This was driven by two factors: 1) general consensus that the system was flawed and needed to be addressed and 2) the Department of Health was successful in engaging stakeholders.  
• The model was introduced with a ‘no loss’ provision to address any potential gaps in funding during the transitional period. While some argued this arrangement conflicted with the equity objective of the policy, other informants suggested the provision was key to minimising objections from stakeholder groups.  
• At the government level, civil servants were regarded as the largest proponents of developing the need-based funding model. Proposals were discussed with politicians prior to approval. The process was resource-intensive and may have distracted attention away from the broader agenda of systems reform.  
• The model did not change the fee-for-service payment model for physicians. |
| Penno et al.       | Peer-reviewed | Australia, Canada, England, New Zealand, Scotland and Sweden (and the Netherlands) | Descriptive comparison of the content of population-based funding formulae. | • There were considerable differences in the structure of population-based funding models.  
• There were three recurring themes when examining the models: 1) All models begin with population size and attempt to identify legitimate factors that influence demand for services. These factors are deemed to reflect health need and may be proxies (e.g. age, gender, deprivation) or actual measures of health (disease status); 2) Most of the models adjust funding for factors other than health need, including rurality and private insurance status; and 3) some models have incorporated factors that make allowances for unmet need among populations (e.g. ethnicity, morbidity).  
• There has been a trend towards including epidemiological data in models, reflecting improvements in data collection and an inclination to capture more manifest measures of health.  
• All models are utilisation-driven, which may reinforce inequities in service provision and access. Of the few models that currently attempt to adjust for unmet need, the variables used are quite limited.  
• Demographic data alone are a poor predictor of healthcare expenditure for both individuals and the entire health system. Funding models that rely on demographic data alone would benefit from further refinement.  
• Further development or refinement of models should be informed by research into how well various approaches provide for the actual costs of meeting healthcare needs. |
<table>
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<tr>
<th>Reference</th>
<th>Type</th>
<th>Country</th>
<th>Description</th>
<th>Key Findings</th>
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</table>
| Barr et al. (2014)         | Peer-reviewed | England                   | A longitudinal ecological study evaluating the impact of population-based resource allocation policy on health inequalities between 2001 and 2011. | • The allocation of resources increased in real terms in the most deprived areas. They also increased in affluent areas, but to a lesser degree.  
• There was a decline in absolute terms in inequities in mortality from causes amenable to healthcare between 2001 and 2011.  
• Observed reductions in absolute health inequalities was statistically associated with resource allocation policy in England. Each additional £1.00 of resource allocation generated greater absolute improvements in mortality from causes amenable to healthcare in the most deprived areas than in affluent areas.  
• Findings suggest the policy contributed to a reduction in absolute differences in health outcomes and relative differences remained stable throughout this period. |
| Agerholm et al. (2015)     | Peer-reviewed | Sweden (Stockholm)        | Analysing differences in GP visitation patterns pre- and post-reform of primary care reimbursement system. | • Findings suggest reforms provided no real benefit for those with greater health needs, with a negative impact on equity in access to primary care services.  
• While there were increases in the total number of GP visits between the two periods (2007 and 2011), the increases were larger for healthy individuals than for those with a health condition or poor self-rated health. |
| Sandiford et al. (2017)    | Peer-reviewed | New Zealand               | Applies data envelopment analysis techniques to examine the technical efficiency of District Health Boards in achieving gains in life expectancy among Europeans and Maoris. | • Efficiency in achieving life expectancy gains were reasonably high, ranging from 79 to 100 percent. Canterbury had the lowest efficiency, which may reflect disruption to services and negative health impacts caused by the 2011 earthquake.  
• Efficiency was strongly correlated with financial performance across the District Health Boards. Canterbury was excluded from this component of the analysis.  
• The high level of efficiency seen across all District Health Boards may be attributable in part to standardised guidelines and policy direction provided by the Ministry of Health. These reduce the potential for substantial variation in service delivery. |
| Chester et al. (2018)      | Peer-reviewed | New Zealand               | Thematic analysis of newspaper articles reporting on the population-based funding formula between 2003 and 2016. | • The findings suggest there is a general dissatisfaction with the population-based funding formula (PBFF) across the District Health Boards. The PBFF was usually reported in a negative light, with much of this linked to perceived shortcomings in the model's ability to adequately account for the demographic and geographic challenges facing District Health Boards.  
• The PBFF was often mentioned in the context of the financial constraints or deficits experienced by District Health Boards. These discussions usually included comparisons of resource allocation across District Health Boards.  
• In many instances, the PBFF was seen as having a negative impact on District Health Boards' performance including reduced service delivery, staff redundancies and limited recruitment of doctors.  
• There was some coverage on the factors used to adjust for need in the PBFF, however this focused primarily on population ageing, rurality and population growth.  
• The PBFF is a target for channelling frustrations around resource allocation to the District Health Boards. Improving transparency and promoting stakeholder engagement around refinement of the PBFF may go some way towards addressing the concerns. Given the emphasis on comparisons of resource allocation across District Health Boards, there is also a need for ongoing monitoring of performance. |
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<th>Country</th>
<th>Description</th>
<th>Key Findings</th>
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</table>
| Andrews (2020)  | Peer-reviewed | New Zealand | Applies data envelopment analysis techniques to examine the technical efficiency of District Health Boards in providing hospital services between 2011 and 2017. | • The technical efficiency scores for the 20 District Health Boards ranged from 77 to 96 percent, with a mean of 90 percent.  
• On average, District Health Boards in areas with high deprivation rates were less efficient than those with less deprivation.  
• Technical efficiency tends to decrease with increased average length of inpatient stay.  
• The resource allocation model, in which funding follows the patient through transfers between District Health Boards, may create perverse incentives. These result in longer average hospital stays and delayed access to tertiary care in District Health Boards that provide only secondary care. |
| Burstrom et al. (2017) | Peer-reviewed | Sweden     | A scoping review examining the impact of primary care services reform introduced in 2010. | • In 2008, needs-adjusted allocation model for primary care was replaced with a mixture of fee-for-service (60%) and capitation based on the number of listed patients in the population (40%). The capitation component was weighted only by the number of patients aged 65 and over. The objective of the reforms was to promote patient choice and create equal terms for providers.  
• Overall, the evidence about the impact of the reimbursement reforms is limited.  
• Primary care centres in disadvantaged areas were disproportionately impacted by the reimbursement reforms, with some reporting up to 30% reductions in annual funding.  
• Activity data indicates that the number of visits per person increased between 2005 and 2012, but at a much lower rate among people with greater needs (particularly women) and male immigrants living in more disadvantaged areas. There were also notable increases in utilisation among individuals who did not have a diagnosis indicating higher need for healthcare services.  
• The resource allocation model was replaced again in 2016. The current model is a mixture of capitation (60%) and other factors including activity and quality of care (40%). The capitation component is weighted by socioeconomic factors and case-mix grouping.  
• A survey of primary care centre managers reported significant dissatisfaction with the reimbursement model introduced in 2008. The majority believed the model incentivised shorter visits and not prioritise people with the greatest health need. |
for Sláintecare emerged that require careful consideration to ensure PBRA can be translated into implementable policies. These will now be discussed in relation to the three stages of PBRA policy development that emerged from the analysis – design, implementation and evaluation – with a key focus on their relevance for Irish decision-making as the country progresses its agenda for universal healthcare.

Designing population-based resource allocation

The findings suggest that before any technical aspects of the model should be considered, clearly defining the objectives and rationale of the model is key. International evidence suggests that this is critical since the overarching goal will influence the type of model or approach required to achieve it, whether it is equity in healthcare outcomes, adjusting funding to match need or equal opportunity for service regions. Moreover, this goal orientation will also guide and affect all other aspects of implementation, including assessment through ongoing monitoring and evaluation. There is therefore a need for Irish decision-makers to explicitly identify the stated objectives of the model at the outset of policy development beyond simply acknowledging the aim of supporting Sláintecare. Notably, the findings indicate that this process would be bolstered by establishing clarity and standardisation of terminology as well as enabling stakeholder involvement; all of which would help to create trust in a shared vision of the model and foster commitment to partnership. For this reason, consensus and a shared understanding amongst stakeholders about how these aspects of PBRA are articulated and mobilised in Ireland should be a critical first step to maximise outcomes. Whether Sláintecare’s PBRA approach aims to achieve health equity or universal access to care, the rationale should be carefully considered, collaboratively developed and clearly articulated.

The review emphasised that it is also critical is to ensure that policy objectives are aligned with the model design. We acknowledge that there is currently no consensus regarding the ideal framework for PBRA models and that approaches will be context specific insofar as they reflect a mix of technical, practical and political factors. However, evidence from other countries revealed a number of contextual considerations for Sláintecare’s PBRA model development that could help to link the overarching policy goal(s) with model design to maximise outcomes. These include identifying:

- the proportion of total funding that should be allocated using the model;
- the range of services covered by the funding formula;
- the characteristics most likely to reflect differences in need for healthcare services;
- the weightings assigned to different types of services;
- whether or not it is appropriate to compensate for regional differences in costs; and
- the legitimate determinants of costs and avoiding capturing supply-side factors.

Critically, this not only requires access to appropriate universally recorded, regularly updated and reliable data on the factors deemed relevant to modelling health need, but also accurate data on costs to model expected expenditure and any unavoidable differences between regions. This is a complex exercise that, in turn, requires a range of expertise in relevant subject matters (such as health policy, public health, epidemiology and health systems performance) as well as health intelligence and data analysis. Following New Zealand, for example, it could be argued that Ireland’s model should be designed to adjust for ethnicity to reduce known disparities in health outcomes amongst those in the Traveller community and other ethnic minorities. In this instance, it would be important to ascertain what kind of data are available to assist with this; whether these data are accessible and reliable in that they are uniformly and systematically collected; and what the weighting assigned to different types of services should be.

International experience has demonstrated that a multidisciplinary approach to design can help to address these issues and ensure the model is both aligned with the broader objectives of health systems reform and measures performance on related metrics. As such, Irish policy-makers must consider the best way to facilitate partnership working across disciplines and settings to not only define and capture population need, but also identify the services and capacity required to meet that need. Since health services often struggle to develop adequate levels of technical expertise, initiatives to support improvements in workforce capacity – including education and training, professional development schemes and stimulating demand from leaders - will be crucial to this process.

Implementing population-based resource allocation

A key theme that emerged from the review was the need to support decentralised resource allocation. Population-based funding formulae are regarded as an essential prerequisite of successful decentralisation policies. Having a clear budget, along with appropriate guidance, provides regions with the flexibility required to respond and adapt to local circumstances. With robust outcome measures and data collection in place, regions can also be accountable for their performance, not just in terms of activity and financial control, but also in terms of their contribution to the health status of the populations they serve. However, the literature from New Zealand revealed a tension between national policies and strategies and allowing service planning and/or delivery to be informed by local contexts; while in England, challenges have arisen when resources were allocated to the local levels (or the regions, in the Irish context) but they did not have the autonomy or capacity to utilise them well. Moreover, across all jurisdictions studied, the arrangements for ‘top slicing’, transitional funding, and interregional or inter-programme transfers were poorly described and policy documents typically lacked clarity about the specific mechanisms that can support integrated care in addition to the allocation of funding.

A key learning for Ireland is that PBRA policy is not a panacea for health system reform. In other words, it is not just about providing the ‘right’ proportion of a budget to each region to
deliver healthcare services; rather, for PBRA to be effective, other elements necessary as part of a broader programme of health system reform must be in place - such as workforce planning and clarity on an entitlement to universal healthcare - to enable the regions to successfully adapt to their population’s needs. For this reason, it is critical to identify all mechanisms beyond the provision of funding that need to be up and running at the regional level to support the operationalisation and efficacy of PBRA. Put simply, if healthcare is to be delivered via the regions - as envisioned in the Sláintecare Implementation Strategy and Action Plan 2021 - 2023 - key decisions are required about how much healthcare will be delegated to the regions; how much autonomy they will be given, particularly around workforce; and how they will be supported to utilise funding effectively. These decisions need to be made in advance of being able to progress the PBRA model.

Evaluating population-based resource allocation

Finally, the review highlighted the importance of developing robust governance and evaluation mechanisms. PBRA policies are well-established in many countries; however, there are fewer details on the criteria used to evaluate population-based models. This is despite the literature suggesting that it is critical to monitor and assess whether the model is delivering and to adjust as needed to meet the stated policy objectives. Indeed, the implementation of PBRA is an ongoing, emergent and complex process and, as shown, there is evidence from the Swedish and Canadian experience to suggest that stakeholder engagement or consultation (particularly with the public) is a key mechanism to ensure PBRA approaches are effectively developed over time.

An important implication for Sláintecare is that clarity on governance structures for PBRA in the context of broader health system and policy goals in Ireland will be important; as will be developing from the outset a system for transparent research and reporting on the impact and evaluation of PBRA. Mechanisms for ensuring this can include: the establishment of an expert advisory group to review the structure and outputs of funding formulae; providing detailed information about the criteria guiding model refinement; and/or the publication of reports or external audits on a consistent basis. Since PBRA is a process that should be amended as Ireland’s population profile and needs change over time, important decisions will therefore be required in relation to how the model will be continuously and rigorously monitored, evaluated and refined to allow for future changes. A robust governance and monitoring system will, in turn, enable these learnings to be fed back into the system to maximise health outcomes in the Irish context.

Limitations

Rapid reviews are a well-established methodology for gathering evidence in a limited timeframe; however, any rapid review is vulnerable to missing relevant material, either through misspecification of search terms or errors in review. We mitigated these risks by establishing clear eligibility criteria prior to data collection and searching. We had to restrict the number of countries included in our documentary and rapid review for reasons of feasibility; because of this, jurisdictions with relevant policy and practice documentation may have been missed. Finally, we sought to minimise investigator bias in a number of ways. Firstly, by selecting countries according to criteria established ex ante and consulting local experts in each of the six regions studied during the documentary analysis; and secondly, by including interdisciplinary experts on the research team to review and discuss material during the narrative synthesis.

Conclusions

Discussions about the design and implementation of PBRA approaches have tended to be orientated towards the technical or data-driven aspects of model or formulae construction. However, what this review has demonstrated is that PBRA is perhaps better framed through the lens of systems-thinking, whereby it is conceptualised as just one component of reform that is interacting with and within a broader complex (health) system. From this perspective, it is only through developing in-depth knowledge of all of the ‘parts’ and how they interact (or not) that the whole system can be understood and made to work effectively and efficiently. The findings, then, arguably have important implications, relevance and applicability for Ireland’s broader programme of health system reform, particularly as it relates to other aspects of Sláintecare’s implementation including workforce planning, regionalisation and ensuring equitable access to universal healthcare.

Since “it is people and not structures” that give meaning to the development of population health approaches (39 p. 274), enacting PBRA reforms and implementing change requires not only a complexity-sensitive programme that acknowledges the importance of context in shaping outcomes; but also deep understanding of the underlying reasoning behind all decisions made. In dynamic health systems of this kind, there are no clear-cut answers about the ‘best’ or ‘right’ way to design or operationalise PBRA policies; nevertheless, the evidence and analysis presented here provide a useful foundation for discussion and debate amongst policy-makers as well as health system leaders, planners and academics. In particular, it points to how PBRA - as part of large-scale health system reform - can be thoughtfully developed, monitored and adjusted in a way that is more than a technical exercise to fundamentally reshape the Irish health system and support the goals of Sláintecare.

Data availability

Underlying data

All data underlying the results are available as part of the article and no additional source data are required.

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4 Examples of other important policy tools that could potentially be used in conjunction with funding formulae to achieve policy objectives include clinical practice guidelines, regulation policies and performance monitoring.
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References

35. Smith PC: Formula funding of health services: learning from experience


