World Health Organization

REGIONAL OFFICE FOR Europe

Improving the allocation of health care resources in Poland

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ABSTRACT

Poland has been going through a series of health care reforms with the intention of further improving its health care system. While some changes have been successfully initiated, access to health care remains inequitable and - to some extent - limited; also further improvement is needed in the efficient operation and coordination of the health care system. With better allocation and/or utilization of health care resources it should be possible to reach an approximation to European levels of health status. The aim of the report is to explore ways in which the macro-level resource allocation can be improved to best serve the purposes of the Polish health care system, and to propose methods to pursue this development process. To accomplish this, the Polish context and the aims of strategic resource allocation were explored, international literature on macro level resource allocation was reviewed and tools, methods, practices and procedures for further improvement are proposed.

Keywords

HEALTH FINANCING
HEALTH POLICY
HEALTH SYSTEMS
RESOURCE ALLOCATION
CAPITATION
RISK ADJUSTMENT
POLAND

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Content

Acknowledgements

This report is an output of the Biennial Collaborative Agreement 2012–2013 between the Minister of Health of the Republic of Poland and WHO Regional Office for Europe. It was produced under the technical guidance of Dr Tamás Evetovits, Head of Office a.i. and Senior Heath Financing Specialist, Barcelona Office for Health Systems Strengthening, Division of Health Systems and Public Health, WHO Regional Office for Europe. The study is derived from the efforts undertaken to collect and analyze the data through quantitative and qualitative tools.

A number of people and organizations should be acknowledged for their substantial technical and scientific contributions in the preparation of this publication:

- Dr Anatol Gołąb - Deputy Director of Department of Health Insurance, Ministry of Health
- Dr Barbara Więckowska - Director of Department of Analysis and Strategy, Ministry of Health
- Mr. Stefan Gabiński - Main Specialist of Department of Health Insurance, Ministry of Health
- Mr. Dariusz Jarnutowski - Director of Department of Economy and Finance, NHF Headquarters
- Mr. Marian Mackiewicz - Deputy Director of Department of Economy and Finance, NHF Headquarters
- Mr. Krzysztof Grzegorz Strzalkowski - Vice – Marshal of the Mazowieckie Voivodship
- Ms. Agnieszka Gonczaryk - Director of Department of Social Policy and Health, The Office of the Marshall of the Mazowieckie Voivodship
- Dr. Krzysztof Romanowski - Deputy Director of Department of Social Policy and Health, The Office of the Marshall of the Mazowieckie Voivodship
- Ms. Monika Sokulska - Director of Department of Owner Supervision and Investments, The Office of the Marshall of the Mazowieckie Voivodship
- Prof. Stanislawa Golinowska - Head of Health Economics and Social Security Department, Institute Of Public Health, Faculty of Health Science, Jagiellonian University Medical College
- Dr Christoph Sowada - Health Economics and Social Security Department, Institute Of Public Health, Faculty of Health Science, Jagiellonian University Medical College
- Dr Adam Kozierkiewicz - JASPERS, European Investment Bank

Special thanks to Dr Paulina Miskiewicz, Head of WHO Country Office in Poland and Julia Cendrowska, intern in WHO Country Office for Poland for their valuable support and to Mr László Szilberhorn for the assistance in the preparation of the literature review which was highly appreciated.

Executive summary

Poland has been going through a series of health care reforms and is aiming to further improve its health system. Strategic resource allocation is one important tool for improving the efficiency and equity of the health system. To assess the potential of this instrument in achieving a more equitable and more efficient delivery system, a careful analysis of the current system is needed including the exploration of causes of poor performance. Once the starting point is established and reform objectives are clearly articulated, the role of strategic resource allocation in the context of the health care reforms can be defined.

The resource allocation algorithm in Poland has been developed over the past 15 years. The current scheme distinguishes the higher and lower cost/risk services, and adjusts for age and gender in both service groups. While the earlier approaches tried to go beyond demographic characteristics and seemed to favor the "richer" voivodships, the recent scheme is closer to the pure age and gender-specific approach, and support the "poorer" voivodships. There have been arguments for and against both approaches but neither of them has been justified by evidence which has resulted in serious conflicts between the regions and central government.

Considering there is very little known about the reasons behind the different patterns of regional level allocation, it cannot be determined whether the current formula reflects the real needs of the population or not. Whether the current utilization reflects efficient allocation of health-care resources is also not known. Therefore it is recommended to explore i) area level healthcare needs and the relationship between needs and expenditure and also ii) the relationship between utilization patterns, and healthcare expenditure in different regions.

The aims of improving resource allocation and the future design of the polish health system will fundamentally determine what type of model can be considered relevant. When the reflection of population needs is an important policy goal, finding independent measures, unaffected by utilization or supply, is the primary and most challenging task during the model development process. When efficiency as a goal has priority and the budgeting system seeks to make purchasers and providers more focused on the costs and benefits of their actions, covering the risk of the affected population and encouraging treatment of important disease areas are most desirable.

The technical development of the formulas over time has been a major intellectual achievement in many countries, engaging some of the most capable statisticians, econometricians and health service practitioners. Such experts are also essential for the development process in Poland. Formula development also involves large data requirements, strong analytical skills and in-depth knowledge of the incentives in the allocation system. Systems can differ in various characteristics and the differences in their performance may be explained by numerous factors. Comparing the performance of inherently different allocation algorithms is not encouraged. It is advisable to benchmark and develop each system, such as the Polish, by its own standards.

Since the formulas influence the redistribution of resources, these are often regarded as tools of governance. Each implementation or reform has winners and losers, supporters and opponents, and as long as "perfect" risk assessment is not feasible, a political choice between more or less imperfect schemes, reflecting views on equity and efficiency, has to be made. In case of a particular model choice the question can be asked whether it should be a preliminary "passive" tool intended to neutralize the financial consequences of differences between risk structures or whether it supports a

more “active” avenue for policy implementation which is moving the system towards the construction of “optimal” allocations.

Apparently, risk adjusted capitation schemes can be further refined by complementary methods, such as prospective and retrospective risk sharing, monitoring, quality assurance of data, and delivery of care. The general intention should be to use an optimal blend of prospective and current information and complementary methods with the aim of maximizing incentives for efficiency, promoting equity, and minimizing adverse incentives.

The complete process of defining a funding formula which meets resource allocation goals and successfully comprises risk adjustment, risk sharing and other complementary policies is expected to take a minimum of 5-10 years. Based on international experience, a gradual move from a less sophisticated formula and strong initial risk sharing mechanism towards a more developed formula which is combined with fewer risk sharing arrangements is advised.

The main options and possible consequences are summarized in Table 2 of the report. The options presented are subject to further refinement on the basis of decisions on important macro-level goals and system development tools which are to be refined together with formula development. Improvement and specification of the formula has to be done as an integral part of health system development, in line with the aims and instruments supporting the equity and efficiency objectives of the Polish health care system.

Introduction

Poland has been going through a series of health care reforms with the intention of further improving its health care system. While some changes have been successfully initiated, access to health care remains inequitable and - to some extent - limited; also further improvement is needed in the efficient operation and coordination of the health care system. There is a huge potential for improvement of the health care system as the health status of the population is significantly below the European average. With better allocation and/or utilization of health care resources it should be possible to reach an approximation to European levels of health status.

Strategic (macro-level) resource allocation is one important tool for improving the efficiency and equity of the health care system. Poland has been developing its own macro-level allocation mechanism for 15 years. The formula is quite simple and has only changed modestly since its first launch in 1999, adjusting slightly to adapt to the changing health policy requirements.

This report was commissioned by the World Health Organization Regional Office for Europe in collaboration with the Ministry of Health in Poland. The aim of the report is to explore ways in which the macro-level resource allocation can be improved to best serve the purposes of the Polish health care system, and to propose methods to pursue this development process. To accomplish this, the Polish context and the aims of strategic resource allocation were explored, international literature on macro level resource allocation was reviewed and tools, methods, practices and procedures for further improvement are proposed.

Methods

A non-systematic review of the literature was carried out to explore the Polish context which was supported by personal consultation with Polish experts and stakeholders[1]. An international literature review on strategic resource allocation methods was carried out through desktop research using the research engines of Google and scientific databases such as Science Direct, Google Scholar and Pubmed, and through snowball research using key recent papers (especially from the last 10 years) and also using important findings of previous literature reviews. The results were presented and proposals were drafted based on the three former research methods of 1) Polish and 2) international reviews, and 3) discussions with local experts and stakeholders. Recommendations were made accordingly.

[1] Meeting with Barbara Więckowska – Director of Department of Analysis and Strategy and Anatol Gołąb - Deputy Director of Department of Health Insurance. Location: WHO CO POL, Al. Jerozolimskie 155, Warsaw.
Teleconference with Dr Christoph Sowada, Health Economics and Social Security Department, Institute Of Public Health, Faculty of Health Science, Jagiellonian University Medical College.
Meeting with Krzysztof Grzegorz Strzalkowski, Vice – Marshal of the Mazowieckie Voivodship, Agnieszka Gonczaryk, Director, Department of Health, Krzysztof Romanowski, Deputy Director. Monika Sokulska – Director, Department of Owner Supervision and Investments. Location: Jagiellonska 26, IV floor, room 427.
Teleconference with Prof. Stanislawa Golinowska, Head of Health Economics and Social Security Department, Institute Of Public Health, Faculty of Health Science, Jagiellonian University Medical College.
Teleconference with Dr Adam Kozierkiewicz, JASPERS, European Investment Bank.

Polish context

Health status of the population

According to the latest HIT report (Health Systems in Transition, Sagan et al., 2012) there was a large gap in life expectancy between Poland and the western EU countries which had widened considerably between 1975 and 1991, and has only recently started to narrow. Life expectancy at birth in Poland since 1991 has increased in parallel with the average of other new EU Member States. In 2009, it reached 80.2 years for women and 71.6 years for men. However, the increasing trend in life expectancy overall is not apparent when looking at healthy life-years. There is still a considerable gap between life expectancy overall and the expected number of years without illness or disability, measured by healthy life-years and disability-adjusted life expectancy, respectively (Sagan et al., 2011). Cancer and its treatment is a notorious example of how Polish health status has fallen behind the European level. Glogowski reported that survival rates for patients with oncological diseases lagged the European average by 5 years, and Poland came very low in the rankings compared to western European countries. Even worse, these statistics have not seen a noticeable improvements over the years (Glogowski, 2011).

Inequality and inefficiency in allocation of health care resources

The Polish health care system struggles both with inequalities (especially in access to health care provisions) and with inefficiencies in the coordination and allocation of health care. While no major differences are observed based on patients' social or economic status at the primary health care level, the same cannot be said for specialist or dental care, where urban patients with a higher income and more education use services more often (GUS, 2007). The limited access to diagnostic equipment in the public system is especially visible for cancer, for which an early diagnosis is crucial to successful treatment. Access to magnetic resonance imaging (MRI) services is only about a third of the average level of OECD countries (Boulhol & et al., 2012). Many further organizational and financial influences, such as ineffective screening programs, late referral to the doctor, delayed diagnosis and admission for surgery or radiotherapy, and delayed access to modern drugs are behind the deficiencies (Glogowski, 2011). On the other hand, the overuse of progressive levels of health care is also apparent. One out of ten Polish citizens is admitted to a hospital or other inpatient health care institution, whereas only about 1% receives health services at home (home visits, home kidney dialysis, injections, post-surgery care, etc.) (Sagan et al., 2011). Furthermore, Polish health outcomes appear weak in cross-country comparison when looking at self-reported unmet care needs (Boulhol & et al., 2012). While most of the health indicators place Poland at the bottom of international rankings, expenditure on health care is among the lowest in the European Union and the OECD (Glogowski, 2011). It seems very likely that allocative efficiency improvements in the poorer regions can be achieved, where a less healthy lifestyle is more common, but access to health care resources is more limited.

Macro-level structure of the health care system

Poland has a single-payer health insurance system with limited role for private insurers and companies offering supplementary coverage for some diagnostic and outpatient specialist services. The contribution to the compulsory health insurance system amounts to 9% of earned income (including pensions and other social security benefits). Revenues are pooled centrally by the National Health Fund (NHF) which is responsible for the allocation of these public resources to regions and ultimately

to health care providers. Private expenditure on health is substantial, accounting for almost 30% of total health expenditure mostly in the form of out-of-pocket payment by patients.

Throughout the past decades the Polish government introduced a series of health care reforms in order to achieve a more efficient and equitable system. For a summary table of reforms see Appendix 1 . The changes concerning the macro-level allocations are discussed below.

At the start of the political and economic transition in 1989, Poland was divided into 49 regions which received their budgets for health care directly from the Ministry of Finance, while The Ministry of Health and Social Welfare was responsible for the major part of national level health care provision (i.e. drug, hospital, ambulance and prevention programs) (Pieprzyk, 2013). In 1999, the system shifted from a centralized state financed system with a national health service apparatus to a decentralized mandatory health insurance system with regional sickness funds. Since then, three levels of territorial administration and local and regional government have been in operation. The principal unit of administrative division with local government status is the *gmina*[2]. It is followed by the *powiat*[3] and the *województwo*[4](voivodships), which form the second and third levels of administration/local and regional government respectively (Pieprzyk, 2013). The population of the voivodships varies between 1.02 million and 5.30 million. In 2003, sickness funds were eliminated so that the regional funds transformed into the single National Health Fund and one central payer was established (Glogowski, 2011). Today the NHF operates through its 16 regional branches and since 2005 the stewardship, management and financing functions have been shared between the NHF, Ministry of Health and the local and regional government administrations (Engqvist, 2012).[5]

"The system that has functioned since then [ed. 2003] has all the hallmarks of a monopsonistic system. Hospital health care services and ambulatory specialist services, financed from public funds, are delivered by health care providers who have entered into agreements ('contracts') to provide health care services. Patients are helped on a first-come, first-served basis, that is, in the order they are registered on the waiting list. The provision of health services is determined by hospital resources and the ability to finance the services by the NHF" (Glogowski, 2011). The NHF establishes general rules for contracting services for the 16 regional branches and providers in the voivodships[6]. The regional branches are responsible for contracting health care services and divide their budgets between various types of services (Sagan et al., 2011). While the NHF branches finance health services provided to the entitled population and negotiate contracts, regional governments (voivodships) are responsible for i) the provision of health tasks determined by law, and ii) the assessment of the adequacy of service provision and health care infrastructure.[7]

[2] Often translated as commune or municipality.
[3] Often translated as a county or a district.
[4] A voivodship, or an area governed by a voivode; also translated as a region.
[5] In 2010, the NHF had a budget amounting to PLN 57.465 billion.
[6] Some general rules are also established a by MoH regulations (mainly connected with the basic benefit package). Many specific rules are established by the director of the NHF branch (e.g. contracting of particular service areas, quantity of services purchased).
[7] Local and regional governments also have a so-called quasi-owner position (they are establishing bodies) for the majority of public outpatient clinics and hospitals.

Strategic resource allocation: history and relation to the health system goals

The centrally pooled contributions are divided by the National Health Fund between its branches according to a pre-defined resource allocation formula.

Nature and evolution of the allocation scheme

Since it was first used in 1999, the allocation and equalization algorithm has been constantly changing, although its fundamental determinants have varied very little. Number, gender and age structure of the insured persons and the amount of allowances formerly granted are the fundamental determinants. Over the years certain changes have been introduced to account for differences in the costs of production of medical services (e.g. remuneration of medical personnel), regional differences in the utilization of health care services, and migration between voivodships. In 2008, for example, the average monthly household income of each voivodship was used as a determinant of regional labor costs (regarded as a proxy for differences in the cost of production of health care services). The drawback of using such a supply related adjustment was that the poorest regions received less money for each medical treatment. Also a direct cost adjustment was introduced recently: in 2006 and 2010, a special approach was used to account for the cost and amount of "normal" and highly specialized services provided (Sagan et al., 2011). The rationale behind these changes was to adjust for i) the differences between the regional level utilization/supply and ii) for the regional level health care consumption which can be associated with needs. These often conflicting goals drove the allocation levels in various directions which resulted in conflicts between the winners and losers and put the health care administration under constant pressure. These conflicts are viewed as important drivers for the practice of frequent changes in variables inconsistently adjusting for health needs and health care supply. Currently there is intense debate over whether supply side variables should be used in the formula (see more in section Results of the allocation).

The principal goal of facilitating equal access to health care through resource allocation is defined by the Health Care Act, but its implementation is not guided by any published documents. The Act on "Health services financed from public sources" says its main purpose is to ensure equal access to health care[8]. Development of a resource allocation formula may indeed support the promotion of more equitable access to health care resources and more efficient operation of the system. On the operational level these may be translated to minimizing health inequities, so as to achieve the fairest overall improvement in health and well-being which can be regarded as an achievable combination of the two goals (Bentley, 2013).

The formula

The current formula used in distributing funds to the regional branches takes account of the following determinants and is set out in the following way:

1) The number of the insured registered with the NHF regional branch is determined;

[8] Based on email communication with Anatol Gołąb (MoH) in 2014 February.

2) Groups of the insured segmented by age and gender[9] and by health care services, including highly specialized services are determined (101 age groups x 2 genders for both highly specialized services and non-specialized services: altogether 404 groups);

3) The health risks attributed to given groups of insured within the scope of the given group of health care services are compared to the reference group and risk ratios for each age x gender specific groups are calculated;

4) The amount of money allocated to each NHF branch is determined by the size of the budget and the number of people in each age x gender x service specific group and weighted by their associated risks (see point 3);

5) The planned costs of health care services financed by a given regional branch of the NHF may not be less than the costs of health care services which were financed by this branch in the previous year.[10]

Briefly, the algorithm distinguishes the higher and lower cost/risk services, and for both types of service, age and gender based adjustments are calculated. Then allocations are made for each branch on the basis of their age/gender/service specific number of persons and their associated risks (i.e. adjusted per capita payments).

It is worth noting that an additional compensation mechanism is functioning parallel to the NHF system, which is also used to finance some health benefits, such as health care schemes implemented by the local authorities. However, this scheme has little direct impact on health care allocation, as local governments (including regional) are only responsible for 4% of all current spending on health care)[11]. This is called the "Janosik" scheme. It involves a mandatory payment to the government budget from the richest local authorities, which is subsequently distributed to the less wealthy. It is defined as a certain percentage of tax revenues of a province from the preceding two years. While it refers to substantial amounts, only a portion of this is spent on health care, therefore the Janosik scheme does not play an important role in determining macro level health care resource allocation.

Results of the allocation

As a result of the NHF allocations, there is significant variation in the per capita budget of individual branches to spend on health services. In 2008, the Mazowieckie NHF branch spent almost 14.1% more per insured person than the poorest branch (Podkarpackie)[12] (Sagan et al., 2011). The difference in spending targets between the "richest" and the "poorest" branch was as high as 31.0% for 2005, 34.5 % for 2008, 16.6 % for 2011 and 7.7 % for 2013.[13] So the difference between the "richest" and "poorest" branches, as far as allocation on the basis of the formula is concerned, has been decreasing, and in recent years, per capita differences have been solely driven by the differences in the age-sex distribution of the voivodships.

[9] One-year groups of insured persons between the ages of 0 and 99 and an aggregated group for 100 or more, separated for each gender.

[10] In 2012 the transfers needed to correct this situation amounted to only 80 million PLN which is slightly more than 0.1% of the total allocated pool of funds.

[11] Data provided by the MoH referring to GUS – National Health Account for 2011.

[12] This figure presents the final allocation and not the allocation targets that are slightly different (see table…). The allocation targets reflect the intentions behind the allocation scheme.

[13] Data according to NHF financial statements; taking into account only the allocation of funds based on the allocation algorithm (further details in Appendix 2).

There have been arguments for and against the current allocation scheme. While the earlier (e.g. 2005) approaches tried go beyond age and gender characteristics of the population and so seemed to favor the "richer" voivodships, the recent schemes are closer to the pure age and gender specific approach and probably support the "poorer" voivodships[14]. Neither of the approaches has been justified by evidence which results in serious conflicts between the regions and the central government. Providing a more justifiable formula might also be seen as a tool to support evidence informed policy debates and negotiations.

Data also show that differences in spending patterns are apparent between the voivodships (presented in Appendix 2). There are considerable differences between the amounts allocated for various types of health services in the budgets of the branches (Appendix 2). This either implies large heterogeneity in the services provided or in the health care needs of the populations or maybe both. The HIT report states that although some degree of convergence between regional allocations (e.g. in the area of primary care) may be desirable, achieving identical expenditure structures between the voivodships is not the ultimate goal of centralized pooling and formula based resource allocation. Regional differences may not only be justified on the grounds of differences in the health care needs of the respective populations, but also on variations in the geographical distribution of health care infrastructure as long as those are meant to achieve higher quality and greater efficiency of the health service provision (Sagan et al., 2011). Currently no data suggest a direct connection between the spending patterns and the current allocation scheme however any algorithm using utilization data has such a potential.

The higher amount of the allocations for the richer voivodships (e.g. Mazowieckie) is often argued for on the ground that these regions provide health care for the population of the poorer regions, too. The largest region has approximately 5 million inhabitants whereas it provides care for around 7 million people. However, in the current system the "money follows the patient": voivodships are fully compensated for providing care for inhabitants outside their authority[15], which means this argument is not necessarily supported by evidence.

Beyond the differences explained by age and gender, the differences in the per capita expenditures of regions may be explained by differences in:

- utilization due to different:
    - needs of the population (social, demographic and economic characteristics not explored yet)
    - access to health care
    - supplier induced demand,
    - coordination of health care,
- price levels.,

These areas need further exploration before drawing in-depth conclusions on the nature of the current allocation patterns.

[14] As mentioned, these are only presumptions and without any further series of analyses it is difficult to make more precise judgements.

[15] It can still be argued that the infrastructure investments and maintenance to provide care for a larger population than the voivodship is not covered by the capitation formula. But investments also mean economic development etc., not only additional costs.

Comments on the formula and the allocation mechanism

- The current allocation scheme is relatively simple, but the few instruments being used to adjust the formula are justifiable;
- There is very little known about the reasons behind the different patterns and amounts of regional allocation. In turn, it cannot be stated whether the current formula reflects the real needs of the population or not. Steps should be taken to gather more information on needs and to undertake explorative research on regional level health care needs and the relationship between determinants of health care needs and expenditures.
- The current utilization patterns are to a certain extent reflected in the formula by distinguishing the higher and lower cost services. However, it is not known whether the current utilization reflects efficient allocation of health care resources - this necessitates further analyses;
- To address the previous question, it is recommended that the relationship between utilization patterns (supply effects) and the average per capita payment that is allocated to the voivodships be examined, e.g. do the richer voivodships get more/enough money because their infrastructure provides access to more patients?
- The size of the regional risk pools (1-5 million population):
    - does not necessitate substantial improvements in the resource allocation formula aiming at further sharing of the financial risk among the regional branches (as risks can normally be handled within such sizes of population groups)
    - may reduce the impact of direct incentives imposed by capitation to provide more efficient health care and allows decision-makers to focus their attention on other instruments than the budget constraint to improve efficiency, e.g. on the instruments for improved coordination of health care
- It is not clear to what extent the current budget constraints imposed by the payment system and the responsibility of the regional branches to coordinate care are linked, and what incentives the payment mechanism provides for the efficient operation of health care[16];
- In order to provide more detailed assessment of the usefulness and relevance of the formula, the role and aims of resource allocation need to be clearly defined and understood by policy makers. Presently there is no shared understanding whether the formula ought to reflect a reinforcement of the current utilization patterns or promote more equitable and/or efficient allocations. Macro-level resource allocation in the health care system needs to be in line with the policy goals of health care reforms.
- An improved resource allocation formula may:
    - justify and reinforce the current pattern of health care utilization while still provide incentives for mezzo and micro level efficiency improvements,
    - change the current (macro level) patterns of health care utilization to promote more equitable and/or more efficient health care

[16] Imagine for example, that at the end of each year there is a soft budget constraint, e.g. reallocation of resources is re-examined based on the year end spending patterns. In this case the formula even when set in a very sophisticated manner will not impose strong incentives on the organizations being financed, as these will be compensated regardless of how efficiently or inefficiently they are operating.

Review of the international literature

Strategic resource allocation

In the current context, health care resource allocation is the process through which money gets from the organization that pools health care funds to the organizations that organize, purchase and/or provide health care on behalf of patients.[17] This process is often also called 'strategic resource allocation' (Rice & Smith, 2002) . One recommended method for carrying out such allocations is using risk adjusted capitation payments, where risk adjustment refers to the method which seeks to adjust per capita payments to reflect the relative expected health service expenditure for members/individuals/populations on the basis of their individual/population characteristics (van de Ven & Ellis, 2000).

Funded organizations might be local governments (e.g. in Scandinavia), local administrative boards (e.g. in the United Kingdom) or sickness funds (e.g. in Belgium, Germany, the Netherlands and Switzerland). The resource allocation task is to distribute national-level health care funds to these organizations in accordance with society's objectives. (Rice & Smith, 2002). The process differs between countries and is fundamentally dependent on how the delivery of health care and related services is organized.

In countries where health care is dominated by private insurance systems, there is no externally set budget from which to allocate resources: the resources are the sum of individual premiums paid to health insurers, who then use this money to reimburse or purchase services (Buck & Dixon, 2013). Reallocation of funds is necessary to ensure that the money the insurers receive is a fair reflection of the risks of their members. In countries such as Sweden, Denmark, Australia and Canada, where the health system is decentralized or federalized, national revenues are allocated in the form of a block grant to the provinces, states or local governments that are responsible for health care. This central funding supplements local budgets in order to ensure equity of access to health services. In Portugal and Spain, health care is largely funded by general taxation collected at a national level, and allocations are made to devolved entities that purchase services on behalf of geographical populations (Buck & Dixon, 2013).

In spite of the widespread acceptance of the use of capitation and risk adjustment for strategic resource allocation, the methodology and implementation of the tools varies markedly across both countries and health care systems (Rice & Smith, 2001).

Goals of resource allocation

Strategic health care resource allocation in the developed world is being driven by at least two main goals: efficiency and equity. However, these are understood and prioritized differently in various jurisdictions.

The *equity* arguments usually reflect the requirement to secure equal access to health care for equal health needs and equal contributions in the form of premiums or taxes for equal income or wealth. In practice, equal access to health care to those in equal need is supported in almost all schemes (Rice & Smith, 2001) and equity of access to health care is interpreted and emphasized with slight differences in all centrally controlled state schemes. In systems of competitive insurance markets, risk adjusted

[17] Resource allocation is different from purchasing, which concerns the transfer of money to those responsible for delivering or providing services (Buck & Dixon 2013).

capitation payments are used to create a “level playing field” for the insurers in the sense that, if risk adjustment were perfect, they would all have the opportunity to offer the same package of care at the same rate of premium, regardless of the risk profiles and incomes of their members. This implies placing an emphasis on the equality of payments with an immediate goal to help the insurance market function properly, rather than to treat citizens equitably (Rice & Smith, 2001).

Cost containment measures have directed attention to *efficiency* objectives in almost all resource allocation schemes. Therefore budgeting systems as currently designed seek to make purchasers and providers more responsive to the issues of costs and benefits, i.e. cost effectiveness (Rice & Smith, 2001). Further efficiency considerations rise in competitive insurance markets (such as Belgium, Germany, the Netherlands and Switzerland). Such systems usually require insurers to set premiums independent of a member’s health status or the number of dependents covered. Furthermore, if premiums are related to income, insurers would wish to recruit members with high incomes and members with few dependents (Rice & Smith, 2002). Therefore insurers have a strong incentive to target their energies either towards the activity of risk selection or towards the inefficient practice of quality-skimping (delivering less than the socially desirable level of care to patients with high needs). In these circumstances, the purpose of resource allocation is to reduce inefficiencies in the operation of health insurance markets (Rice & Smith, 2002).

Essentially, strategic resource allocation based on the method of risk adjusted capitation seeks to address how the limited resources available should be distributed between health care plans in accordance with society’s equity and efficiency objectives (Rice & Smith, 2002). The following chapter provides examples on how such allocation schemes work in practice.

Country examples

England[18]

In England there has been a long tradition of risk adjusted capitation. The Resource Allocation Working Party (RAWP) was set up in 1976 to recommend a system which was responsive to the differing health needs of the population across the country, and to identify and correct inequalities in the existing pattern of distribution of funding. Since then there has been a clear objective for resource allocation "to secure equal opportunity of access to healthcare for people at equal risk" (Buck & Dixon, 2013). Resources are allocated to local purchasers that are nowadays called Primary Care Trust (PCTs). The large majority of the central budget is allocated based on the current formula and pace of change.[19] From their individual allocations, PCTs then make their own commissioning and spending decisions, contracting services by GPs and by acute, mental health and ambulance trusts.

Although the core principles remain central to health resource allocation today, the formula has been constantly evolving as decision-makers and their advisors have sought to improve the approach and expand the coverage of funding.

The allocation system is operationalized through a series of weighted capitation formulas which are set by independent technical experts calculating target allocations for each area (52 PCTs, with an average population of just under 330,000 per trust). Not only the formula is set but political decisions are also made about how fast relative funding given to different areas can be changed to meet their target allocations. The weighted capitation formula has three main components: (a) hospital and community health services (HCHS) (b) prescriptions (the cost of drugs prescribed by GPs) (c) primary medical services (see more in Buck and Dixon 2013 on Figure 4, pg. 11.). For each PCT a weighted population is estimated for each of these three components. Variables (approximately 30 pcs.) for each component of the model are provided in the 7th Edition of the RAWP formula pg. 81-82 (DH Financial Planning and Allocations Division, 2011).. These weighted populations are then combined into a single weighted population for each PCT, and the latter is converted into monetary targets. A single distance from target is calculated for each PCT and the pace of change policy is based on these single distances from target for each PCT.

Within this framework the approach has been continuously refined, leading to a very complex system. These refinements include increasing coverage beyond hospital and community health services, the use of more detailed data sets, more precise formulas for different services, changes in how the population denominator is calculated, and more adjustments for input costs.

Ongoing technical innovations have sought to help deliver a more equitable allocation, including identifying better proxies for need in specific services, using more detailed data, improving the accuracy of population data, and getting more accurate estimates of variations of input costs. While these changes have sought to improve the resource allocation formula, they have also made it more complex. It is also interesting to note that despite an excellent series of analyses since the '70s, major challenges in correctly assessing the need for care remained contested; and after the assessment of various options neighboring Wales adopted a different approach: need is assessed directly based on the

[18] This chapter is based on the work of Buck & Dixon (2013) and the report on the 7th Edition of the RAWP formula.

[19] In 2012/13, PCTs received around £94 billion plus some adjustments (including carried over unspent income from 2011/12 and other income).

reported prevalence of 17 health conditions measured in the Welsh Health Survey (which approach is also not without its problems[20]).

Netherlands

The Dutch health care system is based on the model of managed competition. Citizens are mandated to buy a legally defined basic benefit package from a private health insurer at a community-rated premium.[21] Half of all benefits are financed through income-related contributions (largely paid by employers). Income-related contributions[22] are pooled in a central Risk Equalization Fund, from which health insurers receive risk-adjusted capitation payments. Health insurers compete for customers and are free to set their own community-rated premiums and to contract with any health-care provider. They must also accept any applicant for basic health insurance, irrespective of the applicant's risk status or other personal characteristics.

Since insurers are not allowed to individually rate the risk of their premiums, these under-compensations confront them with incentives for risk selection. Risk selection is undesirable since it may reduce (1) the quality of healthcare (since health insurers have a disincentive to meet the preferences of the chronically ill), (2) the efficiency of care (since risk selection may be a more effective strategy for insurers to reduce their costs than improving the efficiency of care) and (3) the solidarity between the healthy and the chronically ill (when – due to market segmentation – the two groups concentrate in different health plans) (Van Kleef, Van Vliet, & Van Rooijen, 2013).

A sophisticated risk equalization (RE) scheme is intended to neutralize the strong incentive for risk selection created by the requirement to charge community-rated premiums. The scheme compensates the 26 competing health plans for the predictable high costs of people in poor health. Within the scheme risk adjustment is a tool to prevent preferred risk selection in the provision of basic health insurance and to promote fair competition (Schäfer et al., 2010).

During the last two decades the Dutch RE-model has evolved from a simple demographic model (only compensating for age and gender) to a sophisticated health-based model (also compensating for health status) (Van Kleef et al., 2013). The scheme was first introduced in 1993 for the 'old sickness funds' (which also had to compete for members) and has gradually been improved by adding new risk adjusters. The most significant improvements were the introduction of pharmacy-based cost groups in 2002 and diagnostic cost groups in 2004 as indicators for chronic and severe health problems. The current formula is calculated by means of the following factors: age and gender, nature of the income, region, the average consumption of pharmaceuticals for groups of patients with chronic diseases, and some chronic conditions mainly treated in an inpatient setting (Schäfer et al., 2010). The *nature of income (socioeconomic status) variable* compensates for socioeconomic differences. The *region variable* gives higher compensation to regions with relatively high numbers of non-Western immigrants. The *pharmaceutical consumption variable* accounts for 20 pharmaceutical cost groups, since patients who use these chronic disease pharmaceuticals are considered to be at risk for higher health care expenditure. The *chronic conditions variable* clusters chronic conditions into 13 diagnostic

[20] For instance, it is no easy matter to reliably measure the burden of ill-health (although more physiological measurements are increasingly used in the Health Survey for England and others to help corroborate self-reported data); and it is difficult to then establish what resources should be used to meet this need (McConnachie and Sutton 2004). Also the use of direct measures in Wales has not been totally divorced from utilisation, since needs are then 'scaled' against expenditure to give a sense of the overall resources required to meet health care needs, to stick within available budgets. This scaling, of course, relies on existing patterns of spending and utilization (Buck & Dixon 2012).

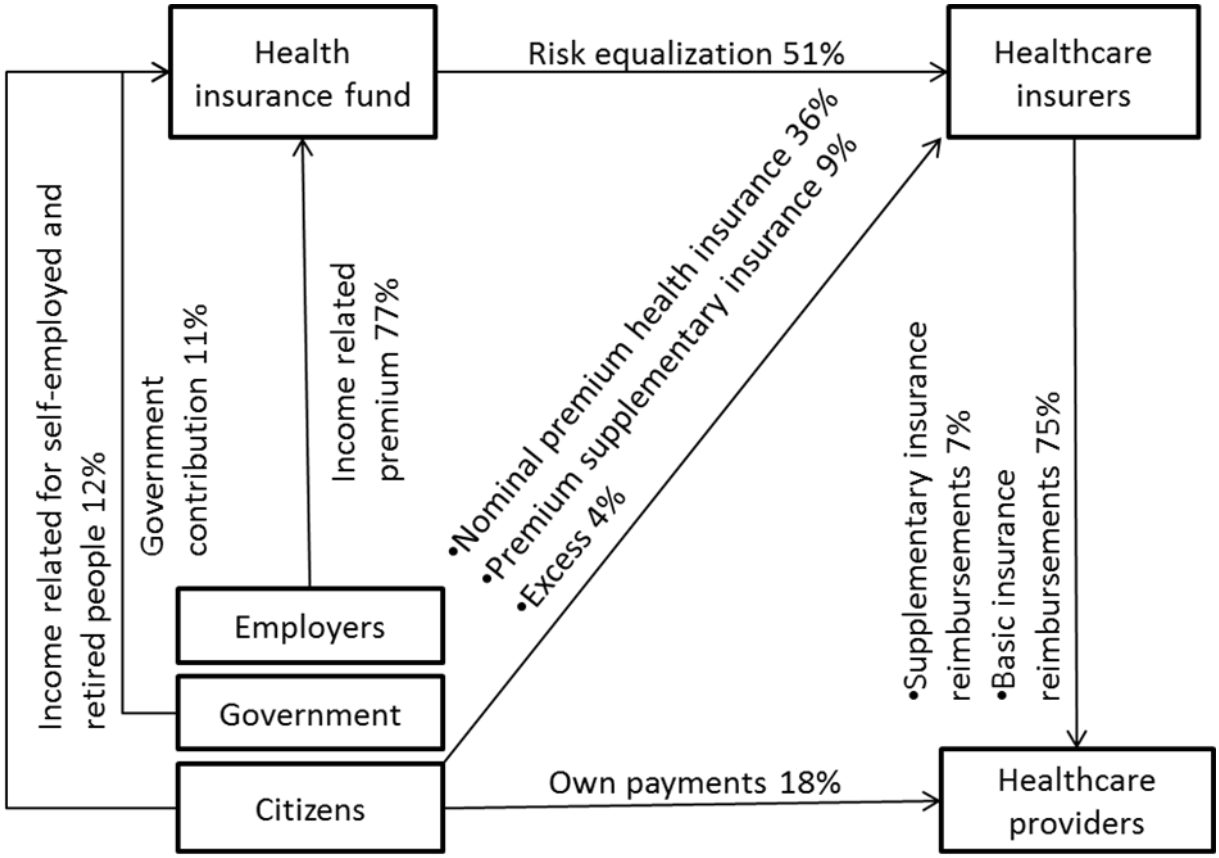
[21] Children below the age of 18 are exempt from paying premiums; their expenses are financed through general taxation.

[22] …and government subsidies for children…

cost groups based on expenditure patterns. For each patient belonging to such a pattern, compensation is provided.

Since risk equalization is not perfect, health insurers receive ex-post compensation for the health care costs of high-risk individuals (i.e. a method of risk sharing). Furthermore, the health insurers receive an ex-post "outlier risk sharing" to cover actual expenses for high-cost care. Above this threshold, 90% of the costs are reimbursed (Schäfer et al., 2010). As the risk equalization scheme has improved, the extent of ex-post compensation has declined from 97% of total expenditure in 1993 to 25% in 2010 (Shut, van de Ven 2011).

Figure 1 The flows of money of the Dutch health care system on the macro level (reproduced with permission of Portegies 2013)



Sweden

Like Britain, Sweden has a national health service system, which is both publicly funded and provided. Of the total healthcare budget around 82% (Diderichsen, Varde, & Whitehead, 1997)) comes from regional income taxes raised by the 26 county councils responsible for administering health care. The county councils are responsible for both the financing and organization of health care services, and most hospitals are owned and operated by the county councils. In the mid-nineties counties started to introduce internal market systems. In particular, Stockholm County Council, serving a population of 2 million with a healthcare budget of 19bn SEK, has been at the forefront in the introduction of a purchaser-provider split, and associated developments in resource allocation

(Anell, Glenngard, & Merkur, 2012).[23] The county budget is distributed to nine health authorities, each covering geographically defined populations of between 50 000 and 300 000. (Diderichsen et al., 1997). Different resource allocation models are in operation in different county councils; we discuss the Stockholm formula below.

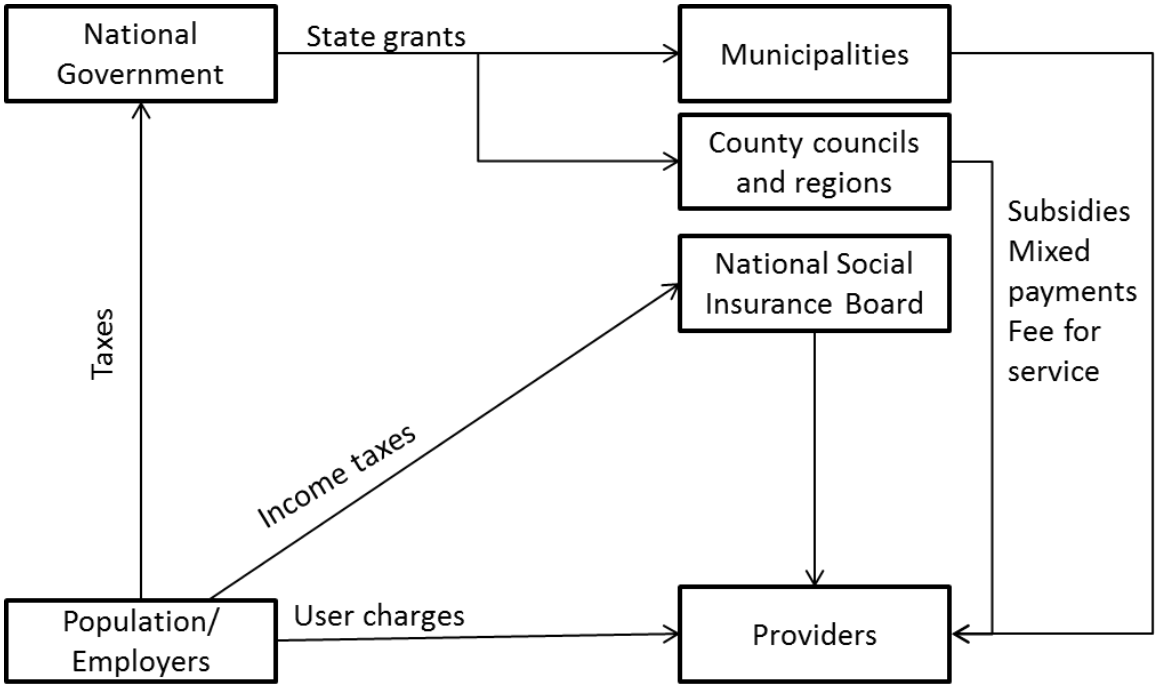
In Stockholm the hospital care budgets (including all publicly financed specialist care and privately owned hospitals) are allocated to geographically defined healthcare authorities (HCAs). Since 1992 the city council has used need-based matrix models for supporting decisions on allocation. The idea was to find interacting sets of population characteristics that vary between the HCAs and express different healthcare needs. Various combinations of resource allocation algorithms have been tested, all using a mixture of the following groups of socio-demographic, socio-economic and health-care utilization variables (Andersson, Bruce, Walander, & Viberg, 2011):

- age, gender,
- marital and family status,
- education,
- occupational status (hierarchy of occupations: those employed, unemployed, retired early, studying, in military service, other),
- disposable income and occupational income,
- social allowance, sickness benefit, early retirement and social classes,
- country of birth (Categorized according to different Regions (22)), citizenship and immigration year,
- residential area, urbanization and housing tenure,
- deceased and children,
- diagnosis-related disease groups: malignant cancer, cerebrovascular disease, inflammatory arthropathy, osteoarthritis, ischemic heart disease, heart failure, hip fracture, schizophrenia and 8 other psychoses.

Similar risk-adjusted resource allocation formulas were developed for other county councils, too. These usually show that the resources allocated to the population within each county reflects past investments in health-care facilities, rather than population needs. As changes are difficult to implement, resource allocation within each county council is usually heavily influenced by historical costs.

[23] Dalarna, Stockholm and Bohus were the first county councils to introduce reforms that included a purchaser–provider split, resource allocation to purchasers according to the needs of the residents, negotiated contracts and per-case payment schemes to providers, and total cost responsibility for providers through the use of internal transfer prices for services (Anell, Glenngard, & Merkur, 2012).

Figure 2 The flow of money of the Swedish health care system on the macro-level (Anell, Glenngard, & Merkur, 2012; reproduced with permission of European Observatory on Health Systems and Policies)



Germany

Germany's social health insurance system has about 350-400 competing, public, not for profit, self-administered health insurance institutions, called ''sickness funds''.[24] In 1993, new legislation was adopted to grant all enrollees free choice of health insurer and promote competition among sickness funds. At the same time a risk adjustment scheme was introduced: sickness funds pay an income-related solidarity contribution into the risk adjustment mechanism, and in return they receive a risk-adjusted premium subsidy from that pool (Behrend et al., 2007). Risk adjustment between these funds is a core element of the regulatory framework in order to create a level playing field.

Originally, the risk adjustment system was mainly based on basic socio-demographic factors. However, sickness funds have identified these factors as being insufficient to discourage risk selection. Morbidity was introduced as an additional set of risk adjusters. In the current system adjustments are made on the basis of age and sex, invalidity, morbidity and sick pay. The basic allocation is calculated as the average predicted per capita expenditure for the standard benefit package.

The morbidity-based adjustment consists of 50-80 pre-selected diseases. These diseases have to be either "severe" or "costly and chronic" and for each selected disease the average per capita

[24] The traditional structure of the sickness fund system in Germany consists of regional funds and so-called ''substitute funds'' (occupation-based), 3 company-based and crafts-based sickness funds (Buchner, Goepffarth, & Wasem, 2013). The main risk adjustment mechanism in Germany covers only the sickness funds of the public system, although it has been proposed to include private health insurance into this system (Buchner, Goepffarth, & Wasem, 2013).

expenditure of those concerned in the year following diagnosis has to exceed 1.5 times the average per capita expenditure of all insured (cost threshold) (Buchner, Goepffarth, & Wasem, 2013).

Challenges of risk adjustment

Types of models

As discussed above, the purpose of resource allocation may vary according to the institutional context, which along with other circumstances leads to substantial variation between resource allocation models.

In countries where resource allocation serves competitive health insurance systems the key aim is to reduce incentives for undesirable risk selection and to maintain the perceived benefits of competition. This implies trying to achieve the goal of matching resource allocation patterns with the actual (or expressed) demands that different individuals place on insurance funds (Asthana & Gibson, 2011). Several such systems have been developed, particularly in the US and in Western-Europe, such as pharmacy- (Fishman et al., 2003; Gilmer, Kronick, Fishman, & Ganiats, 2001; Lamers & van Vliet, 2004; Sales et al., 2003; Zhao et al., 2005), ambulatory- (Weiner et al., 1996; Welch, 2002), and in-patient (Antioch & Walsh, 2002; Ash et al., 2000; Ellis et al., 1996; Kronick, Dreyfus, Lee, & Zhou, 1996) care models, as well as models combining all these forms of information. The starting point for models that are based on health status information (health-based models) is the concept that certain diagnoses and/or the prior use of medications indicate the presence of chronic conditions and can predict future expenditure with reasonable accuracy. See more on the details of the construction of such models in Appendix 3. Health-based models have also recently been tested in non-competitive markets (see e.g.Asthana & Gibson, 2011).

As health-based models have been developed to maximize best fit with past utilization, the allocation seems likely to come close to retrospective reimbursement based on previous health care utilization. Therefore critics say that such ‘utilization-based’ approaches may undermine improvements in efficiency and service quality: the utilization-based adjustment in becoming more accurate reduces the incentive of providers to economize on service provision and reinforces existing patterns of utilization (Asthana & Gibson, 2011). When needs are well-reflected in the current utilization patterns, health-based models and variables are the best proxies of health care needs, and have the biggest potential to characterize the real needs of the population. Yet without the elimination of illegitimate factors, such as explaining the supply of services rather than needs, - the health-based formulas will be more likely to reflect utilization patterns than real health care needs.

In countries with centrally governed non-competitive markets more attention has been paid to the fundamental problem of estimating ‘need’ for health care. The successors to RAWP in England have long grappled with the fact that the health allocation formula should not remain essentially utilization-based and it needs to distinguish sufficiently between the need and demand for care (Buck & Dixon, 2013). Establishing the independence of a particular needs factor from other needs factors (that is, handling covariance between needs factors) remains a difficult task (Rice & Smith, 2002). Those models which do not rely directly on health status usually comprise employment/disability status, geographical location, social factors and other measures (see more in Rice & Smith 2002). Despite the fact that these variables have a less direct relationship with health care needs, the rationale behind their use is that they are less vulnerable to data manipulation, supply effects and permit access to rich

aggregate data sources, and also have the potential to factor in those characteristics of need that cannot be captured by health-based adjusters (Smith, Rice, & Carr-Hill, 2001). Still many statistical issues remain unresolved when using such indirect measures of health care needs.

In brief, the aims of allocation will strongly determine the type of models which are considered applicable. When the reflection of population needs is an important policy goal, finding independent measures unaffected by utilization or supply is the primary and most challenging task during the model development process.

Data and variables

The technical development of the formulas over time has been a major intellectual achievement, engaging some of the most capable statisticians, econometricians and health service practitioners. The development of the formulas involves large data requirements, strong analytical skills and in-depth knowledge of the incentives of the allocation system.

The construction of data warehouses for the calculation of model algorithms is essential and the lack of available information about the quality and nature of the data can strongly impact the process (Holly R, 2011). In England the records of millions of individual patients are used to help make the formula more precise. In the early years of RAWP, by contrast, data were only available from the 14 regional health authorities in aggregate form (Buck & Dixon, 2013). A key challenge for health-based models is also joining diagnostic, prescribing, inpatient and outpatient data at the individual level and the creation of a centralized medical system which records health conditions, treatments, and procedures, for each individual patient (Asthana & Gibson, 2011). The exemplary case of the Belgian formula and variables is provided by Schokkaert & van de Voorde (2011) on pg 21-24 Table 1.

According to the excellent in-depth review of Rice and Smith (2002), “any factors on which formulas are based should incorporate only characteristics that are universally recorded (across all organizations), consistent, verifiable, free from perverse incentives (e.g., cream skimming or gaming), not vulnerable to manipulation, consistent with confidentiality requirements, and plausibly determinative of service needs.” For example, diagnosis-based risk adjustment systems may encourage clinicians to seek out complications or co-morbidities associated with the diagnosis or treatment, since the most complicated cases result in higher payments. Hospitals and/or clinicians may also deliberately miscode and misclassify patient data in order to attract higher expenditure weightings (Asthana & Gibson, 2011). Rice and Smith in their summary paper (2001) describe the extent to which the broad categories of risk adjusters are consistent with the above criteria (pg. 106) . Their classification may not be acceptable in every detail, but may be a good starting point to characterize and classify potential variables with poor and good performance. For example, although performing well on most criteria, demographic data have only limited plausibility in explaining health care utilization, while morbidity data perform poorly on most criteria other than plausibility and reducing incentives for cream skimming.

Monitoring and/or penalty systems are warranted throughout the formula implementation process in order to eliminate non-intended practices, prevent data manipulation, and control provider behavior.

Performance of the models

The performance of the capitation models is usually measured with statistical instruments. The coefficient of determination, denoted R^2, indicates how well observed outcomes (real health care expenditures) are replicated by the risk adjustment model - as the proportion of the total variation of

outcomes explained by the model (Steel R.G.D., 1960). It is calculated as the square of the correlation coefficient ('deviations') between the original and modeled data values. Unlike R^2, CPM (Cumming's prediction measure) and MAPE (mean absolute prediction error) do not square the 'deviations' but are based on absolute values. CPM standardizes the mean absolute prediction error, dividing it by the mean absolute deviation of the observations from average. This results in a range of values between 0% and 100%. As with R^2, a CPM value closer to 100% indicates a better fit of the model. MAPE sums up the absolute deviations from predicted values for all observations and divides the result by the number of observations. For MAPE a lower value means a smaller prediction error and therefore a better model. As for calculating R^2 the deviations are squared, any improvement concerning outliers will lead to a relatively large reduction of that measure in comparison to CPM and MAPE. Therefore, if the focus is on the treatment of outliers (values that lie far from average values), R^2 is the preferred measure. Otherwise, CPM and MAPE might be preferred (Buchner et al., 2013).

In previous sections (Types of models and Data and variables) it was mentioned that the best fit for real expenditure may not be the criterion of success and where utilization patterns are not optimal, it is questionable whether the pursuit of predictive power per se is an appropriate goal.[25] It is also important to note that when measuring statistical performance, there is a notable difference between observing associations between real and predicted expenditures on an individual level versus that on aggregate levels (e.g. area/organization level). Individual level observations providing an R^2 of 20-25% are close to their maximum performance (van de Ven & Ellis, 2000), area level observations are expected to gain significantly higher R-square values. See a comparison of R^2 values measured on various levels of aggregation in Table 1 below.

Table 1 Example on comparing the performance of 5 models on practice and individual level reproduced with permission of Dixon et al., 2011 (

Table 3| **Table to show the added predictive power of including person-based groups of variables to the five models for predicting costs to general practices for commissioning hospital care for 2007-8, using data from 2005-6 and 2006-7**

	Variables included		Performance (R^2)	
Model	Person based	Attributed	Practice level	Individual level
1	Age and sex	—	0.3444	0.0366
2	Age and sex, diagnoses	—	0.6084	0.1223
3 (basic model):	Age and sex, diagnoses	PCT dummies	0.7437	0.1227
Minus diagnoses	Age and sex		0.5981	0.0373
4 (full model):	Age and sex, diagnoses	PCT dummies, 135 needs variables, 63 supply variables	0.7851	0.1272
Minus diagnoses	Age and sex		0.7162	0.0381
5 (parsimonious model):	Age and sex, diagnoses	PCT dummies, 7 needs variables, 3 supply variables	0.7735	0.1229
Minus diagnoses	Age and sex		0.6982	0.0380

When testing the performance of the models it is also important to analyze the expected effects by simply examining the deviations of budgets from the average and/or previous years' allocations.[26] 11)

Comparing the performance of inherently different allocation algorithms is not necessarily encouraged. Systems can differ in various characteristics and the differences in the performance may be explained by numerous factors. For instance, populations, whether defined by area, by membership in social security systems or health insurance plans, or by the utilization of health services, can strongly differ in their risk structures. Depending on the health system, they can also differ in average

[25] Particularly if the methodology that is applied undermines the equitable allocation of resources relative to the need for health care services.

[26] Anderson and colleagues (2011) provide an excellent example in their paper on pg. 51 Figure 3.

per capita contributions to the financing of health services and in their utilization of health services. Therefore it is advisable to benchmark each system to its own standards.

Policy issues

Passive versus active allocation

Strategic resource allocation is often viewed as a politically neutral or primarily technical instrument; it is nevertheless developed and implemented in a political environment (Holly R, 2011). In England, for example, the history of resource allocation is viewed as a constant interplay between what formulas say about where the money *should* go, and how this is moderated by politicians' judgments on where the money actually *will* go. (Buck & Dixon, 2013). The formula influences the redistribution of resources, and is often a tool of governance. Each implementation or reform has winners and losers, supporters and opponents, and as long as "perfect" risk assessment is not feasible, a political choice between more or less imperfect schemes (reflecting views on equity and/or efficiency) has to be made. Such a choice can only be partially based on evidence, and assumptions often play an important role (Holly R, 2011). The organizations receiving devolved budgets often feel they have a clear idea about which needs factors will favor their plan and will thus seek to influence the choice of needs factors through the political process (Rice & Smith, 2001). Thus in the end, resource allocation systems will, to some extent, reflect the interests and power of the potential winners and losers of the mechanism that is implemented (Holly R, 2011).

In the case of a particular model the question can be asked whether the preliminary "passive" health-based risk adjustment tools (i.e. utilization-based approaches discussed in section Types of models and Appendix 3) aiming to neutralize the financial consequences of differences between risk structures should be complemented by "active" risk adjustment? As stated earlier, diagnosis-based methods do not necessarily support the move away from passively modeling the existing influences of expenditure towards the construction of 'optimal' allocations. Indeed, the inherent circularity of the health-based approach not only mitigates against attempts to achieve a more equitable distribution but also reduces incentives to improve service efficiencies (Asthana & Gibson, 2011) (see more in section Types of models).

Prior to considering the aims discussed above, the question must be addressed whether resource allocation is simply a mechanism for moving funds, or is it a tool for achieving wider policy goals? If the former is the case, this may suggest a simpler approach since complexity will not make much difference to the final target allocations (see the English example). However, if resource allocation is accepted as a policy tool, then a more fundamental approach is usually called for (Buck & Dixon, 2013).

Simplicity versus complexity

Improving and refining health resource allocation is regarded as a constant interplay between the advice of technical experts developing formulas and the preferences of politicians (Buck & Dixon, 2013). There is also a persistent tension present between the desire for technical accuracy to promote equity and efficiency and for simplicity which promotes transparency and political accountability (Sheldon, 1997). This tension usually slows down the formula development process. In England, for example, the fact that the resource allocation formula both extended its scope and became more specific over time, with separate formulas for various elements of need, brought the benefits of

precision and fairness. Yet at the same time it also significantly increased complexity, making the outputs more difficult to understand and more challenging for politicians and other decision-makers to question the basis of the formula. Therefore Buck and Dixon recommended taking a look at how complex the allocation formulas really need to be and advise simplification if it may be achievable without losing reasonable precision (Buck & Dixon, 2013).

Complementary mechanisms

As stated in section Goals of resource allocation capitation schemes used for strategic resource allocation encourage organizations to operate efficiently; on the other hand they may increase non intended risk selection behavior. Risk selection becomes a problem when organizations are not compensated for their high risk/high cost members. When capitation is not accurate (or generous) enough to cover current expenditures, organizations will either attempt to "cherry-pick" the less costly population (if they have the chance) or promote other non-desirable behaviors such as quality skimping, under-providing, or shifting the provision of services (waiting lists), instead of attempting to provide care more efficiently.

To prevent risk selection, capitation is often combined with retrospective risk-sharing mechanisms where organizations are retrospectively reimbursed for some of the expenditures of some of their members (van de Ven & Ellis, 2000). There are several ways of risk sharing; however the exact method is usually subject not only to scientific but political, ethical and social judgments. Under "proportional risk sharing" a certain fraction of expenditures are shared. Another method is "outlier risk sharing" where all expenditures above a certain threshold are reimbursed. With "risk sharing for high risks", health plans are free to select a certain percentage of their members for whom some risk is shared. "Condition-specific risk sharing" implies that members with certain medical conditions are selected to have their costs shared (van de Ven & Ellis, 2000). Although risk sharing effectively reduces organizations' incentive for risk selection, it also reduces their incentive for efficiency (van Barnevald, Lamers, van Vliet, & van den Ven, 2001). If organizations know they will be retrospectively reimbursed for some of their deficits, risk sharing may serve as a disincentive to operate efficiently. It is in sharp contrast with risk adjustment that introduces incentives to operate efficiently (Newhouse, 1998). Therefore risk sharing is usually considered as the "second best" strategy after risk adjusted capitation.

Several further arrangements exist for handling the risk that organizations are subject to (i.e. the retrospective variation in actual expenditure from the prospective budget) (Rice & Smith, 2002):

- renegotiating the budget retrospectively with the central payer, (as in Italy and Spain);
- running down or contributing to the plan's reserves (as in many systems of competitive insurance funds);
- varying the premiums or local taxes paid by the plan members (as in Scandinavia and some competitive insurance systems);
- varying the user charges (co-payments) paid by the patients (as in Finland);
- varying the package of benefits available to patients; and
- delaying or rationing healthcare to the population at risk, (as occurs in Norway, Sweden, and the United Kingdom).

These arrangements are especially important when the plans are small and therefore vulnerable to random fluctuation in demand. A population size of 100–150,000 people is the threshold that several studies suggest for the minimum risk pool required to bring financial risk down to an acceptable level (Asthana & Gibson, 2011).

Apparently, capitation schemes can be modified by many other methods of resource allocation, both prospective and retrospective. The general intention should be to use a mixed or hybrid resource allocation system with both prospective and concurrent information, with the aim of maximizing incentives for efficiency while minimizing incentives for risk selection (Garcia-Goni, Ibern, & Inoriza, 2009).

Continuity and graduality

Finally, it is important to note that capitation schemes have often been introduced cautiously and strained to avoid rapid changes from historical levels of expenditure or to implement immediately the revised allocations associated with the new methods. Phasing gradually to avoid large fluctuations in the budgets is very common. There are schemes (e.g. Alberta, Poland) which guarantee that no allocation will be cut in real terms and extra funds are directed to plans below expenditure targets. There are also schemes (e.g. Netherlands) which elaborate a retrospective safety system which offers protection from variations in actual expenditure away from budgets. In Norway previous activities play major role in allocations while the prospective allocations have a subsidiary role (Rice & Smith, 2002). The complete process of defining a funding formula that meets the designated resource allocation goals and that successfully comprises risk adjustment, risk sharing and other complementary policies is expected to take a minimum of 5-10 years with a gradual move from a less improved formula and strong risk sharing mechanism to improved risk adjustment combined with arrangements involving little risk sharing.

Options for Poland

Aims, priorities, methods

Poland is in the phase of reforming its health-care system and decision makers put strong emphasis on the development of the strategic resource allocation formula. It is important to understand the complexity of the process and its place and relation with the wider goals of health system development.

As a first step in development, the aims of resource allocation need to be clarified and agreed on. Based on published papers and interpersonal communication with stakeholders, the motives behind the current changes are not entirely explicit and well-articulated. As long as there is no consensus on the objectives at system level and their potential implications on system design (competitive or not), it is difficult to decide upon the methods to be used for formula development (e.g. active vs. passive approach, simplicity vs. complexity). It is also important to understand and explore the impact and consequences of the current formula, including the risk structure of the population, the potential drivers behind the differences in needs, supply effects and other possible explanations of the current variations in health care expenditures per se (see more in Section Polish context).

The next task is to understand (and/or design) the context in which the formula will come into effect. For instance, if the current system is moving towards a managed care-type scheme for the voivodships, then the formula may have quite different roles than in a system with centrally governed and coordinated care (i.e. in which allocations will most likely reflect central decisions). In that sense it would be very useful to link the current work with ongoing improvements in coordinated care and research on equity. Stakeholders foresee the maintenance of strong autonomy at regional level as far as purchasing policy is concerned. The centrally set rules will presumably not hinder regional purchasing activity; however, to a certain extent it can limit the regions' flexibility in coordinating health care. After exploring the situation and defining aims, appropriate risk adjustment methods (that are in line with the proposed aims and with the health policy context) need to be carefully designed. As seen from this review, there is a large variety of options, from which three broad directions are depicted in Table 2. These approaches intend to portray the broad picture with reasonable simplifications. None of the options are regarded as technically superior to the others; but rather reflect the links between different choices and their consequences. It is only possible to prepare a detailed construction of the risk adjustment system compatible with the aims and in line with the context and the available data after further in-depth analyses of the circumstances (e.g. needs of population, utilization patterns, proposed macro- and mezzo-level policy instruments).

Using the appropriate formula development method is certainly a matter of importance if one considers how well documented it is in the international literature. Most risk adjustment methods have a very detailed description. Some of the commercial formula developers (especially in the US) even provide pilot versions of their classification systems.[27] As Poland has good quality individual level data both for health-based and non-health based risk adjusters, chances are high that it should be possible to implement a complex system of both health and non-health adjusters. The characteristics of the data requirements and tools to analyze the potential model variables were provided in chapter Challenges of risk adjustment. The running of pilot analyses on larger databases by experienced statisticians and econometricians is strongly recommended. This review could not go into the technical details of formula development, although it has provided a variety of examples on the techniques that

[27] See e.g. http://www.veriskhealth.com/demonstration

might be used. Standard mathematical tools for handling large amounts of healthcare cost data along with a large set and variety of explanatory variables is well documented and/or can be further explored. The review also provided some insights into the nature of the literature, and details can be further explored alongside specific model development issues (e.g. data management, statistical issues, incentives, quality assurance, policy measures).

The use of complementary mechanisms (risk sharing, monitoring systems, regulatory requirements etc.) alongside the formulas in order to either temper the imperfections of the formula or strengthen certain policy goals is key to successful development. In order to use such instruments, it is a key requirement to understand the incentives introduced by the payment mechanism. To do this, the budget holding responsibilities and autonomy of the organizations involved in the coordination of care need to be well defined and linked to the formula development process. All countries dealing with macro-level formula funding experimented for a substantial period of time before making changes/adjustment to their formulas. Therefore a gradual approach is recommended with the involvement of stakeholders (potential winners and losers) in the allocations. In England and the Netherlands the formula development has been going on for decades with constant dialogue continuing between the receiver of funds and the actual health care governments. Either the allocation scheme is used to justify the current pattern of care or, on the contrary, it is required to justify the changes in the healthcare system. Transparency and the clear declaration of intentions are important during the development process.

Table 2 Options for the development of the resource allocation formula in Poland

Primary objective of changing current resource allocation	Approach to changing the current system	Prerequisites	Type of risk adjustment model	Data & variables	Development process	Transparency and acceptability	Incentives introduced by changing the current system	Necessary complementary mechanisms	Continuity, graduality & time horizon	Expected results
improve equity of health care delivery	policy tool to change the current system actively and fundamentally	understand the needs of the population; intepretation of equity; definition of equitable allocation of resources and political consequences of implementation	complex, often multilevel hierarchical modelling techique; providing proxies for need unaffected of health care utilization/consumption	non-health variables: socio-demographic, -economic data; selected legitim health variables unaffected of health care utilization	long and complicated with many iterations and time consuming data collection/justification/validation	transparent and justifiable but difficult to understand its complexity and to explain the ignorance of health care utilization data; political opposition of beneficiaries of current allocation	restructure of local health care provison; regional coordination of investment and/or disinvestment; large changes in the budget may result in short term adverse incentives	strong need for risk equalization techniques; requires efficient regional coordination and instruments to influance the pattern of health care	needs continuous model improvement and gradual implementation (5-10 years) with interim allocation targets	unpredictable until the formula is finished and justified
create incentives for improved efficiency based on health care priorities	passive policy tool, justify minor adjustments in current allocation system; reward well treated/reported high risk population	exploring current pattern of health care and whether utilization reflects efficient allocation, search for areas of efficiency improvement	utilization data based, predefined disease classification models	health based variables: direct indicators of health problems; outpatient and inpatient diagnosis and pharmaceutical consumption	adaptation and improvement of existing disease classification models with focus on quality assurance of data and patient pathways	easy to understand but not fully justifiable because data reflect current utilization patterns	improved attention to health care delivery in priority areas, data manipulation/miscoding/misclassification; reflection to current patterns may provide disincentives to economise provision	modest neeed for risk equalization techniques; quality assurance of databases and service provision	needs relatively short time and graduality for introduction (2-5 years), maintenance of large datasets; potential pilot phase	moderate mid-term changes at regional level in comparison to the last 12 year allocation
improve both equity and efficiency of the system	policy tool to change the current system actively but tempered by acknowledging current utilization patterns	understand the current pattern of care and areas of unmet need and inequities in the current system and political feasibility of implementation	self-designed complex model, blend of health and non-health data, with efforts to disentagle needs and demand	non-health and legitim health variables	careful construction of complex dataset, with sophisticated econometric modelling approach	transparent and justifiable but difficult to understand its complexity; use of health care utilization data makes it more acceptable for regional health authorities	restructure local health care by focusing on priority patient groups/disease areas; data manipulation	intermediate need for risk equalization techniques, quality assurance of utilization data, and efficient regional coordination and instruments to influence the pattern of health care	needs continuous model improvement and gradual implementation (5-10 years) with interim allocation targets	controlled but probably radical changes to the current pattern of health care on the long run

Suggested roadmap to develop the allocation mechanism

1. Define aims, which might later be refined and adjusted
2. Explore the current situation regarding healthcare allocation and define the starting point.
3. Choose one or a combination of the risk adjustment methods: adapt, integrate or develop your own method, based on diagnoses, socio-economic and socio-demographic data, and adjustment with supply factors
4. Collect and prepare data
5. Run pilot/explorative analysis with different methods and data
6. Review first results and analyze and discuss potential effects on allocation (also with stakeholders)
7. Readjust according to technical and policy issues
8. Apply appropriate complementary mechanisms
9. Implement gradually with continuous adjustment and remain in balance with complementary mechanisms
10. Use mechanisms for monitoring, controlling and further adjustment
11. Evaluate results continuously and keep adjusting/improving the system

Expected time horizon: a minimum of 2-5 years. Country examples suggest a long, gradual and iterative process.

Appendix 1

Table 3 Major reforms and health policy initiatives in Poland, 2005-2011(Sagan et al., 2011; reproduced with permission of European Observatory on Health Systems and Policies)

Major reforms and policy initiatives, 2005–2011

Year	Reform / policy initiative	Status
Health care information system		
2001–2007	Initiatives to implement Medical Services Register	Failed
2011	Law on the Information System in Health Care	Implementation phase
Improving access to health care		
2005	Executive regulation on waiting lists	Implemented
2006	Law on National Medical Emergency Services	Implemented
2009	Executive regulations (13) on guaranteed benefit baskets	Implemented
2011	Law on Reimbursement of Pharmaceuticals, Foodstuffs for Special Nutritional Use and Medical Devices	Implementation phase
Improving organization and financing in the hospital sector		
2006, 2007	Draft Law on Hospital Network	Failed
2008	Draft Law Proposing Compulsory Commercialization of Hospitals	Failed
2009	Plan B for hospital commercialization	Implemented (limited success)
2011	Law on Therapeutic Activity	Implementation phase
Fighting corruption in health care		
2005	Prolongation of the anticorruption strategy for 2005–2009	Implemented (partial success)
2001–2008	Anticorruption initiatives within Stefan Batory Anticorruption Programme	Implemented (partial success)
Strengthening policy expertise		
2005	Establishment of AOTM	Implemented
2008	Establishment of NIZP-PZH	Implemented
Strengthening patient rights		
2004	Establishment of the Office of Patient Rights and Patient Education	Implemented
2009	Law on Patient Rights and Patient Rights Ombudsman	Implemented
Improving health care funding		
2008, 2011	Draft laws on VHI	Failed
Improving reimbursement of providers by NFZ		
2008	Introduction of DRGs in hospital care	Implemented
2010	Introduction of DRGs in stationary neurological care and cardiac rehabilitation	Implemented
2011	Introduction of DRGs in certain specialized ambulatory care	Implemented
Quality of care		
2008	Law on Accreditation in Health Care	Implemented
Addressing shortage and outward migration of health care professionals		
2007	Introduction of the profession of medical caregiver	Implemented
Since 2006	Increases in salaries of doctors and medical doctors undergoing residency training and increases in admission limits	Implemented
2008	Amendment of the regulation on specialization of doctors and dentists	Implemented
2011	Amendment of the Law on the Professions of Doctor and Dentist	Implemented
Mental health care		
2008	Amendment of the 1994 Mental Health Law allowing for implementation of the National Mental Health Programme 2011–2015	Implemented
2009	Inclusion of community therapist in the guaranteed benefit basket	Implemented

Appendix 2

Table 4 Shares of the total budget in Poland received by regional branches

	2006	2007	2008	2009	2010	2011	2012	2013
Dolnośląski	7.48%	7.49%	7.69%	7.69%	7.66%	7.59%	7.63%	7.63%
Kujawsko-Pomorski	5.42%	5.41%	5.28%	5.25%	5.26%	5.37%	5.46%	5.46%
Lubelski	5.60%	5.61%	5.43%	5.43%	5.46%	5.65%	5.70%	5.68%
Lubuski	2.40%	2.39%	2.49%	2.52%	2.52%	2.58%	2.64%	2.66%
Łódzki	6.70%	6.67%	6.90%	6.90%	6.89%	6.85%	6.87%	6.82%
Małopolski	8.52%	8.51%	8.25%	8.24%	8.24%	8.33%	8.46%	8.48%
Mazowiecki	15.50%	15.58%	15.56%	15.62%	15.58%	14.86%	14.05%	14.06%
Opolski	2.40%	2.40%	2.55%	2.50%	2.50%	2.54%	2.53%	2.53%
Podkarpacki	4.95%	4.93%	4.76%	4.76%	4.82%	5.22%	5.32%	5.33%
Podlaski	3.09%	3.09%	2.99%	2.99%	2.99%	3.06%	3.08%	3.07%
Pomorski	5.36%	5.34%	5.86%	5.92%	5.90%	5.72%	5.76%	5.80%
Śląski	12.72%	12.72%	12.56%	12.46%	12.42%	12.13%	12.16%	12.15%
Świętokrzyski	3.18%	3.17%	3.18%	3.19%	3.22%	3.41%	3.43%	3.41%
Warmińsko-Mazurski	3.54%	3.54%	3.42%	3.42%	3.43%	3.54%	3.59%	3.61%
Wielkopolski	8.76%	8.77%	8.61%	8.67%	8.67%	8.72%	8.87%	8.86%
Zachodniopomorski	4.38%	4.39%	4.46%	4.45%	4.44%	4.42%	4.46%	4.46%

Table 5 **Expenditures on health services per insuree by NHF branch (PLN) 2005-2014**

VB NHF		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	Dolnośląski	806	889	1 027	1 192	1 436	1 466	1 516	1 642	1 691	1 916
2	Kujawsko-Pomorski	786	890	1 020	1 123	1 349	1 377	1 468	1 608	1 660	1 856
3	Lubelski	763	860	990	1 090	1 327	1 365	1 478	1 612	1 666	1 824
4	Lubuski	767	801	921	1 087	1 333	1 365	1 460	1 605	1 665	1 891
5	Łódzki	798	894	1 024	1 194	1 442	1 477	1 541	1 671	1 714	1 872
6	Małopolski	828	918	1 049	1 143	1 366	1 393	1 468	1 600	1 649	1 823
7	Mazowiecki	980	1 044	1 203	1 354	1 628	1 651	1 639	1 659	1 704	1 855
8	Opolski	779	837	968	1 162	1 388	1 423	1 509	1 626	1 678	1 931
9	Podkarpacki	748	801	923	1 007	1 218	1 257	1 422	1 561	1 614	1 796
10	Podlaski	800	882	1 017	1 116	1 349	1 385	1 482	1 608	1 665	1 847
11	Pomorski	785	832	948	1 177	1 434	1 455	1 465	1 585	1 640	1 848
12	Śląski	884	935	1 080	1 213	1 454	1 486	1 519	1 642	1 692	1 851
13	Świętokrzyski	771	837	959	1 086	1 318	1 364	1 517	1 653	1 705	1 881
14	Warmińsko-Mazurski	797	836	959	1 048	1 271	1 304	1 406	1 534	1 591	1 809
15	Wielkopolski	807	890	1 018	1 127	1 367	1 383	1 453	1 587	1 630	1 800
16	Zachodniopomorski	765	879	1 014	1 162	1 404	1 432	1 488	1 619	1 671	1 916
a	Avg	827	900	1035	1169	1411	1440	1504	1619	1669	1851
b	Min	748	801	921	1007	1218	1257	1406	1534	1591	1796
c	Max	980	1044	1203	1354	1628	1651	1639	1671	1714	1931
d=c-b		232	243	282	347	410	394	233	137	123	135
e=d/a		28,1%	27,0%	27,3%	29,7%	29,1%	27,4%	15,5%	8,5%	7,4%	7,3%
f=d/b		31,0%	30,3%	30,6%	34,5%	33,7%	31,3%	16,6%	8,9%	7,7%	7,5%

Table 6 Average expenditure on health services per insuree by NHF branch in Poland, 2005-2009

Average expenditure on health services per insuree by NFZ branch, 2005–2009

NFZ branch	Average expenditure per insured individual (in PLN)				
	2005	2006	2007	2008	2009
Dolnośląskie	885	939	1 057	1 323	1 514
Kujawsko-Pomorskie	870	938	1 071	1 321	1 464
Lubelskie	821	911	1 053	1 295	1 418
Lubuskie	807	851	961	1 255	1 393
Łódzkie	844	920	1 030	1 335	1 506
Małopolskie	890	963	1 095	1 303	1 420
Mazowieckie	1 039	1 088	1 204	1 411	1 638
Opolskie	820	896	1 028	1 338	1 459
Podkarpackie	813	853	955	1 189	1 327
Podlaskie	841	942	1 054	1 308	1 428
Pomorskie	828	875	986	1 289	1 482
Śląskie	969	991	1 124	1 389	1 527
Świętokrzyskie	833	878	997	1 279	1 403
Warmińsko-Mazurskie	843	882	1 004	1 237	1 367
Wielkopolskie	851	929	1 069	1 294	1 422
Zachodniopomorskie	861	914	1 031	1 282	1 452

Source: Based on NFZ data.

Table 7 Selected health services as a percentage of total expenditure on health services, by voivodship, 2005 and 2008

Selected health services as a percentage of total expenditure on health services, by *voivodeship*, 2005 and 2008

	Primary health care		Ambulatory specialist care		Inpatient care		Psychiatric care and addiction treatment		Long-term care		Rehabilitative care		Other services contracted separately		Dental treatment	
	2005	2008	2005	2008	2005	2008	2005	2008	2005	2008	2005	2008	2005	2008	2005	2008
Dolnośląskie	11.11	11.67	6.68	8.29	42.98	37.57	2.95	3.38	1.56	2.07	2.88	3.37	2.90	2.59	2.58	3.33
Kujawsko-Pomorskie	11.27	12.05	7.54	8.02	41.37	38.73	2.77	3.15	1.54	1.98	2.47	2.70	2.86	2.60	3.14	3.53
Lubelskie	12.05	12.46	5.65	7.12	44.98	38.37	3.42	3.50	1.24	1.65	1.65	2.85	2.87	2.41	2.96	3.92
Lubuskie	11.96	12.44	6.33	7.19	41.77	37.89	6.21	4.88	1.38	1.45	3.11	3.20	2.67	2.31	2.58	3.18
Łódzkie	11.22	11.56	5.12	6.89	44.31	39.25	3.53	3.46	1.43	1.67	2.59	3.00	2.45	2.27	2.90	3.52
Małopolskie	10.92	11.78	7.22	8.00	4.21	37.94	2.75	305	1.92	2.30	2.77	3.22	2.99	2.55	2.95	3.89
Mazowieckie	9.44	11.27	7.09	7.61	46.68	41.89	0.29	3.58	1.64	1.80	3.52	3.92	2.81	2.30	2.35	2.67
Opolskie	12.01	11.53	6.47	7.78	42.46	37.99	3.80	3.66	1.62	2.45	4.28	3.78	2.60	2.30	2.81	3.49
Podkarpackie	11.92	12.76	6.51	7.08	42.90	36.91	2.96	3.11	1.96	2.39	2.90	3.62	2.13	2.39	3.43	3.43
Podlaskie	11.57	11.84	7.23	8.55	45.13	38.86	4.05	3.99	1.30	1.68	1.99	2.64	2.41	1.99	2.76	3.93
Pomorskie	11.50	11.75	8.24	8.87	4067	35.83	3.29	3.62	1.20	1.36	2.33	2.91	2.80	2.55	3.57	3.93
Śląskie	9.98	11.22	8.13	9.26	45.49	41.06	3.06	3.23	2.00	2.27	2.63	3.03	2.33	2.18	3.24	3.99
Świętokrzyskie	11.87	11.72	6.41	6.71	44.63	39.48	3.53	3.49	1.02	1.40	2.95	2.91	2.29	2.14	2.32	3.33
Warmińsko-Mazurskie	11.53	12.75	8.02	8.27	42.73	36.07	3.70	3.72	1.67	1.71	2.90	2.87	2.67	2.32	3.93	4.50
Wielkopolskie	11.75	12.63	7.86	8.61	45.42	39.71	3.13	3.14	1.42	1.54	2.36	2.89	2.78	2.28	2.52	3.22
Zachodniopomorskie	11.45	12.40	6.99	7.87	42.61	40.08	2.76	3.17	0.74	1.11	2.40	2.84	2.03	2.26	2.76	3.80

Source: Based on NFZ, 2006, 2009.

Appendix 3

Important characteristics and logic of disease classification models:

Netherlands

The configuration of the original DCG-classification consists of roughly five phases (Van Kleef et al., 2013):

1. To gather all information on hospital care and to deduce all primary diagnoses. In this phase no distinction is made between inpatient and outpatient information.
2. To select the diagnoses referring to a chronic condition. This means, for instance, that the diagnosis "prostate cancer" will proceed to Phase 3, but not the diagnosis "broken leg". Phase 2 involves a detailed medical judgment by a team of experts.
3. To select from the diagnoses those have been determined in an inpatient setting. This step consists of a simple administrative check (i.e. the Dutch coding system for hospital care distinguishes between inpatient and outpatient settings). An exception to this "inpatient rule" holds for a set of severe treatments that may be provided in either an inpatient or an outpatient setting (e.g. radiotherapy, chemotherapy and hemodialysis).
4. To cluster the resulting diagnoses into so-called dxgroups. This step involves detailed medical judgment by a team of experts. Comparable diagnoses are classified in the same dxgroup. In the Dutch RE-model of 2012 the DCG-classification includes 140 dxgroups.
5. To cluster dxgroups (including diagnoses from year $t - x - 1$) into 13 DCGs based on their follow-up cost (i.e. average costs in year $t - x$ corrected for age, gender and PCGs) using Ward's hierarchical clustering method [7]. Reference year $t - x$ is periodically updated (once in about 3–5 years) to correct for changes in follow-up costs.

If enrollees have multiple diagnoses, they are classified in only one DCG, i.e. the one with the highest average follow-up costs. Based on recent research, the Dutch DCG-classification has been extended with three new DCG-groups [12]. These new DCG groups increase the number of DCGs to 15 (because the new groups have high follow-up costs that do not fit appropriately into the 13 existing DCGs).

Germany

The selection criteria of 80 diseases for the German disease classification system (Buchner et al., 2013):

The general criterion (according to the law) is that the selected 50–80 diseases have to be either "severe" or "costly and chronic". For each selected disease, average per capita expenditure on those concerned in the year following diagnosis has to exceed 1.5 times the average per capita expenditure of all insured (i.e. cost threshold).

Prior to making the selection, the term "disease" had to be defined. The range of opinions go from every single 5-digit ICD code defining a disease up to suggestions of defining diseases at the chapter level of the ICD code. The final decision is for a medium level of aggregation, defining 366 diseases based on the 781 DxGroups of the HCC classification model (Buchner et al., 2013). As criterion for "chronicity" a disease had to be diagnosed in at least two different quarters of the year of observation in at least 50% of cases. For a "severe" disease at least 10% of the cases have to be hospitalised within

the same year. After applying these criteria more than 80 diseases remain and from these the 80 most expensive diseases are selected.

In defining the cost criterion, a trade-off arises between high costs due high prevalence and high costs due the high costs per case. Balancing these perspectives, diseases are ranked according to their product of average annual costs per case multiplied by the square root of the number of cases. The average annual costs were calculated as coefficients of a multiple linear regression, hence controlling for multi-morbidity. The top 80 diseases of this ranking which passed the cost threshold are selected and integrated into the risk adjustment formula.

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